JACOBS UNIVERSITY

Digital Mediation of Art and Culture. A Database Approach.

by

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a Thesis submitted in partial fulfillment
of the requirements for the degree of

Doctor of Philosophy in Visual Studies

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Date of Defense: 05.06.2018

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Acknowledgements

Completing this thesis was a long journey. It started in 2009 with work on the research project "Visual-Film-Discourse" and took nine years to complete. The journey took me to different places in Germany, the USA and Austria, through different fields of work, all while always pushing further towards the completion of the PhD thesis. And I could not have done it alone. A big thank you is in order to the many people who supported this endeavor along the way. Nine years is a long time and I am grateful for every discussion, every bit of feedback and every help I was able to get.

An enormous thanks goes to my first supervisor Prof. Marion G. Müller for her endless support of the thesis from when it was just an idea and abstract, her feedback over the years of writing and editing and her firm pushes to finally finish it. Thank you for staying with me as a supervisor over such a long time and believing in me that I could finish the project. Thank you also to my second supervisor Prof. Adalbert Wilhelm for his support as well as my external supervisor Prof. Victoria Szabo for the many insightful discussions, who was also a wonderful collaborator at Duke University at the CHAT Festival as well as a wonderful colleague to teach with. Last but not least, I want to thank my extraordinary committee member Prof. Dr Birgit Mersmann for all the discussions on the topic and support throughout the development process of the thesis.

I owe a huge thanks to many of my colleagues at Jacobs University for their feedback and support. In particular, I want to thank Ognyan Seizov for always pushing and supporting the process and for being a wonderful office mate, friend and band colleague during our time at Jacobs University. I am also grateful to my fellow PhD student at Jacobs University and office mate at Duke University Mastewal Adane Mellese for his support and friendship.

Special thanks go to Prof. Lev Manovich, who not only greatly shaped this thesis with his writings and talks as well as his feedback, but also invited me to his lab and discussed in length the very early stages of his concept of Cultural Analytics.

My time at Duke University as a PhD researcher and Visiting Lecturer in the Department of Art History and Visual Studies was invaluable for the development of the thesis. Thanks to Prof. Hans van Miegroet for making this extended visit of over one-and-a-half years possible. So many colleagues at Duke University contributed to this thesis through feedback during informal and formal presentations, through collaborations and intense discussions, all of which shaped what it ultimately became. Among them is Amanda Starling-Gould, whom I owe huge thanks for our intense exchange and for being a great collaborator and PI on the "Network Ecologies" project. Many thanks also to Prof. Mark Olson, Prof. Rachael Brady, Patrick Herron, Todd Berreth, Prof. Raquel Salvatella De Prada, Michael Tauschinger-Dempsey, Nicola Lercari, Clarissa Lee, Eric Monson, and many other colleagues from inside and outside the department for all the invaluable conversations during my time at Duke University. A highlight of the research stay was the development of a mobile guide and exhibition design for the Nasher Museum's exhibit "Eat, Pray, Weave." Through the practical experience and the discussion with practitioners of the museum field as well as with fellow PhD researchers, it shaped my view on the thesis topic immensely. Thanks to Juline Chevalier, Marianne Wardle, Jessica Ruhle and Molly Scheu Boarati from Nasher Museum as well as my great collaborators Elisabeth Narkin, Iara Dundas, Lindsey Mazurek, Laura Moure Cecchini, Mimi Luse, Katherine De Vos Devine, Katherine Jentleson, Mitali Routhm, Alexandra Dodson and Camila Maroja for the fruitful work on this project, which formed my future ventures in many different ways.

Many friends and colleagues from the field of digital mediation and media arts have shared their insights over the past years, and for this I cannot thank them enough. Among them are my dear collaborators Stephanie Sarah Lauke and Tim Senior; Prof. Oliver Grau, Wendy Coones, Janina Hoth, Viola Rühse and Devon Schiller from Danube University Krems; Marian Dörk from FH Potsdam; Georg Schelbert from Humboldt University Berlin; Chad Weinard from Willams College Museum of Art, who introduced me to many digital museum practitioners in the US; as well as my friend and co-founder of Musealisten, Willem Prins. Huge thanks also to Kasra and Andre Seirafi from Fluxguide, who not only supported the "Eat, Pray, Weave" project and shared their insights on digital mediation, but also took me on as Fluxguide team-member. Thanks for being such wonderful and lovely colleagues.

I am greatly endebted to Devon Schiller, Laura Gemsemer, and Gabi Teufner for their feedback on different stages of the manuscript.

So many friends I cannot name at this point have always supported me immensely on my way towards completion of this thesis. Thank you all for that. Special thanks goes to my girlfriend Gabi Teufner for her endless love and support.

Last but not least, I owe an enormous thanks to my parents Heinrich and Johanna Wiencek for always believing in me and supporting me in countless ways on my journey. I would not be where I am now without you. Thank you for everything!

Abstract

This PhD thesis analyzes digital and data-based practices of mediation of art and culture, focusing on digital cultural repositories and databases as central mediation tools. It embeds the digital mediation practices discussed in this thesis in the media-theoretical and media-historic context of the transformation processes that have taken place in the digital media ecology, which have resulted in challenges for cultural institutions and museums, both in their role as institutions as well as in their daily mediation work. This includes aspects of a digital mindset, such as participatory culture or open source and open data movements. The thesis also situates digital mediation practices in the context of contemporary, analog practices of cultural learning, since the analog and digital realms can no longer be separated in the contemporary media ecology.

One central topic of the analysis is mapping and understanding practices of mediation of art and culture and cultural learning in the digital realm. This is based on the database as a cultural form and repository that defines what can be said and known about a culture or society. The database is thus defined as a nexus point for the digital mediation of art and culture; it maps out forms of cultural repositories and sources of cultural data that can serve as starting points for cultural learning. The analysis introduces digital and data-based meaning-making processes within databases and database-interfaces themselves as well as cultural learning processes that reuse and contextualize the data in learning resources or by forming new experiences with them. The analysis concentrates mainly on web-based approaches and treats the process of co-creative knowledge generation as a central mode of the mediation of art and culture; it takes up the paradigm of Software Studies developed by Lev Manovich (2001, 2013a) as a lens for analysis.

Moreover, the thesis examines what characteristics of contemporary digital media and the digital media ecology are reflected or play an important role in digital, data-based mediation practices. The analysis shows that digital interfaces are displays for art and culture in their own right and establishes digital technology as an important agent for cultural mediation. Mediation therefore cannot only be understood in a didactic sense, but especially in the digital world mediation in the sense of the media-theoretical notion of re-mediation as one central characteristic of digital media becomes prevalent. The dissertation raises the question as to whether the employment of digital data leads to a changed notion of what mediation of art and culture can accomplish. Since the digitization of cultural mediation is not just some short-lived trend, but rather an unstoppable development, the thesis also highlights central directions that museums and cultural institutions might take in reacting to and taking advantage of ongoing digitization.

The thesis thus contributes to both the academic research in the field of Visual Studies as well as to contemporary mediation practice in cultural institutions. The research broadens our understanding of data-based practices of digital mediation of art and culture by bringing them into relation with the complex interplay that cultural data has with technological and media-specific factors of meaning making. In this sense, it seeks to lay the groundwork for the development of effective future digital cultural learning practices.

I. Introduction

1. Mediation of Art and Culture Goes Digital

Digitally mediated environments as well as the use of digital media by cultural heritage institutions are not a new phenomenon per se. According to media archaeologist Errki Huhtamo (2010), the first "virtual museums" appeared as early as the beginning of the 1990s, be it by employing telephone networks or CD-Roms as mediums of distribution. With the popularization and wider distribution of the World Wide Web, this technology quickly became the platform for endeavors of digital cultural heritage. According to art historians Nina Zschocke and Gabriele Blome and research artist Monika Fleischmann, digital cultural heritage comprises the digital storage, collection, and preservation of information about cultural objects (see Zschocke, Blome, & Fleischmann, 2004). An important process on the way to constituting digital cultural heritage is the digitization of the content of physical archives and collections of cultural institutions, which have traditionally served as the "custodians of the past" of Western material culture. In this process of digital reproduction and reconstruction, physical cultural objects become digital objects or cultural data, and thereby embody general characteristics of new media, outlined for example by media theorist Lev Manovich in his famous book "The Language of New Media" (2001) in his "five principles of new media." In other words, digitization translates the physical cultural items into something that shares common features with natively digital cultural objects. This data is made more and more accessible and retrievable in diverse forms of online repositories, which constitute databases as a distinct cultural form of digital media according to Manovich (2001). This move is – at least on the EU-level – politically desirable, which becomes clear in the financial support that has been given to EU-wide and national aggregators and digital repositories such as Europeana, large scale digitization endeavours, the preservation of digital data, as well as the networking and contextualization of information or knowledge.[1] By making cultural data accessible in online databases, it is not only contextualized within the networked environment of the Internet, but is also brought together with natively digital cultural data. In the sense of Manovich (2001), "new media" is culture encoded in digital form. Moreover, practices

[1] Individual countries and other continents like the USA differ in the political and monetary support they give to such endeavors.

[2] Under the term „Convergence Culture", Henry Jenkins subsumes the interplay between three

of mediation of art and culture become part of the contemporary media ecology, which poses additional challenges but also enormous chances for cultural institutions.

The current media ecology is shaped greatly by the network society (see e.g. Castells, 2005, 2010) and participatory culture (see e.g. Jenkins, 2006a; Jenkins et al., 2009). The consequence is not only that society tends to become focused on the creation, distribution, usage, integration and manipulation of information. An additional consequence is the overabundance of information that has to be navigated and filtered – oftentimes by the users themselves – and that is accessible anywhere and at any time through mobile technology. In other words, information has become ubiquitous, as has computing. At the same time, with the shift to a participatory culture in conjunction with the process of "cultural convergence" (Jenkins, 2006a)[2], the move from consumers of content towards prosumers becomes evident (see Bruns, 2008). Prosumers not only consume, but also produce content with the services and applications available to them. This change influences several things within the media ecology. On the one hand, the prevalent communication paradigm moves from one-to-many communication, as practiced by so-called mass media[3], to many-to-many communication, with the users not only acting as "receivers," but also as active contributors. On the other hand, personalization becomes key, as users want to be in charge of their experience and want to appropriate services, data, and content for their own needs. This is apparent in what Eric Gordon (2010) has described as the "digital possessive," in which "practices of networked media encourage [...] the possession of thoughts, actions, and memories in personal folders, accounts, and devices." According to Gordon, this phenomenon is not only applicable to digital media itself, but is transferred into other areas of life too, be it the production of goods, as Charles Leadbeater (2008) points out, or the exploration of physical spaces, such as a city, a

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[2] Under the term „Convergence Culture", Henry Jenkins subsumes the interplay between three main concepts: media convergence, participatory culture and collective intelligence. Media convergence describes „the flow of content across multiple media platforms, the cooperation between multiple media industries, and the migratory behavior of media audiences who would go almost anywhere in search of the kinds of entertainment experiences they wanted" (Jenkins, 2006b). The participatory culture opens up a contrasting image to what previously was described as „media spectatorship". Last but not least „collective intelligence" refers to the concept of Pierre Lévy (1997) and refers for Jenkins tot he added incentive of communication about consumed media, about the available abundance of information, and therewith accumulate the individual knowledge, resources and skills (see Jenkins, 2006b).

[3] For a long time one-to-many communication was a also a role model for communication within museums. Grand narratives are a keyword for this direction.

cultural heritage site or a museum. The participatory culture is about personal points of view as well as about the collection and (re-)appropriation of the points of view of others into a new cultural expression, all with the aim of discussing or criticizing, contextualizing, making meaning or generating knowledge. The definition of participatory culture by media theorist Henry Jenkins strengthens collaborative as well as social aspects of communication, knowledge, and meaning generation.

Thus, besides having tools that support collaborative or co-creative knowledge generation, this kind of practice depends on users' ability to access and retrieve cultural data anywhere and at any time and on their ability to freely manipulate, reuse and share cultural data in places like social media platforms, peer-to-peer networks, websites or online-repositories. As Merete Sanderhoff argues, once cultural heritage has been translated into a digital format, there is technically

> "nothing standing in the way of sharing and reusing it. It can be sampled, remixed, embedded, it can illustrate new stories and move into new media, it can adorn books, posters, and public spaces, advance research and make ideas and creativity blossom. When cultural heritage is digital, open and shareable, it becomes common property, something that is right at hand every day. It becomes part of us" (Sanderhoff, 2014a, p. 9).

This all is reflected in what Henry Jenkins, Erin Reilly, Laurel J. Felt, and Vanessa Vartabedian call the "4 C's of participation": connect, circulate, create, and collaborate. Moreover, digital experiences are no longer separable from the physical world, as virtual and physical space merge into hybrid and augmented spaces (see e.g. de Souza e Silva, 2006; L. Manovich, 2006) and we are, today, literally living in a data-space.

Another novel factor that is often overlooked by contemporary reports on cultural institutions in the digital age (see e.g. Clough, 2013; Hargrave, 2013) is the importance of technology – and especially software – as an independent actor in theprocess of mediation of art and culture and digital learning. According to, for example, Lev Manovich (2013a), William Uricchio (2011) and Ganaele Langlois (2011), software changes the conditions of communication, information production and circulation. Even more, however, it changes the way we perceive and experience not only media, but the world around us. Thus, software has become an important actor in the mediation process in its own right beyond the human level, and its role is not yet fully understood.

Through the increasing digitization of practices, audiences and users become accustomed to the existing media ecology and how it functions. They demand unlimited access to information and the ability to take part in participatory practices, reuse data, and contribute their own point of view. In terms of learning – which, through the rise of life-long learning and informal learning, is becoming more and more important not only for younger audiences, but for audiences of all ages – this goes along with being able to freely decide what, when, where and how to learn.

Cultural institutions have to face these new trends, which pose challenges to their established practices of meaning making and mediation. They have to confront the fears these challenges give rise to, and will have to adapt to data-based practices of cultural learning at the current "intersection of material past and digital future" (EVA Conference, 2014). Museums are transforming from "material archives into digital information hubs" (EVA Conference, 2014)[4]. As Michael Peter Edson, the Director of Web and New Media Strategy at the Smithsonian Institute wrote: "[…] culture only has meaning when it is alive in our minds, reworked by our hands, and loved in our hearts" (Edson, 2014, p. 15). In particular, those institutions with a mandate to use their collections for the public good have to step up to make their content openly available, accessible and re-usable for a global audience in the digital realm. This goes especially for people (with an Internet connection)[5] who do not have the opportunity to visit the institution in person, but is also important in terms of enhancing on-site visits. This also includes the development of digitization infrastructures and sustainable storage processes, not only for physical cultural artifacts but also for digital ones. Another challenge is to find meaningful ways to make sense of the growing amount of data and how to employ it for cultural learning and foster active reuse of the data. To meet the demands of prosumers and to enable dialogue between cultural institutions and the public, institutions also need to adopt and develop new ways to interact with

[4] In turn, this also results in greater competition of public and private information providers.

[5] It is important to acknowledge the digital divide, which still exists. Outreach with the help of digital media has the heavily advertised potential to democratize knowledge. However, this leaves out people without access to the infrastructure of the Internet, for whom other means distribution would be needed.

audiences. They have to find means to present their content in a way that enables and fosters engagement with their artefacts and that encourages all actors to participate and formulate their own interpretations, from the creator, critic or collector to the joiner, spectator or the inactive person (see Forrester Research, 2009). It is time to take some risks and get to work in order to start building the future of digital cultural heritage.

Meeting this challenge demands that we develop an understanding of how meaning is ascribed to cultural data, how knowledge is generated from it, and how cultural learning works within networked environments. What can we know about cultural objects in the digital realm? What is the status and value of a digital cultural object? What knowledge can be generated about cultural objects in a digital environment, especially when we are dealing with processable data and a mix of digitized and documented cultural objects from the physical realm as well as natively digital objects?

Answering these questions requires an analysis of contemporary processes of meaning making, co-creative knowledge generation, and cultural learning in the digital realm, especially those forms located within or based upon digital cultural repositories in networked environments. Such an analysis must take into account the role that technology – and software in particular – plays in these processes. This thesis aims to do just that by focusing on the database as a central nexus and facilitator of mediation processes.

2. Research Questions

To develop a better understanding of how meaning making processes and knowledge generation of cultural data in networked environments work, this thesis will pursue two main research questions.

RQ 1) What are data-based practices of "digital mediation of art and culture"?
This question aims at understanding and mapping practices of mediating art and culture and cultural learning in the digital realm. It takes as its main object the database, which is conceived of as a cultural form and repository that defines what can be said and known about a culture or society. Thus, this question considers digital and

data-based meaning-making processes within databases and database-interfaces themselves, as well as in cultural learning processes that reuse and contextualize data, either in the form of learning resources or in the form of new experiences; it concentrates mainly on web-based approaches.

RQ 2) How do these digital and data-based practices reflect both the characteristics of and challenges posed by art and mediation in digital contexts?
This broad question inquires into the aspects of contemporary digital media and digital media ecology that are reflected or play an important role in digital, data-based mediation practices. In what way are these practices “digital”? In which ways do they go beyond what can be done in analog practices? Does the use of digital data lead to a changed notion of what mediation of art and culture can be and accomplish? Finally, how do these practices reflect or even solve the challenges that the area of mediation of art and culture and cultural institutions are facing in the contemporary media ecology?

3. Lost in Translations

3.1. Between “Kunstvermittlung” and “Mediation of Art and Culture”

This PhD thesis analyzes digital and data-based practices of mediation of art and culture around digital cultural repositories and databases as central mediation tools. “Mediation of Art and Culture” – what is this all about?, you might ask. The somewhat unwieldy translation of the German term “Kunst- und Kulturvermittlung” (see e.g. Kittlausz & Pauleit, 2006) is the author’s attempt of transferring a German term into English, a term many authors say is nearly impossible to translate. It is the nature of language that terms from one language are not 100% translateable into other languages, and the specific terminologies of a discipline often pose the greatest issues. This, of course, can become a major obstacle for communication and discussions in interdisciplinary work. While art educators often understand without issue what the term “Kunstvermittlung” means, the step from German to English and the different disciplinary backgrounds makes it difficult to communicate this very research topic of “digital mediation of art and culture” in other academic settings. This hints towards the ambivalent meaning of the term and the need for a clearer definition.

To begin with, it is important to examine different meanings of "mediation" in relation to "mediation of art." The social psychologist Sonia Livingstone, now working in media and communication theory, traced the meaning of this term for the field of communication in her ICA Presidential Address of 2008, which was titled "Mediation of Everything" (Livingstone, 2009). She discussed the emergence of diverse new, related concepts such as "mediation," "mediatization," "medialization," and "remediation" in the field of communication. According to Livingstone, the terms' meanings and uses varied greatly: while they were sometimes used to wholly rethink media power and media effects, others used them to describe changes in technology. These changes include the introduction of technological intermediaries in communication processes, the way media interfaces increasingly shape our experience of the world and our everyday practices through media interfaces (see Bolter & Grusin, 1999; about the term Mediatisierung see Krotz, 2001, 2007; a summary of the discourse of Medialisierung in Meyen, 2009), the convergence of media (Jenkins, 2006a), or, in case of remediation, "the representation of one medium in another" (see Bolter & Grusin, 1999)[6]. However, the basic meaning of the term "mediation" in different languages remains ambivalent. Livingstone conducted an informal survey among colleagues from different countries, asking them about the meaning of the word mediation in their native languages (see Livingstone, 2009, p. 3/4). Summarizing her findings, she wrote that in "[…] English, 'mediation' has been 'repurposed,' away from the old meaning of conciliation toward an emphasis on the media, as enabled by the fortunate coincidence in the terms for linking disparate elements and for the media of communication" (Livingstone, 2009, p. 3). This does not work so nicely in all languages, though. While in French the term translates directly to "mediation," in Slovenian the concept is difficult to translate, as the literal translation would be the verb "posredovanje" or "posredovati," meaning to mediate or to intervene in a sense that has nothing to do with communication. In Polish, it is a juridical term, while in Tibet a mediator is a matchmaker. In Iceland, mediation translates to "midlun" in the sense of conveying or sharing information. The verb is related to "midill" (medium), which is used to denominate mass media as well as a person who can communicate

[6] Even though not immediately fitting for the notion of mediation of art and culture, the German term "Kunstvermittlung" aims at the notions of mediation, mediatization or medialization as understood in the field of Communication play an important role in understanding the experience of cultural objects in (digitally) mediated environments, brought forth by digital practices of mediation of art and culture.

with the dead. In Portuguese, too, the translation "mediação" is an academic term (not in everyday use) that refers to "the negotiation of media meanings between producers and consumers" (Livingstone, 2009, p. 4). In Bulgarian, like in Slovenian and Polish, the term mediation refers to the legal term of dispute resolution, but the term mediatization is also known "as publicizing or representing an issue in the media" (Livingstone, 2009, p. 4). In Germanic languages, which also exert influence on Scandinavian discourse, Livingstone points out that "mediation (Vermittlung) ordinarily references the legal/regulatory term for seeking discursive solutions to disputes [and referring to Eva Sturm one could add being connected by using the phone or marriage brokerage to the list; addition by F.W.], Mediatisierung (mediatization) and Medialisierung (medialisation) refer to the metaprocess by which everyday practices and social relations are increasingly shaped by mediating technologies and media organizations" (Livingstone, 2009, p. 4).

Looking at these various definitions of "mediation" in different languages, the Portuguese one of negotiating meaning between producers and consumers of media, as well as the inclusion of discourse in the German definition, strike the author as the most useful when it comes to the term "Kunst- und Kulturvermittlung" and the subsequent translation as "mediation of art and culture," as it is used in this thesis. It is an intermediary in or a facilitator of the social process of negotiating the meaning of a cultural object[7], where the discourse on the object can play an important role. Thus, the common translation of mediation in relation to "Kunstvermittlung" falls short if it is used in the common sense of the word. But the concept's signification within the field of communication is different, too. Artist and "gallery educator" Carmen Mörsch argues in an interview with Miriam Sharp on "Gallery Education" (2003) that the term "Kunstvermittlung is actually not possible to translate – it is an umbrella term that covers elements of diverse practices like gallery education, community arts or participatory and interventional art forms, but also curating and commercial art trade" (Mörsch & Sharp, 2003, p. 209). And Mörsch paraphrases Eva Sturm in the interview, according to whom "[t]he term, Kunstvermittlung is at the same time art-mediation / –

[7] The author will use the term "cultural object" in a very broad sense in this thesis, entailing any kind of cultural expression beyond its status as physical object. A cultural object can range from an artistic project, such as a painting, a sculpture, a video installation or a performance, to a website, a digital photograph, a video on tape, or on a social media platform, to everyday objects and cultural heritage sites like monuments. All cultural objects have importance for understanding past and present cultures and societies.

education and / – communication. So KunstvermittlerInnen can be commentators, critics, curators or – more and more – educators" (Eva Sturm paraphrased in Mörsch & Sharp, 2003, p. 210).

In this thesis, contemporary mediation of art and culture is understood as going beyond personal mediation and activities enacted by a specific group of people, namely, the "gallery educators." Instead, it denotes the space between a visitor or user and the cultural object, an interface that determines how the visitor or user can interact with, experience, interpret and learn from and with art and culture. This interface is, for better or for worse, designed. This point extends to technological intermediaries and agents that play a fundamental role in contemporary (digital) mediation practices.

The theoretical works that shape this thesis' definition of mediation of art and culture the most, and that subsequently will be at the forefront of the reflections on the mediation of art and culture that follow, are "Critical Mediation of Art" by Carmen Mörsch (2011) and the "Participatory Museum" by Nina Simon (2010). In essence, these works mark the shift from an approach geared toward the reproduction of knowledge to one focused on the co-generation of new knowledge about art and culture together with the visitors and users and the fostering of the visitors's own interpretations, as Carmen Mörsch's approach proposes. Nina Simon sees the museum as a space for social experience and a facilitator for people to engage in meaningful interaction with artistic projects; by extension, interaction with objects can lead to meaningful interactions with other visitors. Projects of artistic mediation thereby have the potential to ignite meaningful conversations. These two approaches to the mediation of art and culture are significant when thinking about practices of mediation in the digital realm, as they reflect and mirror practices prevalent and important in the current participatory culture (see e.g. Jenkins et al., 2009). The latter is one of the defining paradigms within the contemporary (digital) media ecology and poses a major challenge for cultural institutions.

3.2. Between "Kultur" and "Culture"

Alongside the term mediation, it is also worth tooking a closer look at the second part of the term "mediation of art and culture." The addition "art and culture" signifies that the concept not only encompasses high art that has passed the test of institutional validation, but that it includes any kind of cultural expression or, to use another term, material and immaterial "cultural products" (see Kittlausz & Pauleit, 2006, p. 11). This view follows the work of Aby Warburg, who in his interdisciplinary cultural studies (interdisziplinäre Kulturwissenschaft) bridged what was commonly separated as high- and low-art (see e.g. Hensel, 2011). The act of translating the terminology into English also necessitates that we carefully consider the definitions of the terms "Kultur" in the German context and "culture" in the Anglophone context, even though taking an in-depth look at the different theoretical and philosophical approaches to these concepts over time is beyond the scope of this thesis. Thus, this section is mainly concerned with developing a working definition of the term for the purposes of the thesis.

The word derives from the Latin term "cultura," meaning "agriculture / cultivation / tilling," but also "care / upkeep" and "training." Initially, it was used in the German language in both senses, where it signified both tending to the land and plants as well as the "products of the mind." According to the Duden Fremdwörterbuch from 1997, "Kultur" in the non-agricultural sense can mean "Gesamtheit der geistigen und künsterlischen Lebensäußerungen einer Gemeinschaft, eines Volkes"[8], but also "feine Lebensart, Erziehung u. Bildung"[9] (Wissenschaftlicher Rat der Dudenredaktion, 1997, p. 457, keyword "Kultur"). This breadth of meanings has found its way into the broad definition of "Kultur" used in the German scientific discourse, which Ansgar Nünning[10] defines as follows:

> "Im weitesten Sinne meint 'Kultur' daher die vom Menschen durch die Bearbeitung der Natur mithilfe von planmäßigen Techniken selbst geschaffene Welt der geistigen Güter, materiellen Kunstprodukte und sozialen Einrichtungen. Dieser weite Begriff der Kultur umfasst die Gesamtheit der vom Menschen selbst hervorgebrachten und im Zuge der Sozialisation erworbenen Voraussetzungen sozialen Handelns, d.h. die typischen Arbeits- und Lebensformen, Denk- und

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[8] Translation by F.W.: "the unity of intellectual and artistic expressions of a community or a nation."

[9] Translation by F.W.: "fine way of life, upbringing and education."

[10] Translation by F.W.: "In the broadest sense, 'culture' thus means the world of intellectual goods, material artistic products and social organizations that human beings have created by adapting to nature with the help of systematic techniques. This broad definition of culture encompasses the totality of the conditions necessary for social action that have been created by man in the process of socialization. This includes typical work- and life forms, ways of thinking and doing, moral concepts, and intellectual expressions of a community." (Nünning, 2009)

> Handlungsweisen, Wertvorstellungen und geistigen Lebensäußerungen einer Gemeinschaft (Nünning, 2009).[11]

Following this definition, culture encompasses not only artistic or technical products as expressions of our lives, but also behavioral patterns or moral values of a society – be it a nation, ethnicity, group or the like. According to Marion G. Müller (2008), shared knowledge, shared beliefs and shared attitudes also playa significant role in the perception, reception, interpretation and understanding of cultural artifacts, together with the individual recipient's background and knowledge.

Karl Ermert also reiterates this wide definition of culture. But for his work on "cultural education," he adds a more narrow definition that encompasses "the arts and their creations: visual arts, literature, performing arts (from theater over dance to film), music, the applied arts such as design and architecture as well as the manifold combinations between them" (Ermert, 2009). But it can be argued that the wider dimensions of culture are also inscribed and reflected in the products contained in the narrow definition, which makes these artifacts a good starting point for learning about a particular society. Indeed, this approach has been used in recent practice in the area of cultural mediation that gave rise to this thesis, which is to say, work with museums, galleries and archives, which also provide the material for the case studies discussed below.

In the Anglophone context, and especially in "Cultural Studies," "culture" also has multiple meanings and is analyzed in different ways according to the analyst's

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[11] There are an immense number of different definitions of culture, and Nünning states that most definitions encompass a specific part of this rather wide spectrum. This thesis is not going to attempt to engage in a discussion on the various definitions of culture, even though it acknowledges their existence, nor does it try to draw a line between what is referred to as art and what is referred to as culture – which, in this context, is often used as a substitute for popular culture and is thus associated with a particular value judgment – as this is beyond the scope of this thesis. In the way the expression will be used throughout the thesis, it refrains from making judgments about both "art" and "culture." This would, of course, go against the inclusive spirit of the concept of "mediation of art and culture." Following this spirit, the thesis treats them as equals. The thesis thus opts to generally use the terms in conjunction in order to denote not only all kinds of manmade expressions – from diverse artistic genres to technologies to built heritage – but also all things related to our society, our everyday life, our history, and our collective and individual memory, which are oftentimes expressed, reflected and preserved in these items or processes. However, it should be acknowledged that there have been several attempts to differentiate and classify different artifacts within the system of art and culture. One prominent example is James Clifford's system of objects, which models the cycle of art and culture (Clifford, 1996; see also Wuggenig & Holder, 2002).

particular convictions or agenda. Looking at the preface of Michael Ryan's book "Cultural Studies. A Practical Introduction" (2010), Ryan defines "Culture" as "inseparable from human life. Everything from how we dress to what we eat, from how we speak to what we think, is culture" (Ryan, 2010, p. VIII). Another definition Ryan brings up is culture as "unstated rules by which we live, rules that regulate our everyday practices and activities without our thinking about noticing them" (Ryan, 2010, p. VIII). This perspective sees culture as a common set of rules or shared values of a particular community or a group of people of any size, for example, a region, a nation, a zone. But culture also revolves around institutions within cultures or subcultures that a group of people inhabits and uses, such as courts, marketplaces or workplaces (see Ryan, 2010, p. IX). "Culture as a way of life tends to produce a commonality of thought and behavior, as well as conformity with reigning standards, norms, and rules. It is what allows us to live together in communities by giving us shared signs and signals whose meaning we know and recognize" (Ryan, 2010, p. IX).

Departing from this notion, Ryan also mentions an interpretation of culture more in line with Ermert's definition of it as human-made things that translate ideas into objects (Ryan, 2010, p. IX). Thus, this second dimension of his definition of culture "comprises cultural artifacts, such things as the shape we give the built environment (the architecture of buildings, for example), the forms of entertainment we create (such as Hollywood or Bollywood movies), and the music we listen to (be it techno or rap). That list is far from exhaustive of human creativity or of the multiple ways humans create and develop institutions, activities, and things that are fabricated, artificial, and artistic and that count as culture" (Ryan, 2010, p. IX).

According to Ryan, these two dimensions of culture are related and interdependent. Culture qua norms and values lived by people determines what kind of culture and cultural artifacts are and can be created. And vice versa, the cultural productions of humans influence the culture as value system. Fitting for the current project, Ryan uses a software metaphor for his definition: "culture is the software of our lives. It is the program we live by, the rules that determine how we think and act. But it is also the malleable, rewritable script that we ourselves rework and recreate as we live and produce creative works and say and do creative things in our lives" (Ryan, 2010, p. XI). And in this sense, the term "culture" is more inclusive than "art": while both refer to the results of human creativity, culture also includes those results that are not legitimized by cultural institutions like galleries or museums, which have been vested by society with the power to legitimize creative products. In fact, culture includes human creativity in general, which includes products defined as "art."

A look at Anglophone scholarship in cultural studies makes clear that the Anglophone tradition of thinking about culture has a stronger political and sociological dimension. In their book "The Practice of Cultural Studies," Richard Johnson, Deborah Chambers, Parvati Raghuram and Estella Tincknell discuss seven different key topics in inquiries into culture that reveal this political bent. The first is the issue of **culture and power**, where cultural processes are analyzed as a "medium within which powerful social relationships are played out and possibilities for social betterment are opened up or closed down" (R. Johnson, Chambers, Raghuram, & Tincknell, 2004, p. 10). Questions in this line of research often involve the concept of identity, the authors state, and especially the issue of how individual or collective identities evolve and are created under social pressure. But they can also revolve around what the authors call "culture-as-power-issue" (R. Johnson et al., 2004, p. 10), which involves looking at who actually participates in the cultural processes of meaning-making and the formation of identities. The most widespread position in cultural studies is that everyone should be able to participate in this process, which differs from the dominant but narrow definition of the cultural field as a set of "specialized, often elite, high cultural practices and products that are distinguished from common culture and 'owned' by experts or privileged groups" (R. Johnson et al., 2004, p. 10).

The topic of **culture as value** revolves around the aesthetic and moral value of cultural products. This approach was prevalent in the traditional disciplines of the humanities, which, until recently, generally focused on canonized works that they deemed worthy of analysis. This has been criticized by newer disciplines like media studies, which also deem popular culture and subjects like fan culture, television shows and romantic fiction as worthy of academic study.

Another very specific issue is **culture as policy**, which deals with cultural policy. Johnson et al. (2004) frames this approach to culture as being rather selective, as it tends to only address the policies of large-scale, formal institutions, and in particular governments, thus reifying the power that these formal institutions and cultural elites hold as bearers of cultural identification and authority. And even though cultural studies aims to go beyond the high/low division of culture in the arena of policy as everywhere else, scholars interested in this topic still tend to limit their perspective to the practices of interest to formal institutions. These are usually sports, art, museums or heritage. Thus, it is argued that the policy orientation may recapitulate older reductive approaches to culture that, in the words of Raymond Williams, go back to the general meanings of the word "as cultivation, education or individual and social improvement" (R. Johnson et al., 2004, p. 11).

Culture as cohesion views "culture as a source of social cohesion and belonging" (R. Johnson et al., 2004, p. 11). This oftentimes heavily critiqued framework wants to see cultures as "shared, homogeneous and tightly bound" (R. Johnson et al., 2004, p. 11), where internal relations within a culture are "conflict-free" zones and differences and power are usually analyzed between whole cultures and not intraculturally. This kind of thinking is, according to Johnson et al., often associated with a radicalization of politics and national identity in Western European states. Resulting issues such as racism stress the unity of a (predominantly white) nation where the other is the cause of social disorder, while other issues include the notion that cultural differences follow out of a clash of civilizations and a collision of value systems. This is not a new phenomenon though, and examples of racism and conservative cultural theory can be traced back historically[12].

Another set of questions around culture focus on **culture as standardization** or convergence. Uniformities arising from forms of social control – be they tendencies like commercialized and commoditized forms of popular culture (mass culture), globalization or work discipline – as well as culture as an instrument of regulation are a core topic for this strand of theory. This framework is prevalent in modern schools of thought rooted in sociological theory from Max Weber onwards, with prime examples to be found in Marxist variants of cultural and aesthetic critiques. Examples of the latter are Frankfurt School theorists like Max Horkheimer and Theodor Adorno, who coined the term "cultural industry" to describe the way in which capitalist society created mass culture through standardized cultural goods such as films, radio programs, magazines,

[12] Johnson et al. (2004, p. 12) give several examples of conservative cultural theory and political actions in the close history, and an uprise of this kind of thinking can unfortunately be witnessed nowadays even more radically. Their book also discusses models of cultural studies that heavily critique the model of culture as „pure, bounded, whole or entire" (R. Johnson et al., 2004, p. 12) and keeps constantly questioning culture as the disciplines own key category.

etc. that are produced in a factory-like manner (see Horkheimer & Adorno, 1972). This strand of theory often implies diversity as a preferred critical value (see R. Johnson et al., 2004, p. 13).

Lastly, **culture** can be questioned **as language** or with regard to **understanding**. Directions such as Structuralism look at "how meaning is constructed by means of the conventions and codes of languages in the broadest sense, signs, myths or symbols" (R. Johnson et al., 2004, p. 13). A second direction – Hermeneutics – looks how an understanding of the "the other" – as in for example a text, a language, another culture or a different point in time – is possible.

All these dimensions of culture and all these approaches to research have to be kept in mind when talking about the "mediation of art and culture" in the context of cultural learning. However, this thesis is primarily concerned with culture in the sense of cultural expressions and what can be learned about them, from them and through them by means of digital cultural learning, be it implicitly or explicitly. This includes but is not limited to learning about a particular culture in a broader, often political sense. Further, this thesis is especially concerned with visual culture, including but not limited to visual and process-based arts. Finally, it concentrates on aspects of mediation of art and culture related to cultural institutions such as museums and archives. In this sense, too, the approach to culture as language or understanding, and especially theories that deal with processes of individual or co-creative meaning-making and knowledge-generation in institutional – and especially in digitally mediated environments – are at the forefront in this thesis.

II. Research Design and Approach

1. Argumentative Structure

Parts III through V are dedicated to developing several basic terms and discourses. **Part III** introduces the characteristic of digital media and digitality as well as the current digital media ecology from a media studies and software studies point of view, highlighting key concepts such as a) basic principles of digitality, digital media, and (re-)mediation in a technical sense from different media theory perspectives, which lay the foundations for understanding the move from physical cultural objects to cultural data; b) the idea of the network, which will play a role later on when considering the Web and databases as data-networks and learning- and meaning-making paradigms such as connectivism (see e.g. Downes, 2012; Siemens, 2004), which are based on the traversal, creation and manipulation of networks for learning and knowledge generation; c) the idea of a platform as an open forum for many different intended or unintended uses of the infrastructure; or d) dimensions of participatory culture. These points set the groundwork for understanding the inner workings and values of the contemporary media ecology. This defined ecology sets the stage on which cultural institutions are operating today and in which mediation of art and culture as co-creative knowledge generation takes place.

Part IV offers an overview of the current approaches to "Mediation of Art and Culture." It includes a literature review and discusses the practice as well as the young academic field of gallery education, art education, cultural learning, and Museum Studies, in order to give an overview over the current approaches of the field. After discussing the social need for the mediation of art and culture and cultural learning and clarifying the goals and possible outcomes of mediation processes, the part will situate the practice of mediation within the context of the museum and introduce major directions of cultural learning approaches, bringing together approaches from German and Anglophone discourse. The literature review leads to a preliminary definition of mediation of art and culture as an interface to art and culture. The section then proceeds to develop a model of four intersecting dimensions of mediation, which can be analyzed in line with changes brought about by the digitization of medition practices. Part IV, chapter 3 will highlight contemporary challenges for cultural institutions resulting from transformations in the media ecology, as discussed in Part III, especially in relation to digitization and the production of cultural data, but also in relation to the adoption of a "digital mindset" (Sanderhoff, 2014b, p. 24), the opening of access to and reuse of cultural collections and the transformation towards open cultural institutions. Last but not least, Part IV chapter 4 offers insight into current definitions of digital mediation of art and culture.

Part V deals with the historic and contemporary discourse around collections and archives, as well as their move into the digital realm. The differences between traditional archives and their digital forms – databases – are discussed. The section also analyzes the Kulturwissenschaftliche Bibliothek Warburg as an historic notion of a collection as resource for knowledge generation around visuals. Moreover it discusses the media-scape as cultural repositories and its role for recording, constructing and disseminating or re-presenting histories and memories. This offers a perspective on the communication side of mediation, where media are playing an active role not only in the storage and representation of history, but also in the formation of history, which they accomplish by translating artistic and cultural objects into a mediated form. Moreover, the Internet as a network infrastructure is scrutinized. The section treats it, on the one hand, as a networked environment that constitutes the context of online databases and, on the other hand, as a potential archival structure in itself. Lastly, the chapter defines archives and databases as the foundation for any cultural learning practices.

The theoretical introduction into different facets of the topic provide the context for the analysis of digital practices of mediation of art and culture in **Part VI**, with the two core studies outlined above in the methodology.

The section develops a classification of sources for cultural data and digital cultural repositories. Based on a classification system proposed by Gabriele Blome, this thesis extends and updates Blome's system to fit the contemporary situation. Beyond that, the part includes a study of the meaning-making process of cultural data on the basis of online repositories and platforms, outlining four basic dimensions of meaning-making within databases. These four dimensions are constitutive of the ways in which meaning is forged out of cultural data in a wide range of collection- and archive-driven applications. The four dimensions are a) categorization and information architecture; b) modes of retrieval; c) modes of presentation, contextualization of the material; as well as d) interactive processes within the software architecture of the platform or digital repository, enabling for example participation and collaborative meaning making.

The section on categorization will discuss different modes of ordering and organizing data, from top-down approaches to bottom-up and crowd-sourced methods, from manual categorization by humans to automated, algorithmic data-analysis, which can eventually lead to an abandoning of discrete categorization (see Lev Manovich, 2015).

The retrieval section discusses retrieval as a specific kind of interaction with a database, as a meaning-making process, and as temporary form of contextualizing cultural data. As a process working on the data-level, retrieval goes beyond the interface. Besides introducing several strategies of retrieval, the thesis investigates "Digital Methods" by Web epistemologist Richard Rogers (2013), which uses the framework of retrieval for research purposes. Moreover, this section includes a study on the interface anatomy of retrieval, which serves as the basis for every database interface and involves retrieval, browsing and filtering of data.

The section on presentation and contextualization of data will discuss different methods of contextualization of cultural data and important interface elements: from data visualizations such as generous and ambiguous interfaces, semantic maps, mapping or timeline interfaces to curated contexts such as different forms of online exhibitions and collections as well as hypermedia publications. Furthermore, the chapter will propose some ways in which databases might be used as tools for research and storytelling. In this capacity, databases do more than enable users to traverse relations, instead allowing them to build new ones, which ultimately makes object-based research possible.

This leads to the last section on participation and collaborative meaning-making, which offers an overview of crowdsourced practices relevant to cultural heritage and outlines the concept of co-creative knowledge generation developed by Mary Leigh Morbey, Julian Lombardi and this thesis' author.

Thus, this part analyzes key aspects of practices of digital mediation of art and culture, while concentrating on web-based repositories and platforms as tools for cultural learning. In attempting to cover a broad cross-section of possible meaning making and digital cultural learning practices, the section delves into a range of different digital projects. However, the thesis will, of course, not be able to cover the full breadth of approaches.

Lastly, **Part VII** offers a summary and discussion of the results of the analysis in relation to research questions. It stakes out the limitations of the thesis and considers some future research possibilities.

2. Methodology / Plan of Inquiry

The inquiry consists mainly of two parts: 1) a definition of the contemporary media ecology as the context for mediation of art and culture that embeds also its digital practices. It lays the theoretical foundations for understanding the challenges that this changed media ecology poses for contemporary mediation practices as well as archives and their digital forms. 2) It contains an analysis of contemporary digital and data-based practices of mediation, meaning-making, knowledge generation, and learning about and with art and culture. For these practices, the database will serve as the central nexus and tool for mediation.

The definition of the contemporary media ecology derives mainly from the review, juxtaposition and discussion of current positions in scholarly literature and professional discourses. In order to form a holistic view on the contemporary media ecology, the thesis will bring the following international discourses together, bridging German and Anglophone literature and spanning several disciplines:

a) **Media Theory and Media Studies** with a focus on contemporary digital media. This body of literature mostly discusses the contemporary digital media ecology and digital culture on a meta-level, giving general insights into how our contemporary digital media-scape functions.
b) **Mediation of Art and Culture** or **Cultural Learning** provides an educational framework on learning about, from and with art and culture. This discourse ranges from insights of gallery education practitioners and academic studies to art education or museum studies. In the last decade, with the rise of specific

graduate programs within art / art history or museology departments, the field has become more academic.

c) **Museum Studies (Museology)** includes the theoretical and professional discourse around museums, practices of exhibiting and what is generally called "museum experience" from the point of view of an institution as well as that of the visitors. This field is by now established in the academy and is either taught in specific Museum Studies programs or in conjunction with other humanities programs as a certificate program.

d) **Museum Technology** evolves mainly around a community of museum professionals and technologists working on the integration and application of technology – nowadays especially digital media – into the multifaceted work of cultural institutions. Thus, this is a specific field of media practice. The discourse develops mainly around conferences such as "Museums and the Web"[13], MuseumNext[14], and the Museum Computer Network (MCN)[15], which also publish their proceedings. Besides convening museum practitioners, these conferences also attract academic researchers from diverse fields who conduct research related to the interests of this community. Alongside these large conferences – and several other smaller ones – the community also employs blogs, digital media tools such as videoconferencing and social media platforms such as Twitter for ongoing professional exchange and discussions. Additionally, several large institutions publish reports about their own ongoing work – in a descriptive or reflective manner – or cooperate with universities or private research institutions on studies about or around their practice. Last but not least, consortia of professionals in the field publish reports, which give more general insights into the practice and often result in advice for best practices.

e) **Digital Pedagogy** deals with digital approaches in formal education. Discourses are in part professional discourses by higher education or K12 teachers; some, however, also form an academic discourse in the fields of education and computer science.

f) **Digital Humanities** entails the use of digital research methods and computing for the humanities and scrutinizes these "new modes of knowledge formation"

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[13] http://www.museumsandtheweb.com

[14] http://www.museumnext.org

[15] http://www.mcn.edu

(Burdick, Drucker, Lunenfeld, Presner, & Schnapp, 2012, p. 75). This is mainly an academic discourse across a wide range of humanities disciplines. One set of actors includes computer scientists who work on the algorithmic analysis and visualization of humanities data and on digital research tools that enable enhanced human analysis.

Part VI offers an analysis of contemporary digital and data-based practices of mediation, meaning-making, knowledge generation, and learning about and with art and culture, which is grounded in the context defined in the literature review (Parts III-V). This analysis mainly uses the method of "scientific description" (see Starkulla, 2008), bringing the inductive analysis of the sampled examples together with primary sources composed by the persons in charge of the projects. In other words, it generates insights and overarching classifications within a sample of database, digital collection and data-based-mediation projects by describing, comparing, and analyzing exemplary cases.

The sample of case studies has been assembled in such a way that the cases cover a broad spectrum of phenomena in the realm of meaning making within web-based and networked digital cultural repositories and databases of cultural data along with the kinds of mediation practices that are both rooted in and (re)use these platforms. This makes it possible to give an overview of different strategies and phenomena within the field; but of course, it is impossible to cover every detail, as the study is limited to the specific characteristics of the chosen example projects in a pars pro toto style. The sample was derived mainly from academic discourse on cultural repositories and archives of art and media art as well as professional discourses in museum technology and mediation of art and culture – be it at conferences or in their respective proceedings, awards such as "Best of Web" by the Museums and the Web conference series or the MUSE Award by the American Alliance of Museums, the professional blogosphere, discussions on social media such as Twitter and Facebook, or through conversations and personal contacts within the field as well as my own involvement in different projects at some stage. Several examples – especially the ones from the field of media art – stem from the author's previous research on media art archives (Wiencek, 2006, 2009, 2012a). This includes netzspannung.org, Medien Kunst Netz, GAMA, the Ars Electronica Archive, V2_archive, the Daniel Langlois Foundation, and virutalart.at[16], which were especially important steps in laying the foundations for the author's understanding of the meaning-making process in online repositories.

The examples of online repositories used for the case studies on various aspects of meaning-making in cultural online repositories and platforms and the classification of these projects as resources for cultural data were curated to be representative of specific types of repositories. This makes it possible to define the significant features within the classification of online repositories and exemplify fundamental approaches to meaning-making. Another important criterion for the examples was that they highlight innovative, cutting-edge approaches at the time of sampling. All samples were documented with screenshots; thus, the analysis is based on the screenshots as well as the subjective experience of the functioning websites[17] at a specific moment in time. The links to the projects are included in the footnotes of the text to enable the reader to experience the websites in person as well. However, it is important to note that the projects are – as all content on the Web – in constant flux. Thus, it can well be that the site has fundamentally changed in form, content or behavior, or are even offline by the time this thesis is read.

In terms of theory, this thesis has two important pillars. On the one hand, it focuses on the mediation of art as a form of (co-creative) knowledge generation; in doing so, it draws on "Critical Mediation of Art" by Carmen Mörsch (2011) as its foundational text while integrating the different discourses outlined above. The analysis of the projects is informed by **Software Studies** as spearheaded by Lev Manovich. The idea here is to understand and consider the role of software as a non-human actor and the technical infrastructure underlying the mediation process. Software Studies was first defined by Lev Manovich in his 2001 book "The Language of New Media", where he wrote:

> "New media calls for a new stage in media theory whose beginnings can be traced back to the revolutionary works of Robert Innis and Marshall McLuhan of the 1950s. To understand the logic of new media we need to turn to computer

[16] The former "Database of Virtual Art" (virtualart.at) became the "Archive of Digital Art" (https://www.digitalartarchive.at) in 2014.

[17] An exception is the project "kunstvermittlung.at", which could only be retrieved at this point in time as an archived version on the "Wayback Machine" (https://archive.org/web/), as it was taken offline. The archived version was unfortunately no longer fully functional. Thus, the discussion had to be based on a previous experience of the website in 2007, refreshed by discussions of the project in the professional literature and published screenshots.

> science. It is there that we may expect to find the new terms, categories, and operations that characterize media that became programmable. From media studies, we move to something which can be called software studies; from media theory—to software theory" (Lev Manovich, 2001, p. 48).

Hence, in 2001, he argued that theorists and practitioners incorporate concepts, terminology and ways of thinking from computer science into media studies, which he thought would facilitate analysis of media products within a software environment beyond the instruments designed for analog mass media. In a rephrasing of the statement in his 2013 book "Software Takes Command", Manovich steers away from positioning computer science as a bedrock of truth that would contain the keys for explaining culture in a software society, as he calls it. Rather, he situates computer science and, with it, software itself as part of culture. In his new definition, Manovich claims that "Software Studies has to investigate the role of software in contemporary culture, and the cultural and social forces that are shaping the development of software itself" (Lev Manovich, 2013a, p. 10).

Thus, the thesis does more than aim to understand the different approaches of digital mediation of art and culture and the functions specific applications offer. It also seeks to relate them to the technological and software-related infrastructure that makes them possible and that shapes the inner workings of the applications. Software shapes how users can interact with data, what experiences they can have and what they can know about the world through mediation. Therfore understanding the role of software in meaning making and knowledge generation about and with cultural data is important, and this approach sets this thesis apart from other work done on this topic. But Lev Manovich's approach does not end here: the notion of software and technological infrastructure as cultural objects is important to him, as these are in themselves part of culture and shaped by decisions of the developers as well as conventions that have developed in the field over years. Thus, Manovich actually describes an interaction between culture and software.

Following the outlined approach, Part VI, "Data-Based Practices of Mediation of Art and Culture", primarily spans two areas of study:

a) Classification of online repositories and platforms as resources for cultural data

The classification of online repositories started as a deductive study. The idea was to thematize, but also inductively expand classifications of digital cultural repositories already existing in the professional field. On the basis of this classification, the study gives a basic definition of each category based on examples from this thesis' samples, thus providing an overview of the variety of data sources that serve as the basis of and as tools for the digital mediation of art and culture.

b) The dimensions of meaning-making in cultural online repositories and platforms
This study delimits how meaning is made out of cultural data within or based on databases (or digital cultural repositories) in a networked environment: the World Wide Web. The parameters it adheres to are inspired by literature on archives and database functionality, as well as inductively derived from a sample of online repositories and platforms. The inductive study is a "close-reading" of the functionality of the sample projects on the "surface", which denotes the platforms' interface and interaction potentials, and on the "subface", which denotes the algorithmic underpinning of the projects (see Nake, 2012). The project sample spans a wide range of sources, including institutional archives and collections, national and thematical aggregators, collaborative and educational platforms that directly employ core functions of a database for meaning making, and forms of data-based mediation and knowledge generation applications based on cultural data. The inductive findings are juxtaposed with a discussion of contemporary theory and some models derived from it.

3. Disciplinary Positioning and Relevance of the Thesis

The thesis undertakes an analysis of digital practices of meaning making, knowledge generation and cultural learning on the basis of available cultural data in order to generate an understanding of the breadth of contemporary digital practices of cultural mediation and their position in as well as influence on the contemporary media ecology. Thus, the thesis positions mediation of art and culture at the interface of Digital Media (theory and practice), Cultural Learning and Digital Humanities research. Two aspects of the database stand at the center of attention: the database as one central cultural form of "new media" (Lev Manovich, 2001) and the database as remediation of the archive. As the latter, it can be seen as a repository where data is stored without a specific meaning, waiting to be activated by the engagement of users, who can integrate the data into meaning making processes, narratives or experiences. But the role of an archive or a database for cultural learning is also to define what can be said about the fraction of the world represented in the corpus in the database, which can be mined to generate new knowledge.

As outlined above, the thesis brings together various professional written discourses. But it also seeks to develop interconnections between different practice-based and academic perspectives on the topic, including fields such as graphic design, interface design, digital media, cultural learning with an art theory focus, and "Visual Communication", a more recent field that, as part of the academic discipline of communications, is steeped in a more social scientific tradition; it analyzes mainly visual phenomena, be it the visual product itself, its production or its reception (see M. G. Müller, 2003, 2007).

The disciplinary anchor of this thesis is the young research field of Visual Studies. According to art historian James Elkins (2003), the term was first mentioned in the early 1990s to sum up various approaches to visual phenomena. Elkins cites Margarita Dikovitskaya's dissertation "The Study of the Visual after the Cultural Turn" for a comprehensive survey of early directions:

> "some researchers use the term *visual studies* to denote new theoretical approaches in art history (Michael Ann, Paul Duro; some want to expand the professional territory of art studies to include artifacts from all historic periods and cultures (James Herbert); others emphasize the process of seeing (W.J.T. Mitchell) across epochs (David Rodowick); while still others think of the category of the visual as encompassing non-traditional media—the visual cultures of not only television and digital media (Nicholas Mirzoeff), but also of the institutional discourses of science, medicine, and law (Lisa Cartwright)" (Dikovitskaya, 2001, p. 94; cited in Elkins, 2003, p. 15/16, first names added and punctuation altered by Elkins).

According to James Elkins (2003) and design historian and digital humanities scholar Johanna Drucker (2003), the common denominator of all interpretations of what constitutes Visual Studies is the focus on visuality itself and visual practices across all disciplinary boundaries as the object of inquiry. This spans from scientific images to commercial graphics to artistic projects (still, moving and generative).[18] Thus the field can include visual practice and scholarly research on visuals at the same time, but also has a strong methodological focus – developing and analyzing ways to think about visual representations (see Drucker, 2003, p. 4). The Visual Studies Initiative at Duke University[19] might serve as a good example: according to communication and media scholar Mark Olson, it is an interdisciplinary project that combines theoretical and historical research on visuality with visual practice, which is to say, the production of visual representations. The latter can be moving images, graphic arts, or scientific and historical visualizations. Thus, the initiative combines the arts, humanities and sciences in order to come up with new ways of thinking with and about visuality (Mark Olson in Hiatt, 2009). Johanna Ducker differentiates the approaches of practitioners and scholars:

> "Practitioners conceive of visual studies as a rubric under which the work of artists and designers can be legitimately understood as research in its own right, informed by historical study and theoretical precepts while functioning primarily through creative activity. Within a scholarly frame, visual studies suggests critically rigorous examination of image artifacts that don't fall within the canonical strictures of art history" (Drucker, 2003, p. 4).

But for this thesis, the most important notion brought forward by Johanna Drucker within the visual studies framework is "visuality as a way of knowing" (Drucker, 2003, p. 4) or a visual epistemology. As she formulates it: "Visuality is a primary mode of understanding, but also of our production as social and cultural beings. Identity and authority are constituted through the systems of knowledge production embodied in visual forms" (Drucker, 2003, p. 4). In other words, visual media can affect our ways of

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18 In his 2003 book, James Elkins refers to Visual Studies as a future, more open field of research, while referring to the current practice of 2003 as "visual culture". He initially defines Visual Culture as a term or discipline that is oriented towards the visual and has its roots in the English tradition of cultural studies (albeit less Marxist and less aimed towards social action) and art history, gravitating towards the theories of Roland Barthes and Walter Benjamin. According to James Elkins this field is closer to a European, unquantified and culturally oriented sociology, while Visual Studies can be seen closer to humanities. Visual Culture dominated the scene as a term for visually oriented teaching and research, defining itself in relation to art history as going beyond the subjects that are traditionally the scope of art history. In other words, it included newer cultures and went beyond formalism and the stuy of canonical works of art. It was according to Elkins (2003, p. 16) recognized as a field in the late 1990s.

19 http://aahvs.duke.edu; the 6 year initiative was part of the department „Art, Art History & Visual Studies" at Duke University and was followed up in 2014 by the program „Media Arts + Sciences" that brings together arts and humanities scholarship with natural sciences and social sciences.

thinking,. This means that a visitor can not only learn about cultural objects[20], but also with or through them. In this context, it is important to note that according to visual communication scholar Marion G. Müller, people's understanding and interpretation of visual works is based on association rather than rational, argumentative logic. Intuitively, it follows that the interpretation of visual works is dependent on the context of their production and their reception context as well as the individual background and mindset of the viewer (see M. G. Müller, 2003, p. 22). Müller thus argues that scholars have a responsibility to go beyond an analysis of formal elements, iconography, and iconology by accounting for context. For this, she developed the method of "visual context analysis". Besides the different contexts of production and receptions, Müller's later "Visual Competence" paradigm distinguishes between three different levels of context: the personal/individual level; the situational level, which influences a specific situation; as well as the systemic level, which encompasses social, cultural and political contexts.

Following this tradition, this thesis makes a contribution to the field of visual studies by conducting an analysis of the specific reception context of online repositories and online collections as well as data-based approaches to cultural learning on the Web. All of these analyzed data-based approaches contextualize the digital cultural objects on a situational level but also, as this research will argue, on a systemic level. This thesis works with Müller's three contexts, but it also adds a fourth: technology. Media technology, network infrastructure and software as key agents of a technology-driven mediation process provide the context for cultural data, because these technologies influence on a much deeper, systematic level what can be known about the data and what knowledge is actually accessible under which circumstances. The package of data-based mediation strategies, digital media practices and technological infrastructure constitutes a system for knowledge generation and learning about and from the cultural objects within a contemporary digital media ecology. Their central nexus point is, of course, the database. The selection of objects of research and the inclusion of technology is an essential context that situates the thesis at the interface of visual studies and digital humanities, which is primarily concerned with new modes of knowledge generation based on digital methods. The thesis sets itself apart from

[20] Visuals are defined as one particular type of cultural object and are the primary type of cultural object I am concerned with in this thesis.

existing studies by offering an interdisciplinary view on data-based, digital practices of mediation of art and culture. As argued above, these practices are located at the juncture between cultural learning, education practices, museum studies, digital humanities research and mediation in a literal communication or media theoretical sense. The thesis is able to capture the connections between these various fields precisely because it takes the database as cultural form and as repository as its central point of analysis. On the other hand, the dissertation's approach goes beyond simply acknowledging the contemporary media ecology and participatory practices as significant contexts by actively accounting for technological infrastructure and software as non-human actors in the mediation process. In this sense, the research will broaden our understanding of data-based practices of digital mediation of art and culture, elucidating the complex interplay of cultural data with other variables that play into the process of meaning making, including:
a) the technological and software infrastructure of cultural data and the cultural repositories they are placed in. The infrastructure has an influence on the way users experience this data and forms the interface for interacting with it.
b) digital humanities research, which, on the one hand, reuses this infrastructure for its research, but, on the other hand, also shapes methodologicallywhat can be known about cultural data through computation and the technological infrastructure;
c) the contemporary media ecology, not only as cultural context or as mirror of prevalent media practices, but also as a factor that shapes users' expectations of how they can interact with, experience and learn with cultural data, as well as the skills required to do so;
and d) last but not least, the contemporary practices of cultural learning and mediation of art and culture, which influence the approaches and thinking of cultural institutions as well as the providers of digital resources towards the employment of digital media.

Such a holistic point of view is lacking in the extant research.

This sums up the thesis' contribution and relation to the discipline in which this dissertation is submitted. Important for understanding the thesis, too, is its relation to the work of the interdisciplinary research center "Visual Communication and Expertise" (VisComX). The center is the institutional context in which this research project took place. The VisComX's research is based on four disciplinary pillars: communication science / media studies as a nexus discipline that connects art history, experimental psychology and computer science. VisComX focuses on a process-based approach that seeks to understand visual communication as a process of four intertwined and interrelated areas of competence. It is based on the "Visual Competence" cycle developed by Marion G. Müller (M. G. Müller, 2007, p. 103) discussed above. Müller defines visual production, perception, interpretation and reception as the four main competencies constitutive of a visual communication process. These key competencies form the topical areasanalyzed by the core disciplines within the research center. The pillar "visual production" includes the areas of visualization, visual information processing, and visual classification. "Visual perception" covers the cognitive processing of visuals as well as visual attention. "Visual interpretation" is related to questions about the attribution of meaning and interaction with visuals. Lastly, the field of "evaluation" covers research on expertise and emotional reactions to visual stimuli. The field of communication binds all four fields together, computer science primarily deals with the visualization and algorithmic classification of visuals, psychology with the perception of visuals, and art history mainly with their interpretation (see Research Center Visual Communication and Expertise at Jacobs University, 2013).

Thus, this thesis follows the overall process-based approach of VisComX's research and is situated at the nexus of the disciplinary pillars of art history (interpretation and meaning attribution) and computer science (visualization, processing of cultural data, classification), which are, for their part, bridged by digital communication (media theory, software studies).

III. Transformation Processes in a Digital Media Ecology

1. From Analog to Digital Media

During the second half of the 20th century and the beginning of the 21st century, the world we live in was fundamentally changed by digital media and the way they structure how we communicate and express ourselves; how the economy works with regard to producing, buying or delivering products, and making available a broader range of goods as described in the phenomenon of long tail as well as personalized goods; how the world around us seems to adapt to the needs of the individual; how information is always at our fingertips, and with mobile media only a click away wherever we are. But what are these digital media, what are their characteristics and what is "new" about them in relation to older media forms?

Since several decades writers are tackling what they call "new media", a problematic term in so far as it is a relative term, as Robert K. Logan (2010) argues in his book "Understanding New Media – Extending Marshall McLuhan". All times had and have their "new" media, which are new only relative to the already existing ones. For this reason this term will not be used in this thesis, but it will rather refer to the media it is working with as "digital media"[21]. Digital media form a subset of what is referred to as "media", with very specific qualities, which will be defined and examined in this chapter. However initially the term "media" needs some attention. There are an abundance of media-definitions available, which cannot all be discussed in detail, as this is not the focus of this thesis. A universal use of the term defines media as mediator, a "in-between" between two agents with specific characteristics (see Treutler, 2002). These agents can be diverse, as is reflected in definitions like the one of Jos de Mul (2009). He defines media as "[…] interfaces that mediate not only between us and

[21] This term will be used also recognizing Lev Manovich's critique of the term digital, which he sees as conflation of three unrelated concepts, namely the concepts of „analog-to-digital conversion (digitization), a common representational code, and numerical representation" (Lev Manovich, 2001, p. 52). He calls for a differentiated specification, which of these concepts is at work, when one talks about digital representation. This is why he refrains from the term digital in his book „The Language of New Media". In his latest book "Software Takes Command" Manovich states that the term "digital" still dominates the popular and academic understanding of what "new media" comprises. He describes it there as conflation of "the whole range of new technologies, new expressive and communicative possibilities, new forms of community and sociality that were emerging around computers and Internet" (Lev Manovich, 2013b, p. 147).

our world (designation), but also between us and our fellow man (communication), and between us and ourselves (self-understanding)" (de Mul, 2009, p. 95). Moreover Michael Staiger (2001) differentiates media as technical term (or in the sense of technology), which includes the technical or technological means to communicate; the sociological use of the term media, which views media as mass media and looks at the effect of these media on social processes; as well as media (in terms of their institutions) as actors with and agenda (see Reichertz, 2007). Last but not least he mentions a systemic media term, which refers to symbolic forms of communication or exchange between social systems, for example money.

In general one can distinguish a wide and a narrow use of the term media. The narrow term of the plural "media" used according to Vowinckel (2010) since the beginning of the 20th century, restricts media to traditional or formerly analog mass media. In communication research these are defined as media for mass communication, thus the "communication transmitted through a medium (channel) simultaneously reaches a large number of people" (Wimmer & Dominick, 2013, p. 2). Traditionally this included mainly outlets for one-to-many-communication such as print products (newspapers, books, magazines, pamphlets), recordings (audio as well as film delivered on a specific physical carrier), broadcast media such as radio and television that are sequencing content over time using a time-schedule. In the last years the mass media definition also includes the Internet and digital or digitized media products (see e.g. McQuail, 2010). Media are seen in this narrow definition as carrier of information and communication.

A wide use of the term also "includes other apparatuses such as telephone or computer, motion sequences such as sports or dance as well as the body itself, in so far they store information, transmit messages, work as sign for something else (the latter aspect plays a central role for semiotics) or act as agents in their own right" (Vowinckel, 2010, p. 2 transl. F.W.). The wide definition – which will be referred to in this thesis when using the term media, even though the problematic side of this definition is that nearly everything can be defined as media – was introduced by Harold A. Innis in the 1950s (see Treutler, 2002) and acknowledges the effect of a medium on the form of a message, a distinction most prominently argued for by Niklas Luhmann (e.g. Luhmann, 1997). This means the message, which can be transmitted, is dependent on the (technological) structure, the affordances of a medium, and thus the content needs to be analyzed in relation to the medium used for transmission and be adapted to work within the affordances of a specific medium. Marshall McLuhan, who views technology and tools (in relation to media) as extensions of human beings, or more specifically of human senses[22], radicalized this idea with his famous concept of “the medium is the message” (McLuhan, 1968, p. 23), arguing that the media affect the society by their characteristics, not by the content delivered through them. Where this view might be a bit radical in its entirety, neglecting the power of content, it is important that it recognizes for the first time the technology itself as a major factor and agent in itself in communication, which for contemporary digital media is more important than ever. Even more this notion will serve as an important angle for this thesis, to understand the influence and role of digital media for the Mediation of Art and Culture following the approach of Software Studies (Lev Manovich, 2001, 2013c) that formalizes this theoretical notion into a research paradigm – looking at Software as cultural product but also as independent agent within the media ecology.

The media definition of Dörte Wittig (2002) takes an ecology approach to a media definition, defining different roles of media and its organization within the ecology. She defines media as consisting of

a) “channels”, which are a system of connections between different agents and make an exchange of information or objects in time and space possible (transmission media);
b) “logic space”, which refers to the structure (description, classification, syntax / rules) of the exchanged content, which needs to be known by the sender and receiver, as well as a corresponding and shared interpretation (semantic), which refers to the context of the message.;
c) “organization” which refers to roles, protocols and processes of a medium and transactions.

Similar to Marshall McLuhan she argues that agents in the communication process within an encompassing medium can be another medium, and one agent can be part

[22] Marshall McLuhan’s idea of defining anything which is an extension of the human body as a medium makes a medium which extends our senses and their reach beyond our body, often through means of technology (see also Hörisch, 2004, p. 62). The downside of this definition is what Jochen Hörisch calls a „hyperinflation“ of media, where anything that can be seen as extension oft he body – from wheel over clothes to money – can be seen as medium. This is on the one hand makes it more difficult to differentiate a medium from what is not, as it is a relatively broad and weak definition, but on the other hand allows new perspectives on media (see Hörisch, 2004, p. 64).

of more than one medium. For her this describes also the characteristics of what she calls "new media" as "open, distributed, networked and dynamically changing structures. A medium is therewith not only a carrier of information, but a concept for structuring information objects, to make their exchange between agents possible and to describe their processing." (Wittig, 2002, p. 188)[23]. Therewith she paves the way for a definition of digital media.

When it comes to digital media, the media definition includes for the purpose of this thesis electronic media such as the computer, network technology such as the Internet with its different services (World Wide Web, email, instant messaging, voice over IP (VoIP), bulletin boards, usenet, listservs, etc.) but also mobile technologies. The latter include cellphones and mobile networking technology with its services (voice telephony, SMS (short message service), MMS (multimedia message service), videotelephony, etc.), mp3-players, PDAs, as well as touch devices (smartphones, tablets, multimedia-players) that are nowadays oftentimes converging different media technologies into one (portable) device. Mass media and communication scholars are trying to encompass these converging "new media" (in opposition to traditional mass media forms) into their research field and established methodologies. In their introduction to mass media research Roger Wimmer and Joseph Dominick are subsuming the "new high-tech communication channels" such as smart phones, smart TVs or tablets as "smart mass media" (Wimmer & Dominick, 2013, p. 2). "[…] using these smart media, one person or one organization can now communicate simultaneously with hundreds of thousands or even millions of people via tweets, text messages, social media posts, and email. However smart media can access the Internet and additionally can serve the function of all other mass media" (Wimmer & Dominick, 2013, p. 2). However looking at these media forms and technology as "yet another mass medium" falls short in recognizing how they actually work. They need a more refined understanding of what digitality actually is and how the inherently digital characteristics also change the media ecology beyond being a mass distribution channel on steroids. In contrast it is important to recognize digital media as dialogic and interactive media.

[23] In a similar direction Jos de Mul offers a definition of "artistic media" as "interfaces that not only structure the imagination of the artist, but the work of art and the aesthetic reception as well." (de Mul, 2009, p. 95) This view will particularly helpful for thinking about re-mediation of items of cultural heritage and artworks as well as using media for cultural learning.

The way the larger media ecology functions is determined by the digitality of media that can be witnessed in its smallest component, a single digital media object. Literature offers several starting points to define digital media. One of them is the book "Understanding New Media – Extending Marshall McLuhan" – in which he aims to update the famous theories of Marshall McLuhan's book "Understanding Media" (1968) and to distinguish "new media" from "mass media" – Robert K. Logan (2010) defines "new media" as "digital, interactive, incorporate two-way communication, involve some form of computing" (Logan, 2010, p. 10).

Thus the possibility of interactivity or two-way communication is one of the central defining characteristics of digital media according to Logan. Two-way communication allows the user to interact with the information or with the producer of the information, which "makes dialogue and knowledge sharing possible through the medium of a shared visual or audio space" (Logan, 2010, p. 52) and allows the users to "test the reliability of that information" (Logan, 2010, p. 52/53). This is a difference to "old media", which Logan classifies as "one-way throughfares of information that turn the viewer or listener into a passive recipient of information" (Logan, 2010, p. 52). Interactive media are a process, which can be witnessed and influenced by the users and therewith always in progress, whereas "old media" are rather the endpoint and result of a creative process which took place during the production process outside the medium.

But not only the possibility of two-way communication is important – this existed also already with for example the telephone – but the unique feature of the Internet is the speed of communication. The latter makes fast exchange of multimodal communication possible – be it textual through email or IM, or visual through image and video messaging and sharing – and facilitates Web-based collaboration tools, such as wikis, or videoconferencing as other examples. Other authors use the term "interactivity" for this characteristic. Katja Kwastek (2008) also scrutinizes this term in her essay "Interactivity – A Word in Process" and argues as also Lev Manovich (2001) for more fine grained distinction of interactive concepts and different perspectives on this phenomenon. Lev Manovich looks mainly at underlying media structures or types of interactivity with regard to variability. He strengthens the importance of the interface for interaction, be it interaction with physical interfaces or Human-Computer-

Interaction (HCI), where "each has its own grammar of actions, each comes with its own metaphors, […]." For digital media he distinguishes open versus closed interactivity. As closed interactivity he refers to a structure, which uses fixed elements arranged in a fixed branching structure, where the user makes choices within a hierarchical structure when reaching a particular object. As a special case he mentions hypermedia, where one can create, manipulate and examine a network of information, consisting of nodes interconnected by relational links. Open interaction is more complex and involves a modification and / or generation of the elements on the fly, responding to the user's interaction – thus the user deals with a dynamic system instead of a predetermined set of pathways.[24]

It is evident that in his book Robert Logan focuses especially on the functions of the online environment that builds up on much more fundamental properties of digital media. In total he defines five main differences between "new media" and "mass media", which reinforce each other, as well as nine additional properties. Besides interactivity he counts ease of access to and dissemination of information, continuous learning, alignment and integration – meaning the referentiation of content to each other through for example hyperlinks – as well as community towards the main characteristics of online environments (Logan, 2010, p. 48/49). They all describe "features" and effects of online communication, which is deeply integrated in our daily lives. However what makes digital media unique in Logan's opinion is the way the identified characteristics work together. "Old media" do not have all the features combined but only one or two of them at a time. Another differentiating feature lies in the reception of digital media, as they are often individually accessed and often experienced in a more intimate setting, for example alone in front of a personal computer, a tablet or phone[25]. However before the broader outline of such a new-media ecology can be understood one needs to understand what digitality in itself entails.

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[24] A more finegrained differentiation of modes of interactivity can be found in the essay „Users, interactivity and generation" by Russel Richards (2006).

[25] This cannot be seen as general rule, as digital technologies have also found their way into televisions and therewith the more communal living room settings, or cinemas with digital projection, which is not intimate either. Also multiplayer games on game consoles, where the players are in the same room, create a more communal environment. But the notion of an more intimate reception is true for the classical work or recreational setting in front of a personal computer or personal mobile devices, which are taylored to an individual and foster rather mediated communication than communication within the same space.

1.1. Digital Media Objects – A Basic Definition

Lev Manovich is much more precise and fundamental in the definition he offers in his book “The Language of New Media” (2001). In his seminal work Lev Manovich aims to map “New Media”[26] and analyze its specific media language in relation to other / previously existing cultural forms, media or ways of expression as well as their conventions and techniques and how they operate in digital media. The relation of analogue and digital media is reciprocal, as computerization not only enables new cultural forms, but also redefines the existing ones. As opposed to a first definition of “new media”, which limits the computer to a tool for distribution and exhibition, Manovich understands the computer also as a tool for production of media as well as as media storage device. “All have the same potential to change existing cultural languages” (Lev Manovich, 2001, p. 19).

But “[w]hat are the ways in which the use of computers to record, store, create and distribute media makes it 'new'?” (Lev Manovich, 2001, p. 20), is the key question he asks. He identifies two merged historic trajectories: the computer as machine to process numerical information as well media technologies, which store media data in different material forms. The synthesis of those two allows “[t]he translation of all existing media into numerical data accessible through computers. The result is new media – graphics, moving images, sounds, shapes, spaces and texts that have become computable; that is, they comprise simply another set of computer data.” (Lev Manovich, 2001, p. 20) For these digital media artifacts he uses the term “new media object” throughout his work, naming examples such as digital still images, digitally composited film, virtual 3-D environment, computer games, self-contained hypermedia DVDs, hypermedia Web sites, or the Web as a whole (see Lev Manovich, 2001, p. 14). With the term “object” Manovich adopts a paradigm from computer science (object-oriented programming) to use it for theory on computerized culture.[27] For these digital media “objects” he defines

[26] at the time of publishing he was specifically looking at “Web sites, virtual worlds [defined as 3-D computer-generated interactive environments), virtual reality (VR), F.W.], multimedia, computer games, interactive installations, computer animation, digital video, cinema and human-computer interfaces” (Manovich, 2001, p. 8/9)

[27] An object in class-based object-oriented programming is a particular instance of a class, which in a technical sense usually consists of a combination of variables, functions and data structures. This can be compared to an object, a distinct entity in real life that technically is

five key principles which he does not want to be seen as absolute law, but rather as general tendency: 1) numerical representation; 2) modularity; 3) automation; 4) variability; 5) transcoding. These principles build up on the basic understanding of the use of an object in programming and can be used to differentiate "old" from "new" media.

1.1.1. Numerical Representation

The word digital has its root in digit (number) as well as "digitus", which stands in Latin for finger, for discrete counting. Being a **numerical representation** indicates that all digital media objects are composed of the same digital code, which allows different media types – namely "texts, still images, visual or audio time data, shapes, 3D-spaces" (Lev Manovich, 2001, p. 49) – to be displayed using a single computing device. Because of the numerical representation they

1. "[…] can be described formally (mathematically)" (Lev Manovich, 2001, p. 27). For example an image or shape can be described through a mathematical function.
2. are "[…] subject to algorithmic manipulation. […] In short, media becomes programmable" (Lev Manovich, 2001, p. 27).

Digital data is thus processable, computer-readable, allows the creation of identical copies without loss and is free from physical constraints. What becomes evident here is also the difference between analogue and digital media. Where digital media operate

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modeled in the data structures of the object. The object has a specific behavior defined in the functions, a specific reaction and processing of input and a specified output. Through what programmers call „encapsulation" the object acts as a black box with defined behavior and characteristics, where the actual user does not have to know the inner workings. This is comparable to driving a car, where the driver does not need to know how the engine and all other mechanics and electronics in the car work and play together, as long as he or she knows the basics of using a car, like pressing the gas, braking, shifting the gears and steering it. In other words with an object is a way of modeling elements of the real world or a specific subject area he or she is working with in the program together with their characteristics and behavior. Additionally to this basic principle of an object, object-oriented programming supports very specific ways of reusing objects, namely inheritance and polymorphy. Inheritance builds up on another object and adds or changes functionality. A specific object acts therefore as starting point for a new object, where the basic functionality and behavior is taken over and added upon. Polymorphy is a specific and more complex inheritance, which allows to base a new object on more than one base-object, resulting in a composite of the functionality of the base objects. This conceptualization of an object and its (re)use already gives a first insight into the way also media objects or digitized physical objects are represented and can be (re)used in a digital environment.

with discrete numbers on a binary system represented commonly by 0 and 1 – electronically this can be translated by electricity is on or off – analogue media operate oftentimes with continuous values, which need to be translated – or digitized – in order to be represented digitally. This comes with the risk of loosing information, as there is a technological limit of what can be captured digitally. David M. Berry stresses the effect of the "input mechanism of a socio-technical device within which a model or image is stabilized and attended to" (Berry, 2011, p. 2). Thus the digitization of a "everyday object" results in fitting it into a algorithmically manipulable, electronic grid of numbers, which Berry calls a substractive method of understanding reality that can produce new knowledge and methods for its control through its digital mediation (in the technical sense of the word) (see Berry, 2011, p. 2). What cannot be directly captured needs to be described at best in a standardized and machine–readable form by meta-data so that computers can deal with it.

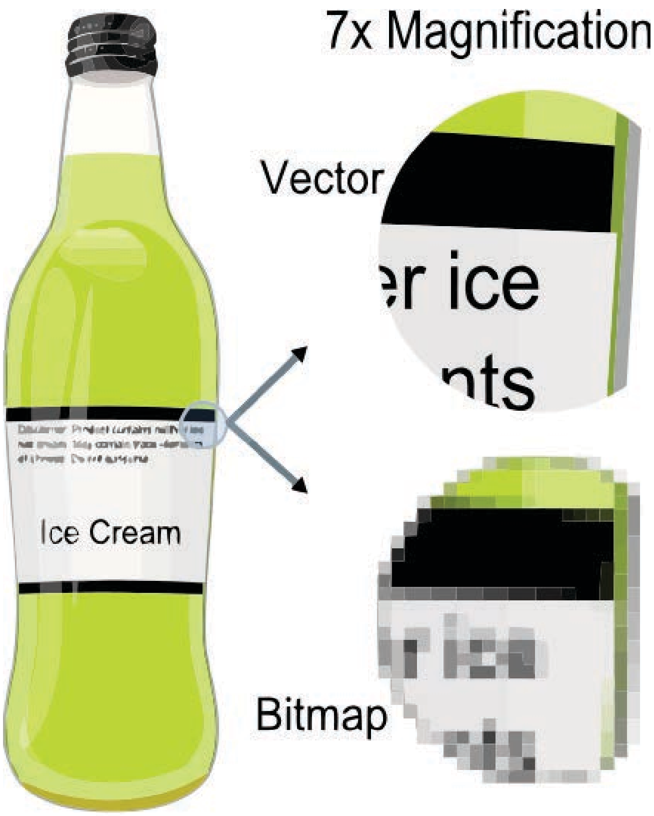

Figure 1: Vector vs. Bitmap image. Image courtesy of Darth Strabo, Wikipedia. Source: http://en.wikipedia.org/w/index.php?title=File:VectorBitmapExample.svg&page=1, retrieved at 31.10.2012

As an example for capturing analogue data one can look at the digitization of 2D-images. For a humanist the term “image” has many different connotations depending on language traditions[28], as the German Visual Communication scholar Marion G. Müller discusses (see M. G. Müller, 2003, 2007). The American linguist W. J. T. Mitchell (1986) distinguishes five different categories of images, defining the term roughly as likeness, resemblance or similitude:

- *graphic images* (pictures, statues, designs),
- *optical images* (mirrors, projections),
- *perceptual images* (sense data, appearances),
- *mental images* (dreams, memories, ideas, fantasmata),
- and *verbal images* (metaphors, descriptions) (see Mitchell, 1986, p. 10).

The field of visual communication differentiates according to Marion G. Müller *material images* (representations) and *immaterial images* (conceptualizations (Denkbilder)), each having a range of forms and different production as well as reception contexts (see M. G. Müller, 2003, p. 22), all of which have influence on the meaning of an image. Most importantly the meaning of an image is based according to Müller (2003) on the logic of association based on reference images, which can be analyzed and interpreted. It is important to note that the interpretation of an image is different for each person, depending on the individual, cultural and social background (see also Huber, 2004). Methods to analyze the meaning of images range from

- *Iconology and Iconography* (for discussions of these methods see e.g. M. G. Müller, 2003, 2011), going back in its modern form to visual scholars such as Aby Warburg (1866-1929) (e.g. 1999) and Erwin Panofsky (1892-1968) (e.g. 1982), analyzing visuals on a motif level;
- *visual context analysis* (M. G. Müller, 2003), tackling the different context levels to get to the potential meaning of an image;
- or *semiotics* (see e.g. Kress & van Leeuwen, 1996; van Leeuwen, 2001), coming from a linguistic approach by Roland Barthes (e.g. Barthes, 1977, 1981), with the key idea of layering meaning in denotation (what or who is depicted) and connotation (the ideas or values depicted through what is depicted in the way it is represented).

[28] For example the use of the German term “Bild” can range from role-model to material image, and can also be used for dream-images, language metaphors or the description of an idea, just to name a few uses (see M. G. Müller, 2003, 2007).

Thus, in summary, for a human an image has a complex meaning for each individual person, determined by many factors. For a computer, however, the same image is translated to and represented as mathematical abstraction of what is visible to the apparatus that records the image: neither having any meaning for the machine in first place, nor being interpretable anymore by a human being. The numerical representation is most evident in images in vector format, in which graphics and shapes are mathematical representations. A line, for example, is represented by two points in a 2D coordinate system, a curve by a Bezier-curve. On top of this representation each object has different values attached, such as a numerical representation of color or an alpha-value (opacity). This mathematical representation is an abstraction of an image, as a visual with a cultural meaning for human beings is translated into formulas and coordinates[29]. The second image type – the bitmap- or pixel-image – is represented as a collection of pixels on a grid – a 2D-sampling of space – all of which are in the simplest case each assigned with a color or tonal value. The density of the grid (dots per inch in print, pixels per inch on a screen) defines the resolution of the image. In image processing images are usually analyzed and processed on a pixel level. How they are saved is dependent on a standardized set of rules specified in a file format. Pixel-images are moreover oftentimes encoded by a compression algorithm.[30]

Both described representations of vector- and raster graphics are a higher-level representation of the images. On the machine level images are nothing but bit-sequences of enormous length, which are not readable or interpretable at all for humans. Thus visuals need to be interpreted or processed by software and transformed back into analog media output – for example an image on a screen or print – in order to be able to be perceived by human beings (see also Negroponte, 1995). This is why in his 2013 book "Software Takes Command" Manovich calls numerical code the "new universal intermediary" (Lev Manovich, 2013b, p. 153). The digital encoding of data has a big advantage: even though not directly accessible anymore to our senses the same data can be formatted for our perception in various different ways, without affecting the actual data, for example by displaying visual data in different "views" in

[29] see section on „transcoding"

[30] a very detailed, mediatheoretical account on digital images can be found in the article „Das digitale Bild gibt es nicht – Über das Nichtwissen der Bilder und die informatische Illusion" by Claus Pias (2003).

an image editing program. A good example for this is the software “Histomages” by data visualization scholar Fanny Chevalier. In the first image on the left it shows two views of the exact same image data. One is a portrait photograph of a young boy, as humans usually would perceive it, the second is a histogram view of the same data ordering the pixels by color-values. Both views contain the same pixel values but only the left image shows a human-recognizable and interpretable image-motif, while the right is an analytical view that rather allows more formal assumptions about the image data itself. On top of offering a different view this interface also allows a different kind of interaction with the image, namely selecting and editing a specific range of pixels of similar or the same color in the histogram view, that would be very hard to select accurately with traditional image editing tools offered in programs like Adobe Photoshop within the human-recognizable photograph.

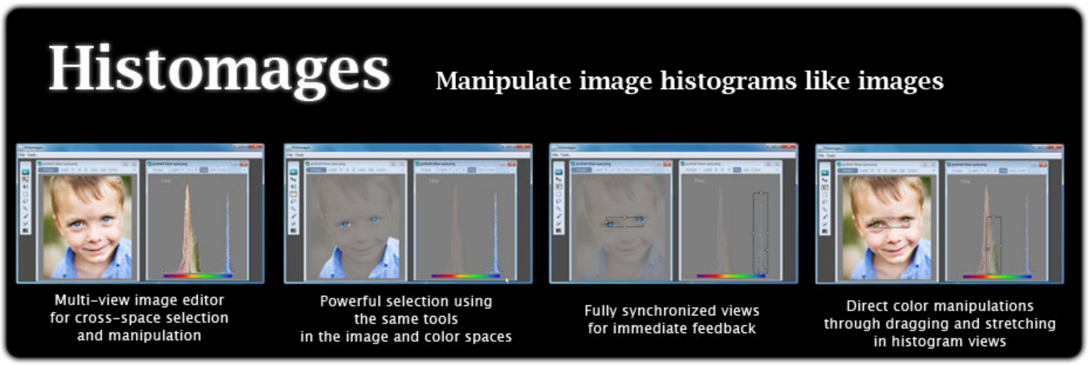

Figure 2: Histoimages by Fanny Chevalier. Two different representations of the exact same pixel-data shown side-by-side, offering different possibilities of interaction. Source: http://www.aviz.fr/histomages, retrieved at 07.05.2015. © by Fanny Chevalier et al.

1.1.2. Modularity

The second principle of new media is **modularity**, of which Lev Manovich speaks as “fractal structure” (Lev Manovich, 2001, p. 30). This is closely related with the principle of numerical representation. “Media elements, be they images, sounds, shapes, or behaviors, are represented as collections of discrete samples (pixels, polygons, voxels, characters, scripts). These elements are assembled into larger scale objects but continue to maintain their separate identities. The objects themselves can be combined into even larger objects – again, without losing their independence” (Lev Manovich, 2001, p. 30).

Besides the fact that digitizations are a collection of sampled data, digital media objects themselves are also on a higher level a conglomerate of different modules, which are brought into a new structure. A simple example is a Photoshop-image, which consists of multiple layers. Another is a webpage, which can consist of different media items such as text, images, and other embedded media items such as a video clip or audio. All these elements exist independently as files on a server but are brought together into a content structure on a webpage, which generates new meaning out of the elements and puts them into a relation (see e.g. Djonov, 2007; Lemke, 2002). Another example are mashups, which create new meaning by combining different available data- or media-sources. Generally speaking this relates to what Jay Bolter and Richard Grusin (1996, 1999) call hypermediacy, which they define as assembly of different 'media-types' / modalities into each other (see Bolter & Grusin, 1999, p. 9), and which creates a heterogeneous space in content and in its modes of representation while making multiple acts of representation visible.

1.1.3. Automation

"The numerical coding of media (principle 1) and the modular structure of media object (principle 2) allow for the **automation** of many operations involved in media creation, manipulation and access. Thus human intentionality can be removed from the creative process, at least in part" (Lev Manovich, 2001, p. 30), as Manovich argues relating the first two principles of new media together. Examples of what Manovich calls "low-level" automation are the use of templates and simple algorithms for the creation of media objects. Those techniques are included in most commercial media-creation-software, e.g. "agents" or "wizards" which automatically create a layout for a document. Another example is dynamically created web-content as well as recommendation systems. The content is personalized and therewith generated tailored to a specific user, based on his / her interests, interactions, input, or the like, by assembling information pulled from a database and formatting it using generic templates and scripts. This allows for individual customization of content as opposite to the mass standardization practiced in mass media. This is also true for access of content, where through technologies such as RSS (Really Simple Syndication) and respective agents that filter the content, content specific to the user's interest can be aggregated automatically.

“Researchers are also working on what can be called 'high-level' automation of media creation, which requires a computer to understand, to a certain degree, the meanings embedded in the objects being generated, that is, their semantics” (Lev Manovich, 2001, p. 33) Lev Manovich writes in 2001 and links this research to the field of Artificial Intelligence (AI). An example he mentions are game characters or AI expert systems in computer games, which have narrow “expertise” to fulfill specific tasks – like attacking an enemy – in a codified and rule based environment of a computer game. Besides media creation Manovich addresses automation in media access. The computer is used to store huge amounts of media material (or media assets), for example in databases of stock agencies and global entertainment conglomerates. There is a need to improve the classification of and searchabilty for media objects. While there are powerful search and filter operations for text files, only in the late 1990 software designers started to provide similar tools for media based on low or high level analysis of media items. In general automated analysis is based on the processing of media data, the detection of patterns in this data on a low level (image segmentation, feature extraction of basic image features such as mean of entropy or standard deviation of all pixel values in an image) up to high-level image analysis, which aims to automatically make sense of the patterns found in the data. This involves a semantic understanding of the data on the side of the computer, resulting in features such as a search for visually similar or identical image content[31], face detection and diverse filter and sorting algorithms. These algorithms address the challenge of finding a specific existing object, which Manovich describes as one of the main challenges by the end of the 20th century (see more in Part V).

1.1.4. Variability

Another result of the combination of numerical representation and modularity of new media objects is **variability**, which refers to the fact, that one object can exist in different, potentially infinite versions. This means a new media object is not fixed but can evolve. An example is a webpage, which can be easily updated over time (periodic updates, also for software) or customized to the needs of the user, whereas a object of

[31] implemented in services such as Tin Eye (www.tineye.com) or Google image search (http://images.google.com/), which allow the upload of a sample image or give an image URL for either a reverse image search or also a search for similar images

"old media", for example a printed product, is at least in a specific instance fixed and manifested in some sort of materiality.

In traditional production of pre-digital media products the final product is completely created by a human author. Through automation different versions of a digital media object such as a dynamic website are at least in parts assembled by a computer[32]. In other words: there is not a fixed "message", but rather a framework of multiple possible messages, and the final output is managed by software (see Lev Manovich, 2013b, p. 36). This results into "production on demand", which is also already transferred to traditional media, such as the print industry (for example print-on-demand, customized print products, made possible by digital printing technologies).

Manovich mentions several principles making variability possible:

1. Media elements are stored in a database and end-user objects, which can vary in content or resolution (scalability in size and detail level), are then generated either beforehand and pulled on demand or are generated on the fly from this database. Zooming into a map is an example for this mechanism, where different levels of detail–tiles are loaded on demand while the user zooms in or out.
2. The separation of data and interface allows different interfaces or views for the same data. This is directly built into modern Web-technology for example by separating design (CSS) and structure (HTML) in web programming.
3. Information about the user is used to customize the content and composition of media. This starts at information about the technology the user employs to access the content (which webbrowser, screen size of the device to ensure for example the right rendering of a responsive website, up to information about the interests and shopping behavior of a user, to customize the ads and offers, as practiced for example by Google or Amazon or recommendation systems for media consumption (used for example by YouTube, Netflix, Spotify).

Variability as such can, according to Manovich, also be seen "as a consequence of the computer's way of representing data – and modeling the world itself – as variables

[32] Of course the code, which allows the generation of the dynamic content and sets the rules for the automatization is controlled by human beings too.

rather than constants" (Lev Manovich, 2001, p. 43). This substitution allows a programmer to make programs as flexible and adaptive as possible. Translating this to a human-computer-interface would be giving the user options to modify the performance or behavior of a program or a media object. He also relates this notion to cultural objects at large, where versions share well defined data, or what media industry calls a "property" – e.g. a well known narrative, an icon, a character or a well known person – acting as a prototype from which the versions are derived. Terminologically there is a similarity to what Jon Ippolito (1998) called "Variable Media", which describes the variability especially of conceptual art, performance or process based artworks, where not every element is fixed, but some elements can vary from performance to performance or installation to installation: be it size and shape, content, configuration or composition.[33] Manovich differentiates himself from this positions, arguing that his notion of variability is not limited to art but rather a "basic condition of all new media" (Lev Manovich, 2001, p. 42).

1.1.5. Transcoding

The last principle, Lev Manovich describes, is **transcoding**, which means to translate something into another format. When it comes to computer data, which all have the same basis, one can for example translate image data into sound. Nicholas Negroponte[34] formulates it differently, in relation to Marshall McLuhan: "The medium is not the message in the digital world. It is an embodiment of it. A message might have several embodiments automatically derivable from the same data" (Negroponte, 1995, p. 71). Transcoding makes a fluent movement of information from one medium to the next possible, which enables a creator to say the same thing in different ways,

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[33] Thus Ippolito suggest a description of the work independent of the media used to create them in order to preserve them and capture their essence (see Depocas, 2003; Ippolito, 1998).

[34] Nicholas Negroponte's book „Being Digital" (1995) is an early analysis of the digital life. Negroponte talks about "digital" in terms of new technologies, new expressive and communicative possibilities, new forms of community and sociality around computer and internet. Reading his book from 1995 in the year 2013 it shows that many of his observations about the digitization of our lives still hold true and many of his predictions became reality by now – maybe not in the exact form he envisioned, but as a concept themselves. He oftentimes refers to the dichotomy of "bits" [a bit – binary digit – is the smallest information-unit in computing, being able to have two values, usually represented as 0 or 1] vs. atoms" for comparing the digital with the analog world, both standing symbolically for the basic unit, the "smallest" building block in their respective world. [This is purely symbolic in nature, as of course according to the „Standard Model" in particle physics there are different subatomic particles, such as quarks, the tau neutrino or the Higgs boson.]

addressing different human senses. Manovich goes further and relates this concept to culture at large. As already discussed in the section on numeric representation, when analogue media are digitized from outside they still seem to follow a logic that makes sense for the human users, but internally the structure follows "the established conventions of the computer's organization of data. Examples of those conventions are different data structures such as lists, records, and arrays; the already-mentioned substitution of all constants by variables; the separation between algorithms and data structures; and modularity" (Lev Manovich, 2001, p. 45). This becomes evident in the already discussed example of a computer image. On the outside it still belongs to human culture, entering the dialogue with other images, on the inside "[…] it is a computer file that consists of a machine-readable header, followed by numbers representing color values of its pixels. On this level it enters into a dialog with other computer files. The dimension of this dialog are not the image's content, meanings, or formal qualities, but rather file size, file type, type of compression used, file format, and so on" (Lev Manovich, 2001, p. 45).

Based on that example Manovich proposes to distinguish between the **"cultural layer"** and the **"computer layer"** of new media objects, which influence each other and are composited together. Transcoding in a cultural sense means "[…] cultural categories and concepts are substituted, on the level of meaning and/or language, by new ones that derive from the computer's ontology, epistemology, and pragmatics. New media thus acts as forerunner of this more general process of cultural reconceptualization" (Lev Manovich, 2001, p. 47).

1.2. From Mediation to Remediation to Media as Software

Another very influential concept when it comes to understanding digital media is "remediation" as brought forward by Jay David Bolter and Richard Grusin (1996, 1999). This concept builds up on an understanding of mediation, which can be defined as "the process of conveying information through an instrument, or medium" (Dolphijn, 2010). It can be seen as a process of translation, transformation or representation for example of born analogue or physical items or events in a specific medium with all its affordances, or conveying information through a specific medium – seeing the medium as an intermediary for information or experience. In the act of doing so Bolter and Grusin highlight the twin logic of immediacy and hypermedicy, which is at work in all media.

The “logic of immediacy dictates that the medium itself should disappear and leave us in the presence of the thing represented” (Bolter & Grusin, 1999, p. 5/6). It represents the desire of a seemingly immediate, direct experience, where the medium should be transparent, where the audience does not perceive the technological layer of the medium but rather whatever is represented. The attempt is “to put the viewer in the same space as the object viewed” (Bolter & Grusin, 1999, p. 11), in other words being immersive or direct. The mediated character of technology is or needs to be denied. The logic of hypermediacy describes a medium as a heterogeneous space, which combines several before distinct media (elements) into one modular media product. The authors give several examples: in film or video this can be a composite of live-footage with different 2D- or 3D computer graphics to create a seamless moving image: for example to realize special effects or implant an actor into an artificially created landscape. In television news the moving images are often combined on screen with text ribbons, photographs, graphics or audio-overlays to convey news up to the minute and give a complete information overview or to present events that are simultaneously happening, while the main story is shown up front. A classical hypermedia product like a website combines multiple media into documents with random access or layer them in panes and windows. This results in a layering of meaning and signs through the relation of the combined media elements. The last two examples make evident that hypermediacy makes the multiple acts of representation visible and does not explicitly hide the fact of its composition, even though they are creating a seamless media product.

Figure 3: Screenshot of CNN news broadcast, showing the seamless integration of different media types into one media product. The of this hypermediated product is to get the viewer the impression to be live at the event and at the same time context information, commentary and a glimpse of other news and information outside the main story. Source: Screenshot from 28.09.2018 of a CNN broadcast archived on YouTube by Rebuild the Dream on 28.04.2015, https://www.youtube.com/watch?v=lS9NmteY4_M (2:38).

However in remediation Bolter and Grusin identify an interesting double logic between immediacy and hypermediacy: "Our culture wants both to multiply its media and to erase all traces of mediation: ideally it wants to erase its media in the very act of multiplying it" (Bolter & Grusin, 1999, p. 5). This gets evident in the film example, where the immediacy depends on hypermediacy, but the hypermediacy is not made apparent. On the contrary in the digital world hypermediated products often borrow characteristics from different digital media forms as well as their analog predecessors, but they also often strive for some kind of immediacy. These two logics are therefore not mutually exclusive but always intertwined and pure immediacy or hypermediacy are neither possible nor really desirable.

Thus according to the Bolter and Grusin media do not operate in isolation, they refashion, reform or repurpose each other in that they "take a 'property' of one medium and reuse it in another" (Bolter & Grusin, 1999, p. 45), but also respond to or compete with each other in the cultural conception of the late 1990s. This argument departs still from the classical assumption, that different media have distinct properties that are usually inscribed in them physically and define how we can produce it, perceive it and interact with it (see Lev Manovich, 2013b). A medium is therefore understood in opposition to the other existing media. Bolter and Grusin define remediation as "the representation of one medium in another", or the "formal logic by which new media refashion prior media forms" (Bolter & Grusin, 1999, p. 273), which for them is a defining characteristic of new media and therewith also the computer as new medium.[35] It leads them as far as to say that at the time of writing the book "all mediation is remediation" (Bolter & Grusin, 1999, p. 55). Thus they argue for a genealogy of media, a continuity of new media with earlier media, where "at this extended historical moment, all current media function as remediators and that remediation offers us a means of interpreting the works of earlier media as well." (Bolter & Grusin, 1999, p. 55) But also the other way round is possible in their opinion, as older media can remediate newer ones, which they call the "double logic of remediation".[36] This double logic can function implicitly or explicitly and they differentiate three dimensions of remediation:

Remediation as the mediation of mediation, which argues that all acts of mediation depend on other acts of mediation. As "[m]edia are continually commenting on, reproducing, and replacing each other, and this process is integral to media [, F.W.] […] [m]edia need each other to function as media" (Bolter & Grusin, 1999, p. 55).

Remediation as the inseparability of mediation and reality, which argues that mediations are as real in our mediated culture as artifacts themselves, but also "all media remediate[37] the real" (Bolter & Grusin, 1999, p. 56). Thus both, mediation and the reality are still part of the remediation.

Remediation as reform, which refers to the aim of remediation "to refashion or rehabilitate other media" (Bolter & Grusin, 1999, p. 56). But remediation can also be seen as "process of reforming reality" (Bolter & Grusin, 1999, p. 56), as mediations are real themselves but also mediating the real.

[35] Even though immediacy and hypermediacy are as logics not exclusive to the digital world, they strongly rely on and draw upon digital technology.

[36] They complement this definition of "new media" with two other main logics, which are at work: immediacy, which describes the transparency of a medium and leave us "in the presence of the things represented" (Bolter & Grusin, 1999, p. 6) and deny the fact of mediation, as well as hypermediacy, which describes the assembly of different 'media-types' or modalities into each other – for example the assembly of graphics, text, photographs and moving image into a screen layout for a news show on TV –and thereby the multiplication of mediation. It is "[a] style of visual representation whose goal is to remind the viewer of the medium" (Bolter & Grusin, 1999, p. 272). These two logics are not exclusive, but their degree varies from one media artifact to another and are in parts dependent on each other.

[37] In that case one could also talk of a translation of reality into media, an abstraction if you will.

An illustrative example from the digital realm for these different dimensions at work is an digital collection of paintings on a website or a CD-Rom. First of all the paintings need to be digitized – or remediated – in order to be presented in a digital format. This oftentimes happens by (digitally) photographing the painting – in case of high resolution images the digitization does not only consist of one photograph but of many edited together by image editing software – or by digitizing already existing photographs. This already is a mediation of a mediation, as the painting itself is a mediation of impressions by the painter, which are mediated into a photograph and then either digitized or already available as digital photograph. But it also shows the inseparability of mediation and reality, as the mediation still refers to the physical painting but is a creative media product in itself. And a digital photograph is not just a photograph, but through its digitality and through the software used to present the images and enabling to interact with them[38] the digital image offers different possibilities and ways of engaging with it than the user could with the painting in a museum. In other words the digital image reforms or refashions the painting.

Even though their basic definition of remediation is not limited to digital media[39] and thus cannot serve alone as definition of digital media, one can summarize with computational media in mind that digital media are the appropriation or translation of other media (mediation), or as Lev Manovich describes it with modern day computers in mind: GUI-based software turns computer into a "remediation machine" which represents or simulates physical media (see Lev Manovich, 2013b, p. 58/59). But the newness of digital media lies in their particular strategies for remediating older media such as television, film, photography, and painting[40]. As Lev Manovich argues in his latest book "Software takes command" (2013b), this definition falls a bit short. He asks: what is the computer's potential beyond remediation?

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[38] Be it zooming into finegrained details at a high resolution image, being able to add the image to a collection, see it as part of a slideshow or download the digital image and manipulate it with image editing software (just to name a few examples).

[39] Bolter and Grusin refer to examples of classical painters drawing scenes from literary sources such as the Bible, Dutch painters were incorporating maps, globes, letters or mirrors into their work.

[40] and in reverse: how older media change and refashion themselves to react tot he challenges of the new media of the time.

It needs to be clarified what remediation means in terms of computational media. The main argument Lev Manovich makes is that the new qualities of digital media but also what is usually called properties of earlier media are not situated inside but outside of the media objects themselves, namely in software. "Between the early 1990s and the middle of the 2000s, media software has replaced most of the other media technologies that emerged in the nineteenth and twentieth centuries. Most contemporary media is created and accessed via cultural software[41]" (Lev Manovich, 2013b, p. 43). In short: media is software and the computer has evolved from a machine mainly used for calculations and data processing for military, science and business to a machine for media access, creation and manipulation. Digital representation makes it possible for computers to work with different media, but it is the software that determines what a user can do and how he can interact with them. In other words: "for users who only interact with media content through application software, the 'properties' of digital media are defined by the particular software as opposed to solely being contained in the actual content (i.e., inside digital files)" (Lev Manovich, 2013b, p. 152).

What does it mean that a medium is software? On the one hand this means through the translation of media types to software "[…] computer programming encapsulates the world according to its own logic. The world is reduced to two kinds of software objects that are complementary to each other – data structures and algorithms." (Lev Manovich, 2001, p. 223) In the case of media, former media formats are translated into a data structure. In this process different media formats in the physical world might be translated into the same data-structure[42], techniques for navigation, creation, editing and interacting with media – in short the media interface and tools – are translated into

[41] Lev Manovich distinguishes different categories of actions enabled by cultural software (Lev Manovich, 2013b, p. 23):

"Creating cultural artifacts and interactive services which contain representations, ideas, beliefs, and aesthetic values".

"Accessing, appending, sharing, and remixing such artifacts (or their parts) online".

"Creating and sharing information and knowledge online".

"Communicating with other people".

"Engaging in interactive cultural experiences".

"Participating in the online information ecology by expressing preferences and adding metadata".

"Developing software tools and services that support all these activities".

[42] a photograph as well as a drawing can both be 2D-pixel images, which is one particular data-format for visual data.

algorithms, which operate on these data structures. To be more precise: "As defined by application software and experienced by users, a 'medium' is a pairing of a particular data structure and the algorithms for creation, editing and viewing the content stored in that structure." (Lev Manovich, 2013b, p. 211/212) "Softwarization virtualizes already existing techniques and adds many new ones. […] Any single 'medium' uses a subset of these." With regard to media techniques Manovich distinguishes media-specific and media-independent techniques, where a "media-specific technique is an algorithm that can only operate on a particular data structure" (Lev Manovich, 2013b, p. 212), and "[…]a media-independent technique is a set of algorithms that all perform a conceptually similar task but are implemented to work on a number of data structures" (Lev Manovich, 2013b, p. 212). Examples for the latter are copy and paste, view control, hyperlinking, sorting, searching, various data analysis techniques or information visualization / sonification. Opposite to earlier media the user experience of computational media is only partly defined by a file's content and its organization, but is mediated through software interfaces, which separates the interface from the content. On the other hand the "software imposes common media properties to any media it is applied to" (Lev Manovich, 2013b, p. 121) Thus what Manovich calls "Digital Media" is a conglomerate of software techniques, algorithms, data structures, as well as interface conventions and metaphors (see Lev Manovich, 2012, p. 6).

Manovich takes up Alan Kay's idea of the computer as "metamedium", which is "a combination of existing, and yet to be invented media" (Lev Manovich, 2013b, p. 335). In other words the computer contains two types of media: on the one hand the simulation of prior physical media through software, which extends these media with new properties. For example in the case of electronic paper, such as a Word Document or a PDF, one can search and replace words, or zoom in and out, which one cannot do on real paper. On the other hand there exist new computational media without physical precedents, such as the already mentioned hypertext or hypermedia, the World Wide Web (including applications on top such as social media services like Facebook or collaborative large scale authoring platforms like Wikipedia), interactive navigable 3D spaces or interactive multimedia.

Another distinctive feature of digital media is the ability to form media hybrids. A media hybrid goes beyond what is commonly known as computer multimedia, which basically means that different media types exist next to each other in electronic documents[43]. This can happen either through insertion of media into documents (for example a website, Word- or Powerpoint document), in form of an attachment (email or MMS), or insertion into 3D space (for example in the virtual reality environments Second Life[44] or OpenSim[45]). "Hybrid Media"[46], in contrast, bring together "different media forms and traditions […] in new media gestalts" (Lev Manovich, 2013b, p. 167), combining the DNA in the form of interfaces, techniques and traditions of their media parents. The process Manovich calls "media evolution" – referring to the concept in biology – goes beyond the gestalt and produces also "new techniques for media authoring, editing, sharing, and collaborating, new interface conventions, and also new algorithms" (Lev Manovich, 2013b, p. 167). As example Manovich names mashups for example the combination of maps with photographs in the application Mappr[47]. The last form is already defined as remix, which mixes media on a content level, but can mix content of different media together into a specific target medium. "In summary, a hybrid may define new navigation and interaction techniques that operate over non-modified media formats. Alternatively, a hybrid may define new media formats but use already existing interaction/interface techniques. A hybrid may also combine both strategies, i.e. it can define both new interfaces/tools and new media formats at the same time." (Lev Manovich, 2013b, p. 197) All these new forms are possible because the media techniques and media data live in a common ecology in form of a shared software environment, and therewith can start to interact, mutate and create hybrids beyond the interaction on a content or meaning level, which would have been formerly prohibited by incompatible hardware.

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[43] this is what Bolter & Grusin (1999) also refer to in their term hypermediacy.

[44] http://secondlife.com/

[45] http://opensimulator.org/

[46] Manvoich (2013c) categorizeses approaches of hybrid media in two different ways

a) asking "what is combined into a hybrid?"

"a combination of media types" (Google Earth)

"using one media type as an interface to another media type" (Mappr)

"using one media type as an enclosure for another media type" (film or images embedded in a 3D environment)

b) asking, if the hybrid provides new ways of representing the world or navigating the represenations?

recombination of media formats, media interfaces or media representations into new types of hybrid representation (Google Earth)

new ways of navigating and interacting with existing media formats

[47] http://stamen.com/projects/mappr

2. Media Ecology in the Digital Age

The outlined characteristics of digital media objects are the basis for the inner functionality of the current media ecology. And as the current society is so dependent on and embedded in this media ecology, which has an effect on all areas of life, digital media transform the society as well. These changes are amongst others reflected in sociological theories of which a popular, but, according to the Cultural History and Social Science scholar László Karvalics (2007), relatively vague concept is the "information society". Even though it is already a bit outdated, it is still used not only in social sciences but also in political planning, political marketing or business to describe the society we live in. Karvalics as well as Alistair Duff (2010), who concentrated his research on the information society, trace the origin of the term to Japanese social scientists in the 1960s. The first use of the expression was according to Karvalics in a conversation between the architect Kisho Kurokawa and the historian and anthropologiest Tudao Umesao in 1961, and was first used in writing in the title of a a study by Jiro Kamishima in 1964 (Sociology in Information Societies) (see Karvalics, 2007). Wikipedia, as a product of this information society itself and part of the movement that brought about changes occurring in the digital media ecology, defines it as "a society where the creation, distribution, use, integration and manipulation of information is a significant economic, political, and cultural activity" (Wikipedia, 2013e)[48]. Alistair Duff is a bit more cautious about a definition of what this term for our post-industrial society entails. He talks about an information-centered society or a society "where information is of unprecedented abundance, where there has been an information explosion" (Duff, 2010, p. 398). He therewith follows the Japanese scientists who coined the term.

In English different terms were used to describe similar concepts, especially the terms post-industrial society and white collar revolution, before different concepts culminated into the umbrella term information society in the 1980s, describing the social changes

[48] The term itself and its origins are contested, even though a wide range of researchers nowadays believe in this concept. However there is no unified theory on what constitutes this post-industrial society, but rather there are several theoretical approaches to define our contemporary society under different names, such as "Network Society" by Manuel Castells (2010), or "Knowledge Society" by Nico Stehr (e.g. 2001), just to name two examples.

that occurred in the second half of the 20^{th} century. The term post-industrial society was first introduced in Great Britain 1914 by Ananda K. Coomaraswamy and Arthur Pentry and later reviewed in the second half of the 20^{th} century in the USA primarily by Daniel Bell as well as in France by Alan Touraine (see Karvalics, 2007). Daniel Bell describes in his book "The Coming of Post-industrial Society" (2008, originally published in 1973) the shift from industrial manufacturing towards postindustrial services and information – so called brain work or knowledge work – which he amongst others pinpoints in a change from industrial machines over electrical technology, such as wired and wireless communication, towards intellectual technologies, such as programming, linguistics and algorithms (see Bell, 2008, p. xxxviii, Foreword 1999)[49]. The notion of information society is heavily critiqued and actualized by sociologist Manuel Castells, who rather uses the term network society. He argues that information and knowledge being central to nowadays society is not the novelty of it, as it has always been important. "What is new is the microelectronics-based networking technologies that provide new capabilities to an old form of social organization: networks" (Castells, 2005, p. 4), as Castells writes. He argues that nowadays digital communication networks are central for "the emergence of a new form of social organization based on networking" (Castells, 2005, p. 3), where the social structure is the result "from the interaction between the new technological paradigm [digital communication network, computing, microelectronics, F.W.] and the social organization at large" (Castells, 2005, p. 3). Thus a simple definition Castells brings forward for the network society is "a social structure based on networks operated by information and communication technologies based in microelectronics and digital computer networks that generate, process, and distribute information on the basis of the knowledge accumulated in the nodes of the networks" (Castells, 2005, p. 7). He describes a network as a system of interconnected nodes which form an open structure that can evolve by adding or removing nodes and connections – each being able to represent different actors and their relationship in more practical terms, when applied to a society, communication, or organizations.

[49] Alistair Duff credits this book as foundational text for information society, even though she states that several other writer before already argued, that knowledge in the broadest sense had become the largest industry in the United States of America (see Duff, 2010).

2.1. History and Idea of the Network

With Castells' paradigm it becomes evident that one of the central ideas for digital media and in the network society in general is the idea of the network. In the literature one finds for example "Networked Publics" (Langlois, Elmer, Mckelvey, & Devereaux, 2009), "Actor Networks" (e.g. Latour, 1987, 2005), "Social Networks", "Neural Networks", or "Trade Networks". The list could be continued. Departing from a basic definition of a network basically everything can be perceived and analyzed as, as well as translated into a network: be it history as a network of persons, places, events and relations between them; a city, where buildings and sites are nodes in a network of a larger city plan but also nodes in different networks, which come together in these locations (history, memory, social networks, information, ...); an archive with all its records related by the categorization scheme and the metadata, but also by content and semantics is a network; our social relationships form networks.

Nicholas Negroponte describes information space and a train of thought as a network: "An expression of an idea or train of thought can include a multidimensional network of pointers to further elaborations or arguments, which can be invoked or ignored." (Negroponte, 1995, p. 70) Bruno Latour's "Actor Network Theory" explores how realities are generated and looks at practices and processes as networks (see Law, 2006). A central concept is the actor network itself, which includes human and non-human actors (technologies, material, etc.), which influence each other in practice. This is central also for theorizing digital media and technology in general as for example actual usage and social interaction determine the development of technology as well as technologies are determining our interaction and discourse.

Crucial for understanding the network society is to also understand the technical implementation of the Internet – the communication network that serves as core of the network society – as well as the different layers, which were built on top of it. Looking at the history of the Internet and the current "online" infrastructure, the central concepts moved from a network of *hardware* (technical infrastructure of the Internet) over a network of documents (Web 1.0), to a network of *data* (Web 2.0) and a network of *locations*, *semantics* and *things* (Web 3.0). Thus the underlying organizational and technical structure of all concepts is the one of a network.

2.1.1. Network as Technological Infrastructure

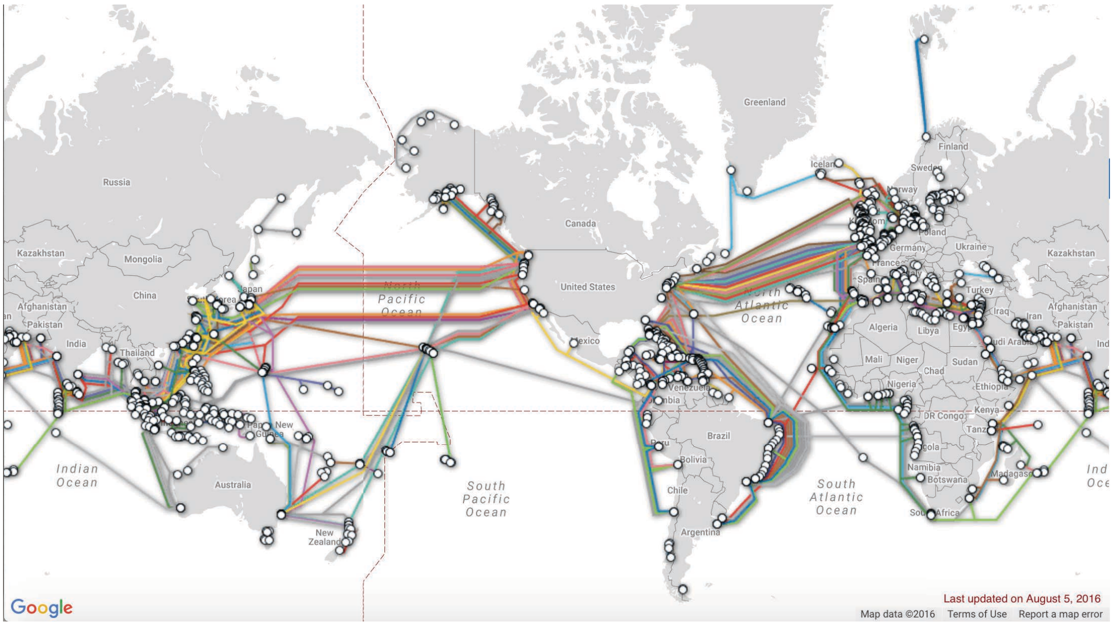

Figure 4: Screenshot of http://www.submarinecablemap.com from 08.08.2016. The depicted submarine cable infrastructure connecting different continents and physical places signifies one part of the physical infrastructure underlying the Internet as communication network and backbone of the network society.

The Internet itself is a network of interconnected networks. Each device connected to the Internet, be it a computer or a mobile device, is therewith via the network of an organization or Internet Service Provider connected to a loose association of different interconnected networks. In the very beginning the research focus was on connecting geographically remote computers and then to interconnect separate physical networks in order to form a logical network[50]. There were several influential studies on networks in the 1960s, which cover different facets of this early strand of developments and paved the way for the technological infrastructure available as backbone of the network society today: J.C.R. Licklider was one of the first publishing on a potential networked future and envisioned universal networking, being able to communicate between different computers and ways to interact with what he called "recorded knowledge" or "the library of the future" (Licklider, 1963, 1965; see e.g. Licklider & Taylor, 1968). Paul Baran (RAND Corporation) wrote a study on survivable networks

[50] A logical network is a network created out of multiple separate networks and is made to appear as a single network. Thus different physical devices within the network that act as nodes of it, are part of separate physical networks. The Internet appears to the enduser as one big network and hides the technological fact of being a conglomerate of different individual networks behind the software interfaces.

for the US Military, where the network should not be dependent on a single computer to reduce vulnerability in case one or several computers in the network are destroyed (see RAND Corporation, 2014). Baran as well as Donald Davies (National Physical Laboratory, UK) (see also National Physical Laboratory, 2012) proposed a very similar technology, for which Davies name "packet-switching" was adopted, and which would divide information transmitted over a network into packet or message blocks. The blocks are sent independently over different routes through the network and are re-assembled at the receiving computer. Last but not least Leonard Kleinrock (MIT, later UCLA) developed a mathematical theory behind this technology in his PhD thesis (Kleinrock, 1962). The first operational network based on these developments was the Advanced Research Projects Agency[51] Network (ARPANET), which went live in 1969. It became the technical core of what would become the Internet later on and used the protocol NCP (Network Control Program) in the early days.[52]

After the development of the TCP/IP[53] in 1973, which allowed the interconnection of networks and is until today the standard for the global network we know as the Internet, ARPANET migrated completely to this protocol suite in 1983. With TCP/IP the

[51] ARPA (later DARPA, Defense Advanced Research Projects Agency) is an agency of the United States Department of Defense

[52] ARPANET was only one of many networks forming over time, even though the most influential one. Examples are NPL (UK, proposed 1965, implemented 1970), the Merit Network (US, Michigan, development started 1966, implemented 1971) and CYCLADES (France, first demonstrated 1973). X.25 and related packet switching standards based on ARPA's research were developed by the International Telecommunication Union (ITU) and implemented into several networks. X.25 was unlike ARPANET available for business use and also the basis of the International Packet Switched Service (IPSS) created in 1978 and the first service which provided a worldwide networking infrastructure. Publicly available commercial dial-in networks provided communications, content, and entertainment features (Prodigy, AOL, GEnie, CompuServe – which offered email as first network 1979), bulletin board systems (which also provided online access emerged, and in the 1980s internet service providers were founded (PSINET, UUNET, NETCOM), which provided UUCP based email and usenet services. UUCP (Unix-to-Unix Copy) was developed 1979 and was the used for Usenet news but also interfaced with dial-up BBS. In the 1980s many transatlantic connections were based on UUCP. In the 1980s the sharing of data and the distribution of costs in computing through connecting supercomputers in education became the focus in research, and several educational networks were formed, such as BITNET (Because It's Time Network) linking research computer centers, CSNET (Computer Science Network) linking CS departments of US universities, and NSFNET (National Science Foundation Network), which begins replacing ARPANET for research networking and was interlinked with ARPANET in the late 1980s. ARPANET was replaced 1990 (see Wikipedia, 2013c).

[53] **T**ransmission **C**ontrol **P**rotocol (TCP), which establishes the connections among sending and receiving Web computers, handles the disassembly of data into packets at point of transmission, and their reassembly at the receiving end; the **I**nternet **P**rotocol (IP) provides the Internet's addressing scheme and handles routing of the packages from sender to receiver.

term “internet” was born, which abbreviated “internetworking” and initially just denominated a network using TCP/IP. From the late 1980s this term started to be used for the name of the large and global TCP/IP network “Internet”. In Europe it took until the late 1980s[54] to expand connections to the TCP/IP based Internet, which was initially only for scientific and educational purposes. UUCP (Unix-to-Unix Copy)-based UUCPNet and the X.25 based IPSS network did not have such restrictions and were also open to commercial use. And so the main international network connections were at that time running via the UUCP services. In the beginning of the 1990s commercial TCP/IP based Internet providers such as Commercial Internet eXchange (CIX), Metropolitan Area Exchanges (MAEs), and Network Access Points (NAPs) were becoming the primary interconnections between many networks and 1995 the NSFNET Backbone Service, which 1990 replaced ARPANET as scientific backbone, was ended and also the research institutions in the US transferred to commercial ISPs. Therewith the Internet was commercialized and thus open for everybody.

All these early studies show that the Internet is in the end a network established in hardware using a specific protocol to enable relations and communication between the machines. And making this machine to machine communication possible was the focus of the early developments in technology development. However what the user perceives as the “Internet” today, are usually services on top of the communication structure, such as newsgroups (Usenet), file transfer (for example via the protocol FTP [File Transfer Protocol][55]), email (using the protocols SMTP, POP, IMAP), listservs, data storage (WebDAV), or the World Wide Web (employing HTTP [Hyper Text Transfer Protocol] and HTML [Hypertext Markup Language]) and all kinds of applications it offers.

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[54] 1989 is a year where the Internet sees a global penetration.

[55] different communication protocols for specific network services were developed and standardized over time.

2.1.2. Web 1.0 – Network of Documents

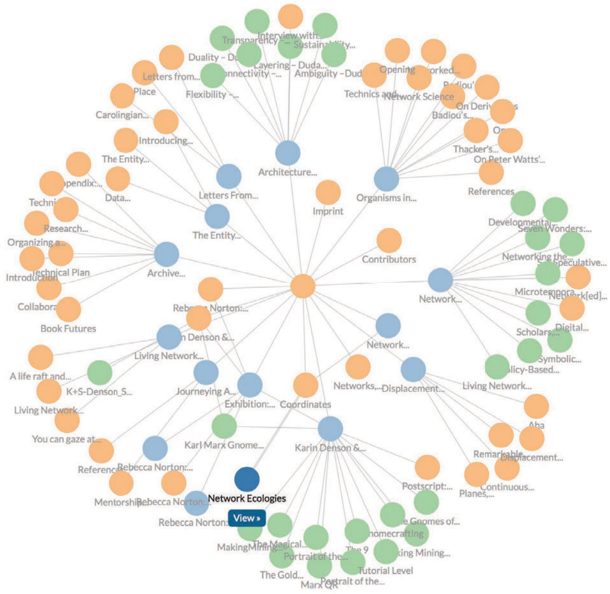

Figure 5: Screenshot of network of content within the online-publication "Network Ecologies" (2016, Amanda Starling Gould & Florian Wiencek (Eds.), http://scalar.usc.edu/works/network-ecologies/index) created on 08.08.2016.

The World Wide Web, which terminologically is oftentimes conflated with the Internet itself, is on the one hand the most popular service on the Internet, on the other hand it allowed a big step towards the second form of networking: the Web 1.0 as network of documents. This became possible through the invention of the Hypertext Transfer Protocol (HTTP)[56] and the structural language Hypertext Markup Language (HTML)[57] in the year 1989 by Tim Berners-Lee (CERN) within the WorldWideWeb[58] project.

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[56] HTTP is "an application-level protocol for distributed, collaborative, hypermedia information systems" (Leach et al., 1999), but it is also a generic protocol which can be used beyond hypertext such as "name servers and distributed object management systems, through extension of its request methods, error codes and headers. A feature of HTTP is the typing and negotiation of data representation, allowing systems to be built independently of the data being transferred." (Leach et al., 1999). One example is WebDAV (Web Distributed Authoring and Versioning), which is an extension to HTTP, which allows the collaborative editing and managing of documents and files stored on webservers. Therewith the web becomes a readable and writeable medium, realizing to an extent what Tim Berners-Lee originally envisioned (see Berners-Lee, 1997).

[57] HTTP and HTML were standardized in 1991. For a good overview of the development of webtechnologies over time see www.evolutionoftheweb.com

[58] WorldWideWeb was the name of the first web browser, written by Tim Berners-Lee and running on a NeXT computer (for screenshots see http://en.wikipedia.org/wiki/WorldWideWeb).

What Tim Berners-Lee implemented was the concept of Hypertext, which "is a collection of text segments that can be connected via links to other segments" (Wijekumar, 2004, p. 224). This concept was then also applied for media, where the interlinked collection of multimedia objects or digital objects in general is called hypermedia (see Sunwalker, 2007, p. 224). Nicholas Negroponte (1995) uses the image of a complex molecular structure for the textual or media structure. "Chunks of information can be reordered, sentences expanded, and words given definitions on the spot […]" (Negroponte, 1995, p. 70). "The nodes and related links allow readers to traverse the information in a nonlinear style. Instead of reading a book from cover to cover, page by page, readers can jump around and be connected to other related information easily" (Wijekumar, 2004, p. 225). Being conceptualized as a participatory medium, these links can ideally be created not only by the creator of the documents but also by the users. This vision, which came back later with systems like Wikis, was at the core of early hypertext concepts.

The implementation of Tim Berners-Lee however was not the first concept or implementation of hypertext, only the one that succeeded to be widely adopted. Historically it had several predecessors. An early conceptual approach was Vannevar Bush's "Memex", a fictious and conceptual machine (ergo never implemented), which he introduced in his influential article "As We May Think" (1945) in The Atlantic Monthly. This machine should allow the user to build "associative trails" linking related texts or illustrations through a vast and expandable archive of material – stored on microfilm in his proposal. Bush believed that association as a mechanism of gathering and ordering information is closer related to how a human mind works than artificial systems of indexing. Later users would be able to follow these inerasable information trails due to the material nature of his proposal[59] and follow the associative train of thought and exploration created by themselves or another user of the system. This idea anticipated already what would later become browsing paths through hypermedia- and database publications as well as digital archives. However, with the proposed technological solution the idea lacked scalability. The way the machine was

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It was later renamed into Nexus to avoid the confusion with the „World Wide Web" as distinct Internet service.

[59] For a discussion of materiality versus digitality see for example Nicholas Negroponte (1995) or David Weinberger (2007)

conceptualized was only for a limited number of users, as too many users would result in a chaotic and useless web of trails.

In the 1960s Ted Nelson – who coined the term hypertext and hypermedia – took up and adapted this idea of interlinking information and brought it into the digital world with his project XANADU[60]. The literature names XANADU as the first implemented hypertext system (see e.g. Schröter, 2009) and it calls itself "The Original Hypertext Project". Bush's trails became links between documents, which were not fixed but able to change, to be edited, corrected, erased[61]. The most important step into digitality, was the concept of an "indirect document" instead of simulating paper documents digitally, which for Nelson "contain all their characters in sequence, and are scrambled together with formatting and one-way links" (Nelson, 2012). Indirect documents mean, that content always stays part of the original document it was created in. Citations happen rather via pointers to the part of the document in the networked source, which embeds in the content directly from this source. Thus a citation is always connected to the original source[62]. But this implementation also embodies an idea which is still popular in todays web development: the separation of content and structure[63].

Also Douglas Engelbart's famous NLS computer system (see Doug Engelbart Institute, 2008b) – which introduced many modern computing concepts such as the mouse, raster-scan video monitors, dynamic two-dimensional display editing, screen windowing or video-conferencing, and employed a full interaction paradigm – also included a pioneering implementation of hypermedia in the system (including "hyperlinked text, diagrams, email, source code etc." (Doug Engelbart Institute, 2008a)). Engelbart published the first idea of traversing an information space of cross linked data on an interactive computer in his report "Augmenting Human Intellect: A

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[60] see http://www.xanadu.com/

[61] Different to the implementation of the Web we find nowadays, there the links were implemented as two-way links, so that both documents were aware of being linked through a central link table, which on the one hand enables a trackback possibility, on the other hand prevents broken links as documents evolve (see Nelson, 2012; Schröter, 2009, p. 337).

[62] Xanadu offers several other unique features such as deep version management, incremental publishing, parallel intercomparison, etc. More information can be found on www.xanadu.com.

[63] embedding is a contemporary way to reach the same in a web-environment.

conceptual Framework" (1962) and it was successfully demoed in 1968[64]. Both systems were inspired by Vannevar Bush's essay and were developed independently from each other at the same time.

The 1980s saw further software implementations of hypermedia. One popular software tool was Apple's HyperCard (released in 1987), an authoring environment in which users with and without programming knowledge were able to create networks of multimedia data. It employed the metaphor of a browsable stack of cards, each holding interlinked multimedia data and common GUI elements, such as interactive objects, text fields, buttons or check boxes – to which Richard Rogers would refer as natively digital objects (see Rogers, 2009) – and offered besides navigation features also search mechanisms.[65] The environment also employed an English-like, object oriented programming language (HyperTalk) to enhance the stacks and to use the tool to create distributable hypermedia systems – and therewith also explorable and ordered data – also referred to as "stackware" (see e.g. Crabb, Green, & Green, 1989; K. Lischka, 2012; Wikipedia, 2013d). Thus this technology moved from expert-systems to software packages, which made creating, distributing and browsing hypermedia projects more accessible to a broader community of users.

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[64] A video of the whole demonstration of the NLS system, which later on was commonly referred to as „Mother of all demos", can be found at https://vimeo.com/32381658

[65] Browsability of information is in the foreground for this software, and therewith it is conceptualized to go beyond a database.

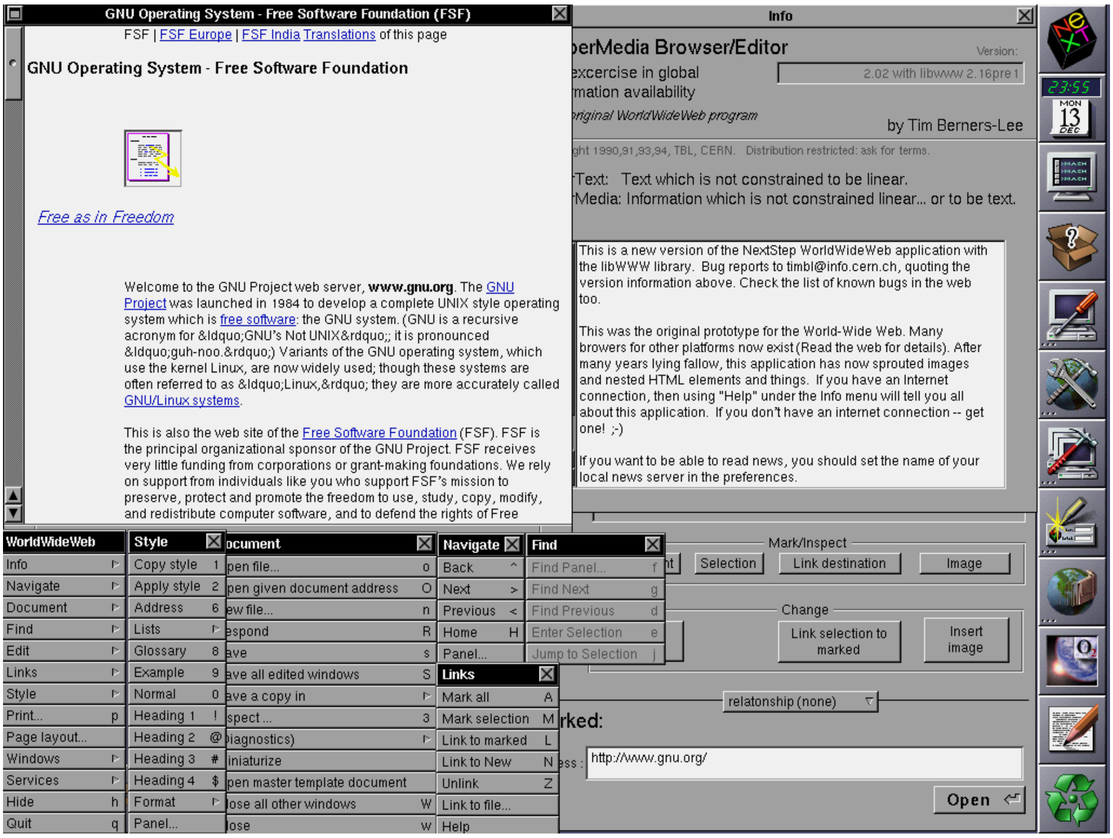

Figure 6: Screenshot of an early WWW browser on the NEXT System from 1994, showing many functions of the WorldWideWeb technology. Image by Tim Berners-Lee for CERN (Public Domain). Source: https://en.wikipedia.org/wiki/WorldWideWeb#/media/File:WorldWideWeb_FSF_GN. retrieved at 05.10.2013.

Only a few years later, in 1989, Tim Berners-Lee developed the concept of the World Wide Web[66], also building up on the conceptual forefathers in emphasizing the importance of interlinking and building relations between heterogeneous elements.[67] But he went a step further by proposing not only a closed content-network, but "that a global hypertext space be created in which any network-accessible information could be refered [sic!] to by a single 'Universal Document Identifier' [now URIs, F.W.]"

[66] The Internet-based hypermedia system was conceptualized as global information sharing system at CERN in 1989. The first web client and server was implemented in 1990. Berners-Lee wrote the specifications for Unified Document Identifiers (URIs) as unique reference for documents, and the Hypertext Transfer Protocol (HTTP) for the transfer of hypertext documents and the Hypertext Markup Language (HTML) for encoding especially the structure of hypertext / hypermedia documents. These specifications became standards of the Web and were refined and further developed with the rise of the Web technology.

[67] „One of the things computers have not done for an organization is to be able to store random associations between disparate things […]" (Berners-Lee, 1998).

(Berners-Lee, 1998). Thus he envisaged an open network of documents[68], a "common information space in which users communicate by sharing information. Its universality is essential: the fact that a hypertext link can point to anything, be it personal, local or global, be it draft or highly polished" (Berners-Lee, 1998). It was designed as a tool to "keep track of the complex web of relationships between people, machines and ideas" (Berners-Lee, 1997) and to be able to retrace the evolution of the latter.[69] Thus the structures and services of such a hypertextual content network allows the ease of access as well as dissemination of information, as Robert Logan (2010) argues. It enables to traverse content networks, as well as the implementation of search engines, which index content based on the links between it and improve findability of content. The latter is one of the big challenges of information society due to the overabundance of information according to Lev Manovich.

2.1.3. Web 2.0 – Network of Data

But Berners-Lee also envisioned another aspect of the Web, which should become reality in the 2000s with what was called the "Web 2.0" by Tim O'Reilly (2005):

> "the Web being so generally used that it became a realistic mirror (or in fact the primary embodiment) of the ways in which we work and play and socialize. That was that once the state of our interactions was on line, we could then use computers to help us analyse it, make sense of what we are doing, where we individually fit in, and how we can better work together" (Berners-Lee, 1998).

In other words the Web is not about publishing (as believed in the 1990s) but about participation[70] (see O'Reilly, 2005). Therewith it moves from a network of documents to a network of data, especially the user's personal data. Time magazine named "YOU" the person of the year 2006 and wrote on the cover of their issue from December 25,

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[68] Documents are also commonly referred to as „pages" or web-pages, a metaphor that comes from the physical world. Several structurally or organizationally related pages together form what is called a „web-site".

[69] As already stated before Tim Berners-Lee also envisioned, that anybody could not only read all information on the Web, but also edit any content – an inherent collaborative aspect, and a functionality, which was implemented in his first browser "WorldWideWeb", but which in this integration was lost in early commercial implementations, until the upcoming of Web 2.0 tools such as wikis.

[70] There is a parallel development visible in the museum world with a move to more participatory concepts in the 2000s (see Part III, 2.4)

2006 the following sentences: "Yes, you. You control the Information Age. Welcome to your world". Readable in product names such as YouTube, or iPhone,[71] which indicate that these products are highly individualized and customizable, reacting to the user's behavior, to his or her preferences but also allowing an individual to express himself, to share content with others. In short they empower the user or at least give him a sense of being empowered by the tools provided. Personalisation is key, as users want to be in charge of their experience. They demand to appropriate services, data, and content for their own needs. Eric Gordon, a visual arts scholar, refers to this phenomenon as the "digital possessive" in which "practices of networked media encourage (…) the possession of thoughts, actions, and memories in personal folders, accounts, and devices" (Gordon, 2010, p. 175).

Lev Manovich describes the evolvement of documents as such: "Continuously changing and growing content of web services and sites; variety of mechanism for navigation and interaction; the abilities to add one's own content and mashup content from various sources together; architectures for collaborative authoring and editing; mechanisms for monitoring the providers—all these mechanisms clearly separate interactive networked software-driven media from twentieth-century media documents" (Lev Manovich, 2013b, p. 38). Therewith he summarizes some of the design patterns for Web 2.0 formulated by Tim O'Reilly.

[71] The "i" in the beginning of the i-product series stood for Internet, but amongst others also for individual. LiveScience refers to other possible meanings of the „i" – could also stand for instruct (for educational purposes), inform or inspire (see Bryner, 2010)

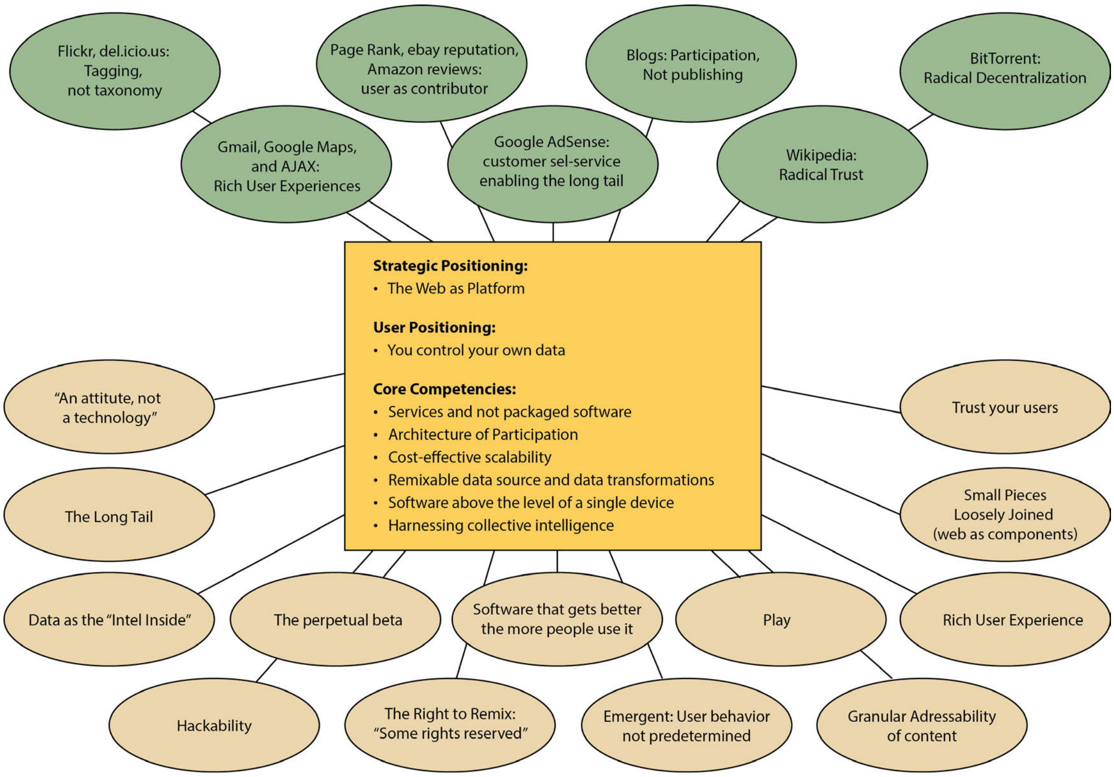

Figure 7: Web 2.0 Meme Map as depicted in O'Reilly (2005) Graphic: Florian Wiencek based on O'Reilly (2005).

Tim O'Reilly says about the direction of the Web after the dotcom-burst, that the web turned into a platform where (personal) data uploaded voluntarily by the users into content management systems – be it to platforms for personal or corporate multimedia publishing on the web (blogging software, cloud based media sharing platforms) or to social networks, such as Facebook, Twitter, Flickr or YouTube – are turned into networks of information through manually or automatically relating the data to each other: be it content e.g. through metadata provided by the users or the data about the users and their behavior itself. Chief rule to success for a company in this changed environment is according to O'Reilly to "[b]uild applications that harness network effects to get better the more people use them" (O'Reilly, 2006). Thus the key is to build environments and engineering processes for the users to employ for their own benefits but also for the benefit of the company – ergo getting the users to contribute and "harnessing collective intelligence" (O'Reilly, 2005). Conceptually several things are important to understand in this: the concept of platform, the concept of network effects and the importance of participation and data.

The definition "**Web as a platform**" means that the World Wide Web provides an environment, a basis for many different services (or web applications)[72] to be built on top. It provides a basic mode of operation, and with its standardized protocols and extensions, an "interface" to the underlying network technology. In that way it can be compared to a operating system of a computer, which builds the basis for desktop software to run. Thus the Internet as network technology is "enabler or middleman between the user and his or her online experience" (O'Reilly, 2005), which happens between the frontend of the browser and the backend of the servers that host content or enable the services.

Another use of the term "platform" in the sense of a website as platform is very similar, in that the site provides a specific interface, a set of functions and tools for the user, that is at best expandable. Most likely the developers had a specific use in mind when deploying the platform, but how and for which purpose it is actually used is up to the

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[72] Tim O'Reilly compares web applications – sometimes also referred to as "infoware" – to traditional software and names the differences by using Google as example as follows: „[…] never sold or packaged, but delivered as a service, with customers paying, directly or indirectly, for the use of that service. None of the trappings of the old software industry are present. No scheduled software releases, just continuous improvement. No licensing or sale, just usage. No porting to different platforms so that customers can run the software on their own equipment, just a massively scalable collection of commodity PCs running open source operating systems plus homegrown applications and utilities that no one outside the company ever gets to see" (O'Reilly, 2005). According to O'Reilly Google goes beyond being a collection of tools and making old applications available via the network (see O'Reilly & Battelle, 2009) but these applications are specialized databases providing data, but also collective-intelligence applications which "depend on managing, understanding and responding to massive amounts-of user generated data" (O'Reilly & Battelle, 2009, p. 1). The relation of data and software is somewhat ambivalent, as tools need data of the users to be of use, and the data would not be manageable without the tools. Thus „the value of the software is proportional to the scale and dynamism of the data it helps to manage" (O'Reilly, 2005). In fact data is oftentimes the USP (unique selling point) of a service, where software is oftentimes open-source. Another difference is what O'Reilly describes as „perpetual beta" where software is released according to the open source principle early and often. „[T]he product is developed in the open, with new features slipstreamed in on a monthly, weekly, or even daily basis" (O'Reilly, 2005). Moreover the user is strongly involved in the development process, for example by monitoring the user and his behavior, which new features are used how in real time, but also for ironing out errors. Moreover software as service puts a strong emphasis on maintainance to keep the system running and on constantly adapting to a changing environment (for example search engines must constantly update their indices and answer user queries). Another important point to mention with regard to web applications is the Rich User Experience similar to a GUI of a desktop program, enabled through new technologies in lightweight client-side programmability. One important example therefore is the set of technologies subsumed under AJAX, which combines presentation with HTML 5 and CSS 3, dynamic display and interaction using the Document Object Model (DOM), data interchange and manipulation with XML or XSLT, ansynchronous data retrieval with XMLHttpRequest and JavaScript as binding all of these technologies together.

user. An example is the social network Facebook. It gives a user the opportunity to share data about himself, starting from the name, the education and career, contact data to relationship status, from what music or movies a user likes to his political point of view. But most importantly it offers a way to connect with other people and to share content with them, which is presented in the order of the time a user shares it (of course one can see content of others too) and comment on or react to the content of others and yourself. Moreover it offers ways to share media, to get in contact with other members (chat, message, phone, video) and use it to publicize events and manage invitations and attendance to it. On top of all of that Facebook has created tools to easily bring external webcontent into the universe of its own platforms (via liking) and to serve as identity provider. And of course the interface of the platform dictates specific ways, how all of these tools function and provides certain boundaries in which it is possible to use these tools. An API for external developers to create products around and for the platform is also available. However all this is only the technical framework that might influences or suggests a certain usage but also opens up a myriad of possibilities of how the toolset of the platform can be employed for the goal of a user. The actual usage of the platform, the employment of the provided and always changing toolset and what exact content can be found on there, is up to the user and goes beyond the provided infrastructure. Some people may use it to stay in contact with old and new friends, for professional exchange and discussion of their research topic, as outlet for their media production, as game center, as media outlet to promote their business, or even as online dating platform. Thus the term "platform" has a connotation of foundation, universality and openness of use to it.[73]

The massive amount of data, which the users collectively publish day by day on the existing platforms on the web can be mined and are a competitive advantage[74] for the companies who "own"[75] the data: "[…] whether through increasing returns from user-generated data (eBay, Amazon reviews, audioscrobbler info in last.fm, email/IM/phone traffic data as soon as someone who owns a lot of that data figures out

[73] At this point the thesis will not go deeper into the topic of Facebook as advertising platform or the revenue model of Facebook, which is based on advertisement and even more the mined data of the users. This is beyond the scope of this chapter.

[74] this is why a critical mass of data and users is important.

[75] The question who in the end really „owns“ the data and has the copyright to it, is another complicated issue, that for the sake of brevity will not be investigated further at this point.

how to use it to enable social networking apps, GPS and other location data), through owning a namespace (Gracenote/CDDB, Network Solutions), or through proprietary file formats (Microsoft Office, iTunes). ('Data is the Intel Inside')" (O'Reilly, 2006).

To come back to the initial quote by O'Reilly, in mining the data the **network effect** becomes important, which means interlinking different datasets in order to generate a surplus of value out of them together. An example is to connect the directory of businesses in a city with reviews and ratings of users in order to build a recommendation system. If this system also has access to the preferences of the specific user because it was able to collect user behavior and data that reflects a user's interests over time (such as search history, websites or specific retrieved articles, purchased goods, etc.[76])[77] or because a user voluntarily entered the data on a platform (for example Facebook), recommendations can be even more personalized by combining this pool of data about user-preferences with the other datasets mentioned before. For the creation of a network of cooperating data services it is important to enable content syndication[78] and have low barriers for re-use of data. In order to achieve this goal one needs to apply the "end-to-end principle" (see O'Reilly, 2005), which is also fundamental to the Internet itself. This principle is about syndicating data outwards and caring for a way to get the data to the receiver, not about controlling what happens to the data when it reaches the end of the connection. So it implys giving up control of how the provided data is used.

A second meaning of the "network effect" is the combination of providing a service for the users which allows them to follow their own interests while building collective value or aggregating user data in order to add value for the producer as an automatic byproduct. This should be, according to O'Reilly, inherent to any web application, as usually only a small percentage of users will actively add value and contribute by

[76] this is the online equivalent to bonus-cards in shops

[77] Bigger companies like Google or Amazon constantly use these techniques to gather information about their users.

[78] Content-syndication means re-use and distribution of content from a source website to other websites, while ideally linking back to the original source to provide proper attribution and that search engines can follow the trail to the origin of the content.

themselves. It is what he calls the implicit "architecture of participation"[79], "[…] a built-in ethic of cooperation, in which the service acts primarily as an intelligent broker, connecting the edges to each other and harnessing the power of the users themselves." (O'Reilly, 2005). This principle goes back to the **importance of data and of participation** for web 2.0 services, which are increasingly data-driven. In order to have a competitive advantage, a service needs to own or build up a dataset, which is hard to recreate for competitors. But these services also depend on the users to either build up the dataset or to add value to it, as "[…] the service automatically gets better the more people use it" (O'Reilly, 2005). Examples for collaborative efforts on the Web are collaborative editing (Wikipedia), collaborative categorization (building up of a folksonomy[80], Flickr), viral marketing (depending on the word-of-mouth from social media users) or peer-production methods of open source (SourceForge.net).[81]

Another more implicit form of collaboration is blogging, as "blogging harnesses collective intelligence as a kind of filter. What James Surowiecki [(Surowiecki, 2005), F.W.] calls 'the wisdom of crowds' comes into play, and much as PageRank produces better results than analysis of any individual document, the collective attention of the blogosphere selects for value" (O'Reilly, 2005). In this point of view the bloggers are collectively taking over the role of filtering out the important information and sources by writing about them and interlinking them.[82] They therewith can be seen as

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[79] This phrase describes „the nature of systems that are designed for user contribution" (O'Reilly, 2004). He follows the maxim of of Mitch Kapor that "architecture is politics" and thus one needs to look at the architecture of a system if one wants to understand its effect.

[80] a vocabuary built bottom-up instead of top-down (taxononmy)

[81] Each of them have individual interests of the contributor as starting point for the collective action. This is most evident at the creation of a folksonomy at Flickr. The users tag their own images in order to make sense of them, to make them searchable for themselves and findable for others. One of the motivations is attention, which is at the core of social media. They want their images to be seen, to share them with others. And uploading them to Flickr as well as describing them by tags is a mechanism to reach that goal. This enhances the data-basis of the service and therewith its value, but also with the tagging they contribute to a shared vocabulary for describing images, which benefits other users.

[82] Robert Logan refers to this in his characteristic of the web called „alignment and integration". In this characteristic he argues that the content builds up a semantic web of information „in which items refer to each other and are often linked by hypertext. In this way the content of the 'new media' become aligned and integrated within the single medium of the World Wide Web, an ongoing email correspondence, or ongoing dialogue of a listserv conversation" (Logan, 2010, p. 55). His critique of mass media is that they do not relate the information and that their information flow is discontinuous versus an integrated information flow in digital media. In an ideal world the relation of information would be done by journalists and institutions, even

distributing the gate-keeping and filter-role that formerly journalists and media corporations had to a larger community, to which in principle everyone has access to.

This goes full circle with the internal mechanisms of the Internet as network of documents bound together with the ranking mechanisms of search engines and therewith the network of data. "Hyperlinking is the foundation of the web. As users add new content, and new sites, it is bound in to the structure of the web by other users discovering the content and linking to it. Much as synapses form in the brain, with associations becoming stronger through repetition or intensity, the web of connections grows organically as an output of the collective activity of all web users" (O'Reilly, 2005).[83] This phenomenon is also referred to by Robert Logan as "Aggregation of Content".[84] As these examples also show, the knowledge-based network that is available 24/7 creates community[85], as Robert Logan (2010) brought forward by employing four characteristics: two-way communication makes people feel involved, ease of access and dissemination "provides a medium for dialogue and a common body of information and knowledge upon which to build common cognitive structures" (Logan, 2010, p. 56), continuous learning allows people to grow together and alignment integrates the needs and preferences of the communicating agents together. Therefore digital media and especially this networked environment "provide an

though the relation is then more in form of an interpretation. Another alignment is the alignment of information with the interests of the user (see also "adaptive production" (Richards, 2006), and "customization").

[83] Hyperlinks are according to Richard Rogers (2009) the currency coming from the network of documents of Web 1.0 and are still important for search engines, which use link structures to predict useful pages. However, social networks challenge this currency as measurements for relevance of a source with social recommendations such as likes and shares. Thus also likes and shares have a collaborative aspect in filtering and distributing content as well as attributing relevance to it (see Rogers, 2010). The users shape the form of the network connections of documents and data by their activity and participation.

[84] The World Wide Web and especially search engines or any other data mashup or embed items for that matter (and be it by simply adding it to a hypermedia network of content), aggregate, organize and therefore (re-)contextualize content, meaning they collect content and information from different sources. This is made possible by the easy access to data and information or in general to what Lev Manovich calls digital (or "new media") "objects" (see Lev Manovich, 2001), but it can also be argued that especially for search engines and mashups the processability of data and therewith automation (see Lev Manovich, 2001) as well as technologies allowing easy interfacing with data, such as APIs, facilitate that process.

[85] It needs to be acknowledged that also „old media" have a community building character around their media outlets, such as fan communities around TV series or the like (see Jenkins, 2006a).

environment for learning, knowledge creation, and sharing and the development of new ideas and projects" (Logan, 2010, p. 56).

2.1.4. Web Squared

But where does the development of the Web go from here? Web 2.0 is not the end of the development with regard to networks. There are several pathways to explore. One path to explore is "Web squared", which is in its essence a revisiting of Web 2.0 by Tim O'Reilly himself together with John Battelle five years after he coined the term. One of the shifts the authors notice is, that

> "[c]ollective intelligence applications are no longer being driven solely by humans typing on keyboards but, increasingly, by sensors. Mobile phones and cameras are being turned into eyes and ears for applications; motion and location sensors tell where we are, what we're looking at, and how fast we're moving. Data is being collected, presented, and acted upon in real time. The scale of participation has increased by orders of magnitude" (O'Reilly & Battelle, 2009, p. 1).

Thus the web moves not only beyond static or dynamic HTML pages describing something in the world (Web 1.0), but it moves towards a state where everyone but also everything constantly casts an "information shadow" that can be captured and processed. The Web becomes the world and the world directly feeds into the Web. And the Web goes even more beyond the PC-based notion of the World Wide Web encompassing all possible devices which can be connected to the network (from mobile devices to a fridge), which also enables multimodal or sensory input, such as for example voice or visual input on a mobile phone.

The authors differentiate two approaches to allow applications to deal with the magnitude of different data: applications that defer meaning through the mapping of two structured datasets (for example mapping GPS data onto physical addresses, referred to as "teaching")[86] and applications such as speech recognition or computer vision, which learn "inferentially" through processing large amounts of crowdsourced datasets.[87] By combining different sensory inputs with a "knowledge base", such as

[86] by teaching an application to recognize connections between two datasets

[87] Again the learning effect is greater the more people use the application or the more data is there to learn from. Take for example a face recognition algorithm as it is implemented in

"speech recognition and search, search results and location", the system gets smarter through our "collective" efforts and gradually understands more of the world. From networks of data the technology is moving towards a **semantic network**, where the computer is developing gradually the ability to make sense of the data through processing them.

But at the same time also the communication with the devices and the network has changed, and the services can react not only to learned preferences of a user but also to the situation he or she is in physically. This is reflected in what Eric Gordon and Adriana de Souza e Silva (2011) call "Net Locality", which denominates the localization of data that "takes the otherness of the web and places it squarely where you are" (Gordon & de Souza e Silva, 2011, p. 2). The web is bound back to a place by for example taking the place where the user physically resides into account at search results, Google started to integrate location data – be it determined by an IP address of a computer or GPS coordinates of a mobile device – as a factor into search, in order to deliver results which were not only tailored to the interests through personalization (individualization) but moreover most relevant at the geographical location of the user.

Another important factor for Net Locality are mobile devices, especially smartphones or tablets with mobile data connections. They take the Internet wherever the user goes. One does not need to go somewhere to access the Internet, **the network and the networked information has become ubiquitous**. "We don't enter the web anymore, it is all around us" (Gordon & de Souza e Silva, 2011, p. 3). By bringing networked data to a location one cannot only contextualize the information or the location but also use it to augment the location. This can be done for example by overlaying images of the world around a person with data and making additional digital layers on top of the physical world explorable, using Augmented Reality browsers such as Layar[88] where the digital information feeds into the world.

Apple's iPhoto but also in social networks such as Facebook or Google Plus. In the beginning users tag faces in photographs with names of people. But combining the tagging data with computer vision the application will gradually learn to automatically recognize people and might be able to offer suggestions who is on an image, or find the person at least within a range of certainty in images, where he or she is not tagged yet. The more training data the application has, the more accurate it gets.

[88] www.layar.com

But also the other way round works: the objects and people from the physical world possess an “information shadow”[89] in the digital world. Examples are books that have information shadows on several platforms such as Amazon, Google Book Search or Goodreads[90], but also on diverse social media platforms or on the blogosphere and in journals through reviews. And there might even be unique identifiers these shadows link to – such as an ISBN or ASIN number for books[91]. But besides using a unique identifier one can also identify things and people by triangulating other data, such as name and address, a photo and a location or the like. Through these existing information shadows and devices equipped with a multitude of sensors the Internet of Things is already reality, as O’Reilly and Battelle argue. Maybe not that wide spread in the technological form as it is discussed usually – a combination of RFID and IP addresses for everyday objects – but rather in an indirect way through a combination of different sensors as eyes and ears of the web, data analysis, pattern detection and visualization in combination with constantly enlarged searchable information shadows.

Therewith **the world becomes part of the information network**, and the need for explicit metadata diminishes, at least ideally[92] (see O’Reilly & Battelle, 2009, p. 8). But the devices do not act alone but are always paired with their human partners and their knowledge as well as action. One example for such an application is Google Goggles. It works by analyzing any image a user is taking with his mobile device and performing a Google image search, pairing it up with location data. If there is a result, the application notifies the user in the background and presents him with the information shadow of the photographed object or person in form of a Google search results for it, or at least what Google believes to have seen on the image. Thus with the concept of Web Squared it becomes clear that nowadays people are not only living in a network society, they are actually living inside the network that is all around them, collects knowledge around them and enhances their experience of their surroundings by adding accumulated information or at least make it easily accessible.

[89] O’Reilly and Battelle refer to Mike Kuniavsky (2009) for this term

[90] http://www.goodreads.com

[91] other examples would be part numbers, the social security number for individuals, the vehicle identification number for cars

[92] especially for more complex tasks semantic recognition for non-textual data has still a long way to go to be perfected and researchers are right now somewhat cautious about the progress in near future, beyond a semi-automatic recognition.

2.2. Participatory Culture

Within such a networked environment a participatory culture was developed over time, as it got evident in the discussion about collaborative aspects of the Web 2.0. It became a major paradigm of contemporary culture. Henry Jenkins et al. define participatory culture as

> "a culture with relatively low barriers to artistic expression and civic engagement, strong support for creating and sharing one's creations, and some type of informal mentorship whereby what is known by the most experienced is passed along to novices. A participatory culture is also one in which members believe their contributions matter, and feel some degree of social connection with one another (at the least they care what other people think about what they have created)" (Jenkins et al., 2009, p. 3).

In the process of "cultural convergence" (Jenkins, 2006a) a move from consumer of content towards a prosumer[93] took place, where the latter not only consume content, but rather also create content themselves within the services and applications available to them. Additionally they share the content with others within social media and communicate around it. This process also brings with it a blurring of professional and amateur, as "regular people – not just artists or academics – appropriate cultural

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[93] The term was coined and defined in this way already by Alvin Toffler in his book „The Third Wave" (1980). Toffler described a future type of consumer, who becomes involved in the design and manufacturing of the product, which allows a product to be made to individual specification. The term is interpreted differently or more limited for marketing purposes. For example in an analysis for new business opportunities Cisco – specifically William Gerhardt (2008) – uses the term „prosumer" to label a specific group of potential customers for technology products. It resembles nearly as an epithome of our hyperconnected society, on the other hand depicts a very stereotypical and necessarily narrowed but potent target group: „someone who makes little distinction between his or her home and work lives. The prosumer engages in activities belonging to either sphere, regardless of time or location. Because of their complex lifestyle, which combines a demanding workload and an active family life, prosumers are eager adopters of Web 2.0 products and services […]. Prosumers typically embrace Web 2.0 technologies such as social networking (Facebook, MySpace), blogging, video on demand (VoD), podcasting, VoDcasting, virtual realities (Second Life, There.com), mobile communications, and other Internet-based technologies and services that allow people to stay connected whenever and wherever they desire. […] they access whichever technology subset best suits their individual preferences and lifestyles" (Gerhardt, 2008, p. 1). Axel Bruns (2008) describes this development in his book „Blogs, Wikipedia, Second Life and Beyond", where he uses the terms „produser" and „produsage" for the same phenomenon, and also Robert K. Logan describes what he calls the "reintegration of consumer and producer afforded by computing capabilities and interactivity of digital media. He describes the movement as empowerment of "users to create their own content, reversing their role as the passive consumers of content" (Logan, 2010, p. 66). Thus besides providing the means of producing media digital objects, digital media – especially the World Wide Web – provides also the means to distribute said content to a potentially global audience.

artifacts for their own derivative works and discussions" (Simon, 2010, Chapter 1) as part of what Eduardo Navas defines as remix culture: "the global activity consisting of the creative and efficient exchange of information made possible by digital technologies that is supported by the practice of cut/copy and paste" (Navas, 2012).

This recombinant practice directly connects practices of personalization of content and employs the characteristic of "modularity" as defined by Lev Manovich (2001). According to Mirko Tobias Schäfer (2009) it falls under the domain of "accumulation", which "describes all activities evolving around texts originally produced within the established media industries. This content is collected, altered, further developed or remixed by users and dedicated fans" (Schäfer, 2009). William Gibson (2005) writes in his essay "God's Little Toys", where he traces recombinant modes of production[94] in different areas of culture:

> "Our culture no longer bothers to use words like appropriation or borrowing to describe those very activities. Today's audience isn't listening at all - it's participating. […] The record [as physically manifested and static cultural product, F.W.], not the remix, is the anomaly today. The remix is the very nature of the digital" (Gibson, 2005).

Gibson describes nowadays creative work as "endless, recombinant, and fundamentally social process" (Gibson, 2005). Robert Logan defines culture in itself as "remix of all accomplishments past and current of the members of a society" (Logan, 2010, p. 71) as the cultural production always happens within the context or tradition of former developments and achievements, which then are "remixed" or modified with the insights of the contemporary artist.

In the wider concept of cultural convergence participatory culture goes along with the concepts of media convergence and collective intelligence, according to Jenkins (2006a). Convergence describes in a very technical sense the ability of digital media to

[94] For music Gibson mentions bootlegs, remixes and mash-ups as common practices as opposites of the „record", in literature it could be a „cut-up method", as the writer William S. Burroughs was using. The word „sampling" comes to mind as. As shown before at the discussion of the characteristic "numerical representation", this is a technique which is already inherent in digital media and the digitization of media itself. Even the scientific writing of this review of literature is a remix of different sources I have read and engaged with – a point also Logan (2010) stresses.

combine different media in one device[95], even though this is not unique to digital media, but convergence existed in “old media” as well (see Logan, 2010, p. 57). But as Henry Jenkins argues, convergence is not only "bringing together multiple media functions within the same devices" (Jenkins, 2006a, p. 3), but it is rather a cultural shift where the former consumers are "encouraged to seek out new information and make connections among dispersed media content" (Jenkins, 2006a, p. 3). Thus consumption as well as creation have become a collective process. The pooling of resources and combining skills to bring together individual knowledge is what Jenkins refers to as “collective intelligence”, referencing Pierre Lévy (1997), who coined the term.[96]

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[95] see also the characteristic of “numerical representation” defined by Lev Manovich (2001). A primary example for digital convergence is the smartphone, which combines the features of a cell phone (voice telephony and text messaging service) with the ability to take, edit and transmit photos and videos, serves as access point to the Internet and therewith also to social networks, VOIP and videotelephony, instant messaging, music and video player, game console and much more. But also the World Wide Web can be described as convergent medium according to Robert K. Logan (2010), integrating multiple modalities such as “text, audio, video, and graphics and allows for conferencing, telephoning, videophoning, and online versions of selling buying auctioning, banking, searching, researching, learning, attending seminars and trade shows, and gaming […]” (Logan, 2010, p. 57/58). In other words media and activities from the physical world are transferred or “mediated” and converged into one “virtual” environment. Interestingly Logan also describes the phenomenon of divergence taking place in digital media, referencing a conversation with Mogens Oelsen, where media can be suddenly consumed on many different devices (smartphones, tablets, computers) and cameras can be found in many of the devices as well (cell phones, smartphones, tablets, notebooks, desktop computers, etc.).

[96] A form of tapping on this collective intelligence is called crowdsourcing. It can be seen as a form of aggregation of human resources and human knowledge. Jeff Howe (2006) first mentioned this term in his article in Wired! Magazine and describes it as “everyday people using their spare cycles to create content, solve problems, even do corporate R & D” (Howe, 2006). Some paragraphs later he formulates it a bit more harshly: “Just as distributed computing projects like UC Berkeley’s SETI@home have tapped the unused processing power of millions of individual computers, so distributed labor networks are using the Internet to exploit the spare processing power of millions of human brains” (Howe, 2006), no matter where they are, as long as they are connected to the network. An example is the open source software movement, which is a network of passionate volunteer programmers working on open source software (for more information see http://opensource.org/osd) and produce high quality software which can be distributed for free and the source code is available, which enables them to be modified and adapted by any skilled person. Platforms like iStockphoto (http://www.istockphoto.com/) make it possible also for amateurs to sell and licence their photographs for affordable prices. Wikipedia uses crowdsourcing to tap on the knowledge of the people to collaboratively compile a comprehensive online encyclopedia. These new models of course challenge established business models and production models and make it necessary to redefine their value in the market. On the other hand platforms such as “Amazon Mechanical Turk” (https://www.mturk.com) give companies the possibility to tap on the crowdsourcing for “HITs” (human intelligence tasks) – micro-tasks which computers cannot solve very well and which are designed to require little time, and therefore offer little compensation – in order to have them solved by human beings. With regard to information Logan claims, that accessibility has the potential to increase the reliability of information on the web, as one can cross-check the information with other available sources.

This participatory approach of the culture is also directly reflected in the media ecology and the system itself. Tim O'Reilly (2004) wrote about an "architecture of participation", which he defined as "the nature of systems that are designed for user contribution" (O'Reilly, 2004), which for him is inherent in Web 2.0. Even though all media had the potential to create collective action and cooperation, the Web takes this action to a global level and oftentimes amplifies the effect. Individuals, who have never met face-to-face, are enabled cooperate. Logan describes four categories of collective collaborations which digital media enable: 1) *collective interests*, where for example platforms can serve as means to find other people, who share the same interests; 2) *collective judgements*, which can take for example the form of product reviews and evaluations or the further use of automatically collected usage patterns of users; 3) *collective resources*, for example related to hardware and infrastructure, which can be the sharing of computing power (skype.com) or a distributed network for file distribution and sharing (BitTorrent.com); 4) *collective projects*, which can include anything from collaborative software development in the open source movement, over wikis to the co-creative production of a film (e.g. http://www.thejohnnycashproject.com/). Usually these projects are based on an environment, which allows the outcome to be greater than the sum of its parts and which encourages people to participate and to contribute.

Also Jenkins et al. define different prominent forms of participatory culture, such as:

> **Affiliations** — memberships, formal and informal, in online communities centered around various forms of media, such as Friendster, Facebook, message boards, metagaming, game clans, or MySpace).
> **Expressions** — producing new creative forms, such as digital sampling, skinning and modding, fan videomaking, fan fiction writing, zines, mash-ups).
> **Collaborative Problem-solving**— working together in teams, formal and informal, to complete tasks and develop new knowledge (such as through Wikipedia, alternative reality gaming, spoiling).
> **Circulations** — Shaping the flow of media (such as podcasting, blogging).
>
> (Jenkins et al., 2009, p. 3)

The move towards a participatory culture has a variety of implications for different areas. Especially for media system and individual expression the move to social media is often equaled with the belief that they offer "greater possibilities for anybody to participate in and challenge the production of a shared social world and cultural horizon" (Langlois, 2011, p. 2), which according to Ganaele Langlois claims two things: "first, that new communication tools are inherently democratic because they allow greater participation, and second, that these communication tools link the activities of producing and exchanging meanings with social and cultural action" (Langlois, 2011, p. 2), meaning that actions in participative platforms can have effects in the real world. According to Jenkins et al. this might lead to a diversification of cultural expression and in general an empowerment of the public, even though this depends very much on who is in control of the environment, the services, the access, which is a constant struggle (see Jenkins, 2006a; Waal, 2007).

And of course these ways of idea exchange also influence the way we learn and generate knowledge today. Jenkins et al. argue that the mentioned forms of participatory culture, which also include forms of peer-to-peer learning, strengthen collaborative and social aspects of communication, knowledge- and meaning generation, where "users work together on the basis of equality to create meaning and compile knowledge" (Waal, 2007, p. 22), for example on platforms such as Wikipedia. "We think therefore we are" (Leadbeater, 2008), is the motto Leadbeater puts forward. "In the past you were what you owned, now you are what you share" (Leadbeater, 2008).

According to Martijn de Waal trust in one another and the acceptance of another's knowledge or the willingness to discuss it are important, as it is always the question whose opinion counts in case of a conflict. But in general some writers and philosophers are skeptic if equality really can be equaled with truth (see Lanier, Dyson, Origgi, & Leadbeater, 2007). This healthy skepticism leads to what de Waal calls "new forms of institutionalization of expertise and reliability", for example in forms of reputation systems on online marketplaces, karma systems for contributions to a community, or the direct ratings of individual contributions. As he argues further, "[t]he expert paradigm in which experts accredited by official bodies determine what is true and what not, is being replaced here by a more meritocratic system where what counts is proven expertise rather than institutional embeddedness" (Waal, 2007, p. 23). Gloria

Origgi relates the Web as epistemic system[97] to its status as reputational tool: "The Web is not only a powerful reservoir of all sort of labelled and unlabelled information, but it is also a powerful *reputational* tool that introduces ranks, rating systems, weights and biases in the landscape of knowledge. Systems as different as the PageRank algorithm in Google – based on the idea that a link from page A to page B is a vote from A to B and the weight of this vote depends on who A is – and the reputational system that underlies eBay, are powerful epistemic tools insofar as they do not only provide information and connect people, but sort people and information according to scales of value" (Lanier et al., 2007). And she predicts that with a growing amount of information and potentially knowledge on collaborative platforms will grow, the more important reputational cues will become to judge the trustworthiness of the information. Martijn de Waal argues, that this will lead to "new collective forms of canonization" (Waal, 2007, p. 23), even if these canonical corpuses of knowledge are rapidly evolving and tentative , as Gloria Origgi describes them (see Lanier et al., 2007)[98].

But whatever content one can experience online, it is dependent on the conditions, which allow the expression, as well as the environment in which these expressions are displayed: in other words the production and reception context, which for digital media is to a large part shaped by software (see e.g. Lev Manovich, 2013b). As Ganaele Langlois argues, "[o]nline participatory media platforms offer an exemplar of the new conditions of the production and circulation of meaning beyond the human level: they offer rich environments where user input is constantly augmented, ranked, classified and linked with other types of content" (Langlois, 2011, p. 1). All of these mechanisms of interlinking, ranking, augmentation, search, but also the way we can actually interact with media, produce, edit and enhance media is determined by the

[97] Richard Rogers also studies what he calls „web epistemology", defined as „the new hierarchies of sources, and credibility, outputted by engines" (Rogers, 2013, p. 9). This analysis is undertaken at the intersection of the medium and the user (see Weelden, 2007, p. 101).

[98] Yochai Benkler describes in his book "The Wealth of Networks" (2006) a more faceted peer review system on the Web, which exists in the relationship of sites which attract a large public and niche sites which have a smaller audience. The smaller sites are often the places where discussions amongst peers take place, which are monitored by the more popular sites, which have the power to popularize a topic (see also Waal, 2007).

functionality of the software or the (web-)applications we are using to do so[99]. And as William Uricchio (2011) argues especially in relation to visuals " […] that over the past decade or so we have had increased access to new ways of representing and seeing the world, ways dependent on algorithmic interventions between the viewing subject and the object viewed" (Uricchio, 2011, p. 25). In short in what Uricchio calls the "algorithmic turn", software and algorithms as active agents change our relation to the world as we perceive it, experience it, interpret it, and constitute what we perceive as subjective "truth". This is also true for the filtering mechanisms in place on the Web, which predetermine the points of views we are confronted with, the information available to us to construct our own opinion and point of view, to grasp a topic. David M. Berry (2011) describes what he calls the "computational turn" especially with regard to digital humanities research as a change not only in the perception of objects, but also in the way researchers or in general knowledge generators approach them, think about them, or conduct research, which is according to Berry increasingly mediated through digital technology. The mediation affects "both the epistemologies and ontologies" (Berry, 2011, p. 1), especially through the digitization process, which largely determines what we can know about the item in question in first place.

The processability of the digital objects in their new state as well as the process of the digitization and reconstruction itself also allows to ask different questions than researchers were able to ask and answer before, as it underscores what is not known, and new ways of interacting with the items alter the experience and the ways you can scrutinize them. Or as Jonathan Shaw argues:

> "[…] the work of the humanities is to create the vessels that store our culture. In this sense, the digitization of archives and collections holds the promise of a grand conclusion: nothing less than the unification of the human cultural record online, representing, in theory, an unprecedented democratization of access to human knowledge. Equally profound is the way that technology could change the way knowledge is created in the humanities. These fields, encompassing the study of languages, literature, history, jurisprudence, philosophy, archaeology, religion, ethics, the arts, and arguably the social sciences, are entering an experimental period of inventiveness and imagination that involves the creation of new kinds of

[99] Lev Manovich (2012) and Claus Pias (2003) point out the obvious in their essays, in that they show the different possibilities of display and interaction with media data of different software tools.

> vessels—be they databases, books, exhibits, or works of art—to gather, store, interpret, and transmit culture" (Shaw, 2012)

Thus digital technology as active agent not only changes the media ecosystem or influences what and how humans perceive cultural data. But it also affords novel insights to be made and knowledge to be generated by employing the technologies and methods surrounding them in the digital ecosystem.

IV. Mediation of Art and Culture

Before exploring what these changes in the media ecology mean for cultural institutions and especially for cultural learning, this part will introduce and define the general concept of Mediation of Art and Culture. It is one of the central concepts around which this thesis revolves. The first chapter of this part will trace different current notions and concepts of mainly non-digital practices of mediation of art and culture to derive a working concept, which will serve as baseline to look at data-based digital mediation practices.

As already stated in the introduction of this thesis, "Mediation of Art and Culture" is the author's provisional translation of the German concept of "Kunst- und Kulturvermittlung", which encompasses a wide variety of activities in order to provide an interface for engagement with art and culture – from artistic approaches such as performances in everyday situations over exhibitons and gallery education to cultural education and cultural marketing – in different social and institutional contexts –, as Viktor Kittlausz and Winfried Pauleit define in the introduction to their edited book "Kunst-Museum-Kontexte" (2006).

There exist a multitude of points of view, what the aim and scope of mediation of art and culture may be. One of the things this approach encompasses is learning from, with and about art and culture as reflected in Anna Cutler's approach of "Cultural (Creative) Learning". First of all it needs to be defined what learning in this respect encompasses. According to Cutler "[l]earning, at its most fundamental level, is the outcome of the neurological process of receiving and processing new data." (Cutler, 2009, p. 58). She argues for the fact that the basic process of learning encompasses the brain to receive information from external stimuli, "where it is filtered through analytical and emotional networks and then stored as memory (or rejected en route)" (Cutler, 2009, p. 58). This broad notion of learning, to which also Stephan Schwan (2009) refers, sees learning as permanent mental change through experience, but this definition does not necessarily imply an intention to learn nor a specific goal for learning, but includes forms of implicit and casual learning (see Schwan, 2009, p. 34).

Another definition Cutler puts forward is the one of "education" as "the structures and systems established to manage and guide learning; the *what* we learn, *why* we learn it, and *how* we learn as a method of approach" (Cutler, 2009, p. 58). One might want to add another dimension for cultural learning: namely *where* we learn – describing the context or the setting in which learning takes place. This definition gives a good set of questions to think structurally about mediation of art and culture that this part will follow, even though the term education is often associated with a formalized, structuralized learning setting – something which mediation practices and cultural learning as approach try to avoid. This gets evident in the argument of Viktor Kittlausz and Winfried Pauleit (2006), that the practice of mediation is not the same and more open ended as museum pedagogy or education (Museumspädagogik). Where the German (and French) term pedagogy or education is more associated with a formal training[100], the anglophone tradition is seen as interpretative practice (see American Association of Museums – Standing Professional Committee on Education, 2005), which serves as interpreter between the museum objects and the public – thus similar to what German "Vermittlung" aims for. Eva Sturm puts forward that mediation is not about making art didactically manageable and controllable and not about creating formally measurable knowledge that can be tested in a quiz. In contrary, mediation is about using the nature of producing and perceiving art as an "unpredictable process" (Sturm, 2004b, p. 137), which opens up a space that enables an engagement and learning with and about art and culture.

1. Reasons and Goals for Mediation of Art and Culture

Asking "why do we mediate art and culture" leads into two different directions. One is the question "Why do artworks and cultural objects need mediation?", the other is the more general question "Why do we need to know about and to engage with art and culture?".

A very basic reason for the mediation of art and culture in a very wide sense is the need of access. Art and culture need to be accessible in order to engage with it, be it

[100] „Museum pedagogy is a theoretical and methodological framework at the service of educational activities in a museum environment, activities the main purpose of which is to impart knowledge (information, skills and attitudes) to the visitor" (Allard & Boucher, 1998; cited in and transl. by Desvallées & Mairesse, 2010, p. 31/32).

directly, for example in form of an exhibition, or through various media in form of a translation or representation[101]. To enable access and to provide and form an interface for the engagement with art and culture is one of the tasks of mediation of art and culture in a quite literal sense. Another is to act as facilitator for engagement with the cultural items, as a intermediary and translator through which the objects and artworks themselves can "speak" to the audience (see Werner Schmalenbach in an interview with Christine Breyhan; Breyhan, 1991, p. 57). This is based on a widespread insight, that cultural artifacts – or museum objects[102], as Roland Albrecht (2006) calls them – are silent witnesses of their usage, the practices and contexts they are or were part of, the history, which is inscribed in their materiality. In short they tell their own stories, but these needs to be translated in order to be understood (see Weizman, 2012) Mediation in that case can be subsumed as storytelling or enabling to derive the stories from the items on display. With art a similar argument could be made. As Gabriele Stöger quotes a keyworker[103] in her text: "The philosophy of the museums is based on

[101] This applies mainly for artworks which are manifested in the physical world, for example paintings, sculptures, installations, etc. For so called „media art", where the artwork itself is made by using mass media or electronic / digital media as its medium and/or outlet, the natural place for the artwork or cultural product might be a media channel. Thus here mediation / translation has other implications than for physical artifacts, and the accessibility might be different as well. One example is a lot of these works are ephemeral – be it because of their performative, time-based or interactive character, be it because of the decay of technology or the storage / data medium. Thus they oftentimes are only preserved in form of documentations. In this case, but also in the case of for example long destroyed built heritage, mediation in the very literal sense of translation into a medium or into another medium – for example into a documentation – becomes relevant also for the preservation of cultural heritage.

[102] Roland Albrecht (2006) describes objects in a museum as objects, which are taken out of the economy, they usually stay in the collection once they are acquired, are preserved and are taken out of their original context of use (de-contextualization) and are re-contextualized, and therewith subject of the ideology of museums. They are selected to exemplary represent similar objects, serve as document of the past with significance for (collective) memory and remembering as well as carrier of meaning, as sign in a semiotic sense. Therewith their usage changes: cultural objects are not actively employed anymore, but are rather contemplated or gazed at, at least in a classical museum context. The Wikipedia article on the German term "Musealisierung" – which describes this process – also points out, that this can not only be applied to objects but also to buildings, building complexes or city areas, especially when they are declared to be protected historical monuments (see Wikipedia, 2013g). It is likewise a process of validation of the objects, which is also or even more so true for artworks and the artist himself, due to the economical rules of the art market (see Albrecht, 2006, p. 26).

[103] Keywork is a model for civic involvement and volunteering that is not based on long term engagement but rather focuses on shorter projects and actions in a participatory way. It is primarily targeted towards older citizens that act not only to aid the common good but also to benefit themselves, for example recognition or doing something that interests them personally (Water, 2011). It gets evident are parallels between this offline engagement for example in cultural institutions and contributing in social media, when it comes to the motivation or gratification to donate time and working power to a task.

the belief, that art is linked to meaning, but the meaning is not carried in the artworks themselves, but is constructed between the artwork and the person which encounters the artwork" (Keyworker, Dublin, quoted in Stöger, 2009, p. 75). And this interface for, this in-between needs to be provided and formed to the needs of the visitor, so that at best everybody who wants, no matter what personal background he or she brings to the table, could potentially have for him or her personally meaningful engagement with the item in question.

Why is it important for a person and for a society at large to have access to, engage with and learn about art and culture? The answer to this question can usually be found in educational approaches and political directions, which clearly define the value of art and culture, even assigning them and the associated institutions an educational duty (see Pfeiffer-Poensgen, 2009). The key term in politics is "cultural education". In the book "Key Concepts of Museology", published by the International Committee for Museology (ICOM), the scope of education is defined as "training and development of human beings and their capacities by implementing the appropriate ways to do so" (Desvallées & Mairesse, 2010, p. 31). In relation to a museum the authors of the same book define "museum education" as "set of values, concepts, knowledge and practices aimed at ensuring the visitor's development; it is a process of acculturation which relies on pedagogical methods, development, fulfilment, and the acquisition of new knowledge" (Desvallées & Mairesse, 2010, p. 31). These definitions imply a very clear mission for learning: transfer knowledge for the development of a human being, and for the cultural sector provide the person the knowledge to become part of a specific culture. Karl Ermert writes in the opening lines of his definition of cultural education:

> "Kulturelle Bildung bedeutet Bildung zur kulturellen Teilhabe. Kulturelle Teilhabe bedeutet Partizipation am künstlerisch kulturellen Geschehen einer Gesellschaft im Besonderen und an ihren Lebens- und Handlungsvollzügen im Allgemeinen. Kulturelle Bildung gehört zu den Voraussetzungen für ein geglücktes Leben in

In the definition Gabriele Stöger (2009, p. 76) uses the term it comprieses people that act as mediators between the institution of a museum and a broad, mostly adult or young adult public. These persons are not employed in the museum and are either volunteers or working as mediators independently of he institution.

> seiner personalen wie in seiner gesellschaftlichen Dimension. Kulturelle Bildung ist konstitutiver Bestandteil von allgemeiner Bildung." (Ermert, 2009)[104]

In this very humanistic view on cultural education – meaning education in music and aesthetics as well in theory as in practice – Ermert defines this term as part of the general education of young persons[105] with the goal to prepare them for the jobmarket, to enable taking part in politics and society as well as to form their personality (see Ermert, 2009). Artistic products and cultural artifacts reflect and therewith can teach people about our their and other cultures, societies, and history. Learning to engage with them trains people to critically reflect the world they live in and learning about the different modes of cultural production develops their own ability to express themselves, but also enables them to form their environment, their society, their culture. To reach this goal various authors argue for uniting cognitive, emotional and aesthetic process in the education (see e.g. Cutler, 2009; Mercator Stiftung, 2013). With its program "Kulturgesellschaft 2020"[106] Mercator Stiftung aims to foster the solid integration of cultural education in the formal education system, meaning on an equal level as the core disciplines, such as mathematics or languages. Moreover they argue for partnering with cultural institutions as spaces for learning, as schools alone cannot master the complex challenges. The integration is not happening in practice from the side of politics and science, as Mercator Stiftung claims, even though culture itself is highly regarded in political programs be it on national or European level. A similar initiative exists in the United States of America under the acronym "STEAM", which argues for putting Art and Design in the center of the highly fostered science education under the acronym STEM (Science, Technology, Engineering, Math). The goal of STEAM is to influence research policy to place art and design at the center of STEM, and therewith integrating art and science, to encourage this integration also for K-20 education and to foster the hiring of artists and designers in corporate industry to push innovation. This movement took its start from Rhode Island School of Design under the direction of John Maeda, and is according to them now widely adopted by institutions, corporations and

[104] Translation by F.W.: „Cultural education means eductation in order to be able to partake in culture. To partake in culture means the participation in the artistic and cultural events of a society especially and in its life and activities in general. Cultural education is the prerequisite for a successful life be it with regard to personal or societal dimensions. Cultural Education is a constitutive part of general education." (Ermert, 2009)

[105] Stiftung Mercator calls this "the general education in the medium of the arts" (Mercator Stiftung, 2013, p. 32).

[106] transl. by the author: „Cultural Society 2020"

individuals – an example being the STEAM Challenge at Duke University[107], which took place in Fall 2013.

STEAM presents indirectly another reason for cultural education, besides the educational goal in building the personality and educate a person to take part in society: the fostering of creativity[108], which is regarded an important factor for the job market and innovation. Culture is seen as "catalyst for creativity and innovation" (European Commission, 2013a). Learning about your own as well as other cultures is moreover an important factor for integration which is necessary in a globalized society as well a European multicultural society fostered by the freedom of movement. This needs an ongoing intercultural dialogue (see European Commission, 2013a; Mercator Stiftung, 2013) amongst others for the creation of a shared identity which includes and affirms the heritage and identity of all people and fosters the acceptance of diversity, which in itself is regarded a "source of dynamism, innovation, creativity and growth" (European Commission, 2013c). The intercultural dialogue is an ongoing priority of the European Union, which should be fostered (see European Commission, 2013d). But the European Commission criticizes in their agenda for culture from 2010 that cultural awareness is not a strategic priority in most European countries, and argues to foster this as a key competence with regard to lifelong learning along with "enhancing creativity at all levels of education and training" (European Commission, 2010, p. 14).

Another key competence of the 21st century is to understand media as form of cultural expression, as all people are literally immersed in them in our everyday lives. Therefore it is important to critically engage with and examine media processes from production to reception. This competence is subsumed under several terms. Media literacy, stemming from a basic understanding of literacy in terms of reading and writing, wants to shape people to what could be called "critical consumers", by teaching a "basic understanding of the ways media representations structure our perceptions of the world; the economic and cultural contexts within which mass media is produced and circulated; the motives and goals that shape the media they consume; and alternative

[107] see http://dukesteamchallenge.org/

[108] Andrew Dewdney is also giving insights to the question: „How do we move from a paradigm of collection and connoisseurship to that of creative social agency?" (Dewdney, 2008, p. 2) in his article „Making Audiences Visible: Gallery Education, Research and Recent Political Histories" (2008).

practices that operate outside the commercial mainstream" (Jenkins et al., 2009, p. 20). Henry Jenkins et al. (2009) also identified additional skills, which he regards important for nowadays "prosumers", namely: play, performance, simulation, appropriation, multitasking, distributed cognition, collective intelligence, judgement, transmedia navigation, as well as networking and negotiation. This is why Mary Leigh Morbey (2011) argues for a "Metamodal Mastery" which shifts the focus from consumption to production, focusing on the "combinatory possibilities of the metaverse-enabled-metamedium"[109] and employs the skills Jenkins et al. identified, and therefore needs also a more hands-on approach for learning. Marion G. Müller developed a process based research oriented approach with focus on visual communication called "visual competence" (M. G. Müller, 2008), which integrates four core competencies across different context levels[110], namely: visual production competence, visual perception competence, visual interpretation competence and visual reception competence, which make up the visual competence cycle (M. G. Müller, 2008, p. 103). The core difference of this approach to the others is that it takes into account and highlights the importance of the contexts in which production, perception, interpretation and reception happen and strives for a understanding across contexts: meaning the logics and constraints of production in different production contexts; the psychology behind perception for example as an individual versus a group as well as factors such as "[a]ge, gender, experience, and social as well as cultural factors" (M. G. Müller, 2008, p. 103); differences in meaning attribution to the perceived visual for individuals as well as groups – from small groups to whole cultural groups – and the influence of the individual background or external, for example cultural influences, on the interpretation of visuals; the understanding of cognitive and emotional reactions to visual materials, which happen during the reception process (see M. G. Müller, 2008). A lot of the processes described in Marion G. Müller's concept are still not fully understood and need further research, which is currently happening in the Research

[109] This expands the concept focus of the computer as metamedium to the mobile devices which have the ability to enhance the world around also thanks to their ubiquity, bridging the digital and the real. A metaverse is defined as "convergence of 1) virtually enhanced physical reality and 2) physically persistent virtual space." (Smart et al., 2007, p. 4), which is a junction of the virtual and physical world, oscillating between augmentation and simulation as well as perceiving, measuring or interacting with our external world e.g. through sensors versus what is going on inside of a person (identity, interaction) (see Smart et al., 2007, p. 17).

[110] personal context, context of a specific situation, and systemic – social, cultural, political – context

Center "Visual Communication and Expertise" at Jacobs University[111]. Therefore a media education, which covers all three elements – critical consumption, mastery of production and an understanding of the context, which influence both – has to be an integral part of 21st century cultural education. Artistic practices – especially in the field of so called "media art" – can offer a critical view on media production and media usage and the whole environment of production and consumption, and therewith can help to understand the system by transforming it and experimenting with it (see Thiedeke, 2004).

Even though the methods of mediation of art and culture differ quite a bit from the formalized methods used in purely educational settings, with the aim of the transfer of quantifiable and testable knowledge, and employ a more experiential and experimental approach to learning, they still operate under the same objectives prescribed by the educational politics, but in opposite to education they do not shy away to question the contexts and institutions under which they are operating.

In relation to the role of mediation of art and culture for education and society, several goals for the mediation process can be identified. Victor Kittlausz and Winfried Pauleit mention as a very basic goal of mediation to make art and culture accessible and to interest people in cultural content and keep them interested. Isabel Pfeiffer-Poensgen (2009, p. 26) formulates the following aims for mediation of art and culture:

- the development of the own creativity and phantasy (formulated especially with regard to children and youth).
- to enable to engage with and tap on the resources of art and culture, e.g. through acquisition of knowledge.
- learning about and through art and cultural artifacts, amongst others allowing critical engagement and reflection of given social and political circumstances in your own and other cultures. This requires an understanding of the possibilities these items offer as well as a preparation of the ability to make judgments.

Anna Cutler (2009) adds

[111] for more information on the research center see http://jacobs-university.de/viscomx

- the development of an understanding of art but also an understanding of the visual and spatial world around us through cultural (creative) learning. This includes in my opinion our contemporary media environment.
- the development of the personality by building own knowledge and own experiences "through language, looking and discussion" (Cutler, 2009, p. 65), which will enable a person to form own opinions and not only rely on filtered information and ideas from others.
- to make meaning of cultural objects and to learn to transfer of ideas across different objects and modalities, for example from verbal to visual.

Anna Cutler as well as Isabel Pfeiffer-Poensgen therewith argue that cultural learning – which according to Cutler "takes place beyond the classroom or lecture theatre; within a cultural setting, and that takes cultural product as its subject matter for direct engagement" (Cutler, 2009, p. 61) – should foster critical thinking which can be applied beyond the learning environment, and therewith the development of transferable skills and life skills, but also for sustained engagement across disciplines and therefore the bridging of formally set boundaries (see Cutler, 2009, pp. 62–63). Doris Lewalter (2009) argues with outlook to Kirsten Gibbs, Margherita Sani and Jane Thompson (2006) for varying outcomes for cultural learning, especially in a museum as institution for life-long learning, as Gibbs et al. analyze it. These outcomes range from learning in a more general sense – such as the broadening of existing knowledge, a deeper understanding of specific ideas or the improvement of technical and other skills – over social interaction and communication, to outcomes affecting a visitor on a personal level – such as the change of attitude or values, recognizable joy, increased confidence, as well as personal and identity development (see Lewalter, 2009, p. 48). Arja van Veldhuizen (2009) also reiterates the mediation of knowledge and insights and the information with regard to societal topics as well as heightening the amusement of the visit in her analysis of the most important goals, but she also mentions more economical aspects such as the increase of the numbers of visitors. Moreover she lists the intensification of the museum experience – including empathy with the visitor – and fostering an aesthetic experience[112].

[112] According to Jos de Mul "[…] experience is constituted and structured by the forms of sensibility and the categories of human understanding […]" (de Mul, 2009, p. 95).

The movement of “critical mediation of art” (Kritische Kunstvermittlung) (see e.g. Mörsch, 2006, 2011) – of which Carmen Mörsch is one of the important German practitioners and theoreticians – as well as the anglophone “Gallery Education” (see Allen, 2008) represent practices of critical engagement with art and culture but also with the institutional, social and political powers behind it. They relate their practices to concepts like Jacques Derrida’s deconstruction (see e.g. Jacques Derrida, 1997), institutional critique and gender theory. The main goal of this practice is not the reproduction of existing knowledge, but the production of new knowledge together with the visitor, as well as fostering of the engagement of the visitor with the item on display and his / her own interpretation (Mörsch, 2011). Nina Simon argues in her book “Participatory Museum”, that the museum space is a space for social experience and facilitator for meaningful interaction with the artistic projects and with other visitors (Simon, 2010). Therewith all these concepts put the individual in the center of attention and give him/her an active role. This role is not only the one as learner who needs to be educated, but as a person knowledgable in his/her own right, who can contribute to the understanding of culture with his / her own point of view: through engaging with culture, bringing the own background to the table, but also by being transformed by this encounter and the encounter of other people. And this as a process of learning, collaboration in knowledge generation through the engagement with culture and other members of the society can and should have a transformative effect not only on the persons involved but also the community or the society at large. This process based understanding of mediation of art and culture with the goal of co-creative knowledge generation is central to this thesis.

How can these set goals be reached? What are the methods and approaches employed in mediation of art and culture? The following section will highlight some – but by far not all –mediation approaches to give an impression what strategies of mediation of art and culture exist, which can be employed in a non-digital environment as well as be transferred to a digital one. Therefore this section will focus mainly on approaches used for what Anna Cutler calls “cultural learning”, which takes place in cultural settings outside of school.

2. Contemporary Approaches

2.1. The Museum as Place for Informal Learning

The museum or gallery space is an important example for a space and cultural setting where informal cultural learning[113] takes place and towards which many contemporary mediation concepts are developed. The ICOM (International Council of Museums) defines a museum[114] as "[…] a non-profit, permanent institution in the service of society and its development, open to the public, which acquires, conserves, researches, communicates and exhibits the tangible and intangible heritage of humanity and its environment for the purposes of education, study and enjoyment" (International Council of Museums, 2012). The core tasks of a museum are therewith collection, preservation, research, display and education / mediation.

By collecting and accumulating items and de-contextualizing them from their original context and re-contextualizing them in the collection, but also through formalized ways of presentation or display in exhibitions – a specific interface for art and culture –,

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[113] Two kinds of settings can be differentiated: formal learning environments, such as schools or higher education, as well as the so called informal learning environments, such as youth groups or cultural settings including the museum (see Cutler, 2009, p. 57; Lewalter, 2009, p. 45). These two settings ideally have different organizational structures, even though Cutler argues that often the structures of formal learning approaches are also transferred to informal settings. A formal setting is classically characterized by splitting knowledge areas into subjects or departments, fifty- or sixty- minute transmission model, course structure, the transmission of knowledge by a teacher, e.g. in form of lectures, central goals for the learning outcome defined by a curriculum or the teacher which are assessed quantitatively resulting in a grade which either honors that the student reached the goal or penalizes him/her for not doing so (see Cutler, 2009, p. 58; Schwan, 2009, p. 36/37). Stephan Schwan characterizes the formal approach as "one size fits them all", as the knowledge is usually transmitted by fixed didactic methods in highly structured situation, which does not take into account individual preferences of learners. Schools and universities try to balance this by homogenizing the groups, for example by having classes of the same age or the same / similar discipline(s). In the last years there also emerged various pedagogic methods in school and higher education settings, which differ from this „formal" notion, taking elements from informal settings. One example are the „Flipped Classrooms", which turns the class upside down by providing lectures and work on content as homework to consume in the student's own pace along with the possibility to discuss with peers and/or the instructor (usually technologically enabled) and using the face-time in class to engage with the concepts and therewith learn through activity (a summarizing infographic can be found e.g. at Knewton Inc., 2013).

[114] Besides the museum or gallery there are many different cultural heritage contexts and institutions in which cultural learning can take place, such as urban space or public space in general (see e.g. Gordon, 2010; M. Müller, 2006), monuments or specialized collections such as cinematheques (Pauleit, 2006 see e.g.). However the museum and gallery setting as well as the media scape related to it will be the primary setting for cultural learning in the context of this thesis.

the museum provokes a different perception of the exhibited objects, communicating through the architecture of the museum, the configuration of objects and their spatial relations in installations as well as interpretative material and processes of mediation (Kittlausz & Pauleit, 2006, p. 16). Through this process of selection value is added to the items, as it seemingly separates artifacts, which are worthy to remember or essential from those, which are not. And also the presentation and placement in the museum gives them added value through aesthetic validation or artistic judgment. Thus the museum does not only collect and present items, but also assesses, validates and orders them. Since the 1960s it is often criticized to favor a specific master narrative and to exclude other counter narratives[115], which especially critical mediation of art criticizes and wants to balance out by rather understanding mediation as opening a range of perception, allowing and promoting alternative points of view to the institutional or societal master narrative. The critique of the museum's mechanisms of inclusion and exclusion as well as selection and validation lead to the development of a neutral interior museum space – also referred to as "white cube" – serving the art (see O'Doherty, 1986). Nevertheless the display directs the gaze and reflects social constructs and institutional politics.

Not only the re-contextualization changes the status of the objects, but according to Proust, Adorno or Beuys the museum is a transitory space through preservation of cultural goods, which leads to a loss of liveliness. Museums are places of research, making meaning out of the objects they collect and preserve and therewith keeping heritage and memory alive, or at least one particular, institutionally approved version or master-narrative of it. But a museum does not only do research itself, their repositories can be resources for further research by individuals and researchers from outside, and also the works of artists and the makers of exhibitions are oftentimes done in the spirit or methodology of research, and they may include the visitors into the research, who are confronted with their own process of looking (see Kittlausz & Pauleit, 2006, p. 16). And through critical mediation moreover the visitors can be actively part of an ongoing meaning making and knowledge generation process. Thus "[a] museum is not only a place of preservation and interpretation of objects. In the ideal case it is a center for media, an archive, a meeting place for communities, a study center, a place

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[115] Elke Krasny calls this the „zu ersehenden Mainstream“ [the seeable mainstream, transl. by F.W.] (Krasny, 2006).

for art related events, an institution for learning and training as well as an actor for social change" (Stöger, 2009, p. 82).

Lastly the museum has also function of mediation and education. To quote Bianca Bocatius: "Museums are places of education and learning. As part of the society they perceive themselves nowadays even more as places of learning, than as simple warehouses of cultural heritage" (Bocatius, 2011, p. 1). According to Anna Cutler (2009) the main task for various areas of a museum – from exhibiting cultural products, via courses on different platforms, community and regeneration programs to library services, archives or conservation – is to serve to offer learning experiences, where the quality of the experience matters over the quantity of the delivery, depth over breadth.

The museum education as part of cultural education was professionalized since the 1970s (see also Bocatius, 2011). Besides the cultural education of the youth the museum is also a place for life-long learning, which is crucial in the knowledge-based society of today (see Bocatius, 2011; Gibbs et al., 2006). In that process the museums became places of shared knowledge and – especially in light of the European heritage and integration – “agents of social change and social integration, bringing more people back into the learning cycle” (European Museum Forum, 2005). With this shift to life-long learning it is widely recognized that “most of what we learn is acquired in informal contexts and that museums are ideal places for learning throughout life, as they offer free choice learning and can address all age ranges” (European Museum Forum, 2005), and is better in adapting to a heterogeneous audience and flexibly compensate different backgrounds through visitor-oriented, adaptive exhibition design and mediation (see Schwan, 2009, pp. 36–37). The latter is done by initiating more open mediation processes targeted towards the visitors, which are outside of official curricula (see Lewalter, 2009, pp. 45–46). As already stated in the previous section, non-personal mediation is on the forefront in the moment and is enhanced by personal mediation. This means learning in this informal space is largely based on self-directed active engagement of the audience with the presented facts, topics or situations, where the audience is supported to develop an own point of view about a topic or reflect about it. This support can have different formats in the analog world, comprising the supply of accompanying material amongst others in form of labels, catalogues, handouts or lecture series to didactically structured modules such as audio guides or guided tours. All these materials have a high variability of didactic approaches and the educational possibilities are offers where it is up to the visitor to take them up or not. Anna Cutler (2009) sees the museum as "laboratory for education", as the institutions do not have the limits of time, space or set curricula, which other educational institutions have, and therefore the content and not so much the timetable can drive the work. Thus they can and should let go of extrinsic demands and take the opportunity to be more authentic, free and diverse and really differentiate themselves from traditional educational institutions. One way to do so would be for example to invite collaborations with artists, to provide space (physically and intellectually) to cultural practitioners to enable them "to truly innovate, take risks and be bold about practices" (Cutler, 2009, p. 68). A place where it is safe for cultural practitioners but also for learners to make mistakes without serious repercussions.

The possible experience a visitor can have in a museum as a cultural space, a learning space but also a social space is very important for cultural learning as experience based learning by engaging with cultural products[116]. Andrew Pekarik, Zahava Doering and David Karns (1999) distinguish four levels of museum experiences: a) *object related experience* – i.e. seeing 'the real thing' or rare/ uncommon/ valuable things; this concept is very much related to Western material culture and its idea of an "original" object or what Eyal Weizman (2012) would call "forensic aesthetics"; b) *cognitive experiences* – i.e gaining information or knowledge or enriching your understanding; c) *introspective experience* – i.e. the reflection on the meaning of what you have seen, the individual imagination of for example other times and places, the remembrance of previous experiences; the personal relationship to the topic or object is central; in a more critical sense this would entail also engagement with the cultural object and its context in order to come to ones own interpretation; d) *social experience* – i.e. the experience in relation to other persons or groups around the visitor (familiy, friends, colleagues, other visitors, museum personnel, etc.) (see Lewalter, 2009; Pekarik et al., 1999). All these experiential dimensions become tools and parameters to be used in contemporary mediation of art and culture, of which some concepts will be discussed in the following chapters.

[116] A museum experience does not necessarily have to take place only physically inside a museum. John Falk and Lynn Dierking (2013) separate experiences taking place inside and outside the museum, or on a time dimension before, during and after the visit, and therewith extending what can be viewed as "museum experience" into other spatial and time-dimensions. Also a museum without a physical manifestation – in a purely mediated form – is possible. This is a concept that becomes important when thinking about a museum in the digital age.

2.2. Gallery Education

Looking at mediation of art and culture today, especially at the British tradition of "Gallery Education" (Allen, 2008; Dewdney, 2008; McLaren, 2006; Mörsch & Sharp, 2003), the field "can be described as professional field of practice that exists to engage people in thinking about or using visual media – primarily, though, not exclusively, exhibitions – as a resource for learning" (McLaren, 2006, p. 195). Janice McLaren (2006, p. 195), Head of Education at the Photographers' Gallery (London, UK), defines four main areas for gallery education: interpretation, in-gallery interactive, artist-in-residence and continuing professional development work (CPD)[117]. Interpretation means in the definition of McLaren a one-way dialogue from the museum to the audience and a "more passive engagement with the gallery programs" (McLaren, 2006, p. 196). Classical interpretation materials include amongst others labels in different layer of detail – from basic tombstone information to extended labels with contextual information about the artist or the work[118]; take away material like leaflets, information sheets, guides or catalogues, over audio guides; resource rooms offering further information in form of different media; informal talks and tours in the gallery for groups and individuals; and events which supplement the exhibition or provide context, such as film-screenings or performances. In-gallery interactives should offer an 'interactive experience with the ideas and potential meanings within exhibitions" (McLaren, 2006, p. 197). These can range from simple – not staged – conversations amongst peers in the museum that – following McLaren – might be seen as a form of 'interactive learning', over workshops, "which often involve a mixture of looking, discussion and practical art-making" (McLaren, 2006, p. 197), to "live guides", which are people stationed within the gallery space who "encourage visitors to ask questions, make comments or to have a conversation about an exhibition" (McLaren, 2006, p. 197). Artist-in-Residence is an outreach program, where galleries might commission an artist to produce a work in a community context, for example a school, and often the community is involved by supporting this endeavor either by realizing own or

[117] For an example of Gallery Education in practice see the description of Tate's approach to gallery education at Felicity Allen's article „Situating Gallery Education" (2008). She also gives an insight how the movement developed out of principles used by feminist artists and historians.

[118] The practice of providing labels is heavily criticized for example in the text „Death by Wall Label" by Jon Ippolito (2008).

collaborative work. The process of art-making is in the foreground here. Last but not least CPD includes activities related to professional development particularly of teachers in K12, for example by special preview events for exhibitions, workshops or in-depth discussions related to exhibitions and the interests or needs of the pupils. These events are held by the artists, gallery staff or practicing teachers. Another form could be more formal, longer-term courses up to degree programs in cooperation with higher education institutions (see McLaren, 2006). McLaren also mentions other forms of mediations such as artist commissions, mentoring or self-run spaces, where the gallery provides space for a group to "generate their own activities related to particular exhibitions or to art in general" (McLaren, 2006, p. 199).

2.3. Art and Culture as a Starting Point

One approach that many concepts share, is to take art – or a bit more generic cultural goods or cultural heritage[119] objects – as a starting point for learning and teaching or, as Eva Sturm formulates, to act "von Kunst aus" [starting from art](Sturm, 2004a, see. e.g. 2004b, 2011). She argues for using art as a resource, a "specialized space for negotiation" (Sturm, 2004b, p. 137), to learn with and from art and culture, by engaging with it and grappling with it. Following a constructivist approach with the basic thesis that knowledge is only generated through the individual building of connections and relationships of objects, facts, experiences and other nodes in the knowledge network means that there is no need for a general canonization of knowledge for everybody, as Carmen Mörsch argues. Rather there is the need to provide individual ways of access and to an artwork or cultural object in form of interfaces to interact with it (see Mörsch, 2006, p. 178). Art as space for negotiation in

[119] Cultural heritage is defined by UNESCO as „a monument, group of buildings or site of historical, aesthetic, archaeological, scientific, ethnological or anthropological value" (Cultural Affairs Bureau Macau, 2013; see also United Nations Educational Scientific and Cultural Organization, 1972). Wikipedia takes up diverse other areas which UNESCO defines separately into its definition, such as intangible heritage and natural heritage, and defines cultural heritage as "the legacy of physical artifacts (cultural property) and intangible attributes of a group or society that are inherited from past generations, maintained in the present and bestowed for the benefit of future generations. Cultural heritage includes tangible culture (such as buildings, monuments, landscapes, books, works of art, and artifacts), intangible culture (such as folklore, traditions, language, and knowledge), and natural heritage (including culturally significant landscapes, and biodiversity)" (Wikipedia, 2013a). For a wide range of different definitions see J. Jokilehto (2005). For a definition of "heritage" see David Atkinson (2005). For a collection of theoretical foundations on "digital cultural heritage" see Fiona Cameron and Sarah Kenderdine (Eds.)(2007).

this respect means that the perceived meaning of an artwork or cultural object is not fixed and inherent in the item, but is rather constructed between the visitor and the item at the encounter. Thus in an ideal case art affects the audience in some way mentally or bodily, it provides an experience, it triggers memories or thoughts. But the actual meaning of the work, what it tells a single visitor personally, is always a negotiation between the work or item and the viewer (see Sturken & Cartwright, 2001, p. 45). This is dependent on the person and his background and mindset – motivation and expectation towards the object as well as previous knowledge, interests, opinions or beliefs – but also on the context in which he or she encounters the work, including the social setting, the spatial context such as the architecture, the design of the interface, the language of the medium, for example an exhibition (Scholze, 2004). In short the individual meaning of an artwork or cultural object and its experience depends on the space which is opened between the visitor and the item on display and is influenced by the personal, socio-cultural and (physical) reception context (see Falk & Dierking, 2013; Huber, 2004; Lewalter, 2009)[120] [121]. In a physical museum context comprises a social mediation process in personal mediation, also including the visitor and other people – be it facilitators, e.g. museum personnel, or other visitors, known or unknown, part of a group or individual. In case of non-personal mediation it includes according to Doris Lewalter (2009) three factors of an adapted didactic triangle: a) exhibited items and objects – from original objects, installations to media items of various modalities – that take the place of the teacher; b) the content to be mediated, which can vary in topic, the level of difficulty and the closeness to the lived reality of the audience, and usually comprises of several content levels to adapt to the prerequisites of the audience; and c) the visitors as learners. Thus **mediation is about the inbetween, between art / culture and the audience. It is about interfaces and how they allow to interact with the art.**

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[120] Of course artworks or cultural objects have also a production context as amongst others Hans Dieter Huber (2004) and Marion G. Müller (2003, 2008) argue, which plays a role for the item itself and also for its perceived and intended meaning. It surely plays a role for the documentation (see Wiencek, 2006) together with the context of usage or previous exhibitions. For a full understanding of the implications of a work this information needs to come in as additional information or metadata.

[121] These three contexts are usually defined in the literature with a museum experience and therewith with an exhibition as medium in mind. With regard to mediation in a communication science understanding, the aspect of media, its interfaces and its affordances start to play a role as well, besides the physical location in which the interaction with them takes place. In the digital realm digital technology and especially software becomes an important actor in this process.

This “inbetween” can be shaped by the human and non-human mediators, be it by simply allowing access to the object or work – be it directly or indirectly in form of a translation into or representation in another medium – or by shaping its display[122] and its context. With regard to an exhibition context the exhibition design can shape for example the spatial order by positioning the item in question in conjunction with other objects or works of art, or together with interpretative or informational material such as labels or audiovisual media as non-human mediators, which shape and alter the understanding of the artwork or object or its story. The “inbetween” can moreover be altered by “forming” the mindset and / or memory of the visitor. This can be done for example by “building interpretative and observational abilities in order to create and detect symbolic meaning” (Cutler, 2009, p. 63), but a display setting can also be used to create interest in a topic and therewith influence the learning of the visitor (see Schwan, 2009). Stephan Schwan gives several examples of how this could be achieved: for example by creating situational interest and transferring it to personal interest or by making hidden previous knowledge usable through remembrance via emotional involvement (Schwan, 2009, p. 36). The curiosity of the visitor can be fostered according to Schwan by creating playful puzzles, mysteries or brainteasers; interest can be increased by offering surprising experiences which go against his/her expectations. This can be achieved for example through hands-on experiments. The experience of an unfamiliar situation involving as many senses as possible – for instance by employing dioramas, models or re-enactment – can foster a more intense engagement with a topic and facts can be made more interesting and therewith more memorable by giving them a “human touch” by linking them to personal fates and stories.

[122] Jana Scholze (2004) subsumes a display under “presentational form” museum exhibits, including the following: „the arrangement of all presentation media, from exhibited objects over architectural constructions, cases, graphic material, light, sound to moving images as concrete spatial implementation or translation of an exhibiton concept“ (Scholze, 2004, p. 11).

2.4. Participatory Practices

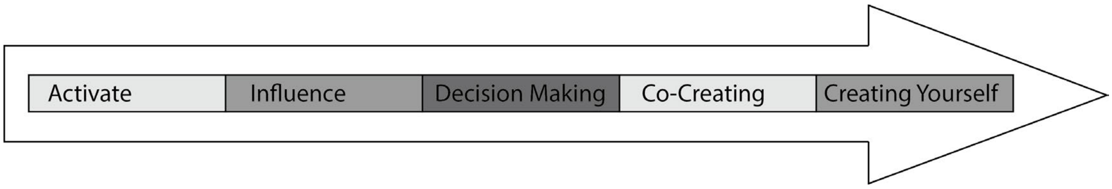

Figure 8: Intensities of cultural participation. Source: Graphic by Florian Wiencek based on Gabriele Stöger (2009), p. 76

As these last examples show, participation and activation of the visitor are important visitor-centered approaches for mediation, which become more and more popular and important nowadays in order to connect with audiences and keep them as visitors. Participation, a term coming from the Latin word "participatio" is oftentimes used with the meaning of "taking part" in an activity or process, being involved in or having an influence on something. Gabriele Stöger (2009) (Figure 8) differentiates in her graphic different intensities of participation in the area of culture, that ranges from a simple activation of the user from a passive mode of reception and consumption of cultural objects over having an influence on a decision someone else takes to actually actively being allowed to take a decision in a specific situation to producing something with others or autonomously. It becomes evident that the amount of influence and power of an individual gets towards an end-result – which can range from for example the reception and interpretation of a work, over how a guided tour evolves to the design and planning of a part or a full exhibition – is increasing from left to right. A good example for an approach of involving visitors tightly into the process even of the creation of an exhibition is the user-centered approach used in the Indianapolis Museum of Art, where they involve the visitor in shaping an exhibition from the title to specific interactive elements within an exhibit to make sure, the design is right for the target audience (Silvia Filippini-Fantoni, 2015, min 07:18 ff). This increased activation of a visitor also parallels with the increasing importance of personalization of products, services or experiences in all areas of life that does not stop at the museum.

Moreover participation has an influence on the information flow, interpretation and storytelling as well as experience within an exhibition. Nina Simon (2010) as well as Kasra Seirafi and André Seirafi (2011) point out that especially in participative practices the information flow between users and institutions is different from a traditional one way communication, which implies a different design strategy. In traditional exhibits “[d]esigners focus on making the content consistent and high quality, so that every visitor, regardless of her background or interests, receives a reliably good experience. In contrast, in participatory projects, the institution supports multi-directional content experiences. The institution serves as a “platform” that connects different users who act as content creators, distributors, consumers, critics, and collaborators” (Simon, 2010, Chapter 1). This means the experience is not consistent or stable, because it is not fully controlled by the institution. Rather the cultural institution provides a framework for diverse possible experiences, which are dependent on the visitors interaction. This leads some authors to identify them as co-producers. One can detect parallels to participative strategies of Web 2.0 – Nina Simon talks about “Museum 2.0”, also the title of her blog[123] – but also to interactive art, which can be seen as rule-based space and for which Arjen Mulder describes as shift from objects to the action a project evokes in the user as carrier of artistic value and meaning. „As an object, interactive art is nothing. [...] But as an action, it is everything. Then, it allows you to know something you can understand only by doing“ (Mulder, 2007, p. 54). In order to be successful, this means, one needs to design scenarios and opportunities in which the visitors are able actively engage and interact with items and/or with each other – which strengthens the role of relationships between visitors, staff members / the institution and the items – and where they can create, remix and share content that is appealing and meaningful to them – including ways to communicate and display it attractively. But it also means to see a project as an open process within a set framework, implying “being open to the possibility that a project can grow and change post-launch beyond the institution’s original intent” (Simon, 2010, Chapter 1). This needs also a good portion of trust in the audience.

Participation allows to integrate the visitor’s voice and their point of view into an exhibition or cultural institution[124], to make it a living space for communities, foster an active engagement with and meaning making of the material and make the visitors “feel at stake of what they see” (see Samis & Michaelson, 2013)[125]. Peter Samis and

[123] see http://museumtwo.blogspot.co.at/

[124] An example is to foster the creation of media material (images, texts etc.) by the visitor and to place it alongside other items in the gallery (see Samis & Michaelson, 2013)

[125] Peter Samis and Mimi Michaelson are currently working on a book with the working title „ONLY CONNECT: Visitor-Centered Museum Interpretation“. The article „Meaning-Making in

Mimi Michaelson point out important lessons for meaning making: "honoring controversial and complex thruths; conneting past objects with present issues; presenting grisly facts; inviting new collaborators to co-create exhibitions; providing fresh ways of looking at stereotypes; offering places to linger or to try one's hand" (Samis & Michaelson, 2013, p. 59) In total the goal is to offer multiple ways for experiences, to connect and "to move *inside* a story" (Samis & Michaelson, 2013, p. 59). But the focus, as Arja van Veldhuizen (2009) also already pointed out, is the experience itself – "be it aesthetic, emotional, intellectual, playful, spiritual, or a combination thereof" (Samis & Michaelson, 2013, p. 59). And also Nina Simon points out that participatory techniques like "promoting a dialogue, creative expression, shared learning or co-creative work" (Simon, 2010, Chapter 1) can develop more valuable and compelling experiences, provided the design and overall scenario is right for promoting and evoking the desired experience as well as participation. According to Arja van Veldhuizen there are two contrary tendencies visible with regard to experiential aspects of an exhibition: on the one hand diverse styles of learning are taken into account in the exhibition and the visitor is offered different material that offers him/her individual ways to engage with the material; on the other hand there are experience designs which lead visitors to follow a predetermined path (see Veldhuizen, 2009).

Peter Samis and Mimi Michaelson feature the example of the Columbus Museum of Art (CMA), Columbus OH (USA), which can clarify how such a participatory practice can look like. The short experience describes people engaging with art and hands on activities such as a puzzle related to a painting by Arthur Dove or a bunch of red and white stones on a table top opposite to a sculpture by Richard Long consisting of stone blocks which are arranged in concentric circles on the floor (see Samis & Michaelson, 2013, p. 57). This is happening in what is called "The Wonder Room", one specific gallery space at CMA, which invites the visitor with the words "Let yourself play. Use your imagination. Collaborate with others. Challenge yourself. Follow your curiosity" (Columbus Museum of Art, 2013). This gallery presents artworks in a dynamic spatial design, which also provides hands-on activities for visitors of all ages in relation to the artworks. Moreover staff is frequently present to "promote imagination and playful learning with visitors" (Columbus Museum of Art, 2013). Thus this experience allows

Nine Acts" (Samis & Michaelson, 2013) offers an overview of nine contemporary participative scenarios.

the users to engage with and re-appropriate the artistic concepts and therewith get a better understanding of them. But hopefully it also opens up space for interaction with other visitors, by creating something together.

2.5. Visual Learning and Critical Gaze

Visual Learning (Cutler, 2009) fosters the active and ideally critical engagement with cultural objects or artworks, and emphasizes the direct interaction with the "real object". The direct interaction with a possibly "original", one of a kind cultural object is seen as one of the big advantages for mediation of art in the setting of a cultural institution[126]. Elke Krasny (2006) talks about "critical viewing" or "critique by gaze", which has several possible starting points: a) the single object; b) the canon and its inscribed points of view or the institutional logic, which is also reflected in c) the exhibited collection and its selection and presentation (see Kittlausz & Pauleit, 2006; Krasny, 2006)[127]. For the last point it is important to consider is that this "in-between", which organizes the relationships of institutions, artifacts and stories is not neutral but structured by social and cultural models of perception (Nierhaus, 2006). These relationships "which emerge around the artifacts, […] have an educative function for the society, as they offer 'narrations' which could serve for the individual and collective construction of meaning" (Kittlausz & Pauleit, 2006, p. 12), as have the objects and artworks. Thus an exhibition could be considered a "story told with and by objects" that construct an information space (see Lewalter, 2009). With the "critical gaze" we deconstruct this information space, the ways mediation for example in a museum setting is at work to show what was, what currently is, what is thought today about the past and its relation to the present, as well as how the present is reflected in the past (cited in Krasny, 2006, p. 38; see Krasny & Glaser-Wieninger, 2003). And with the

[126] There is a difference between the mediation of physical artworks or cultural objects and the mediation of digital artistic projects or time-based and process-based media art, especially with regard to digital mediation of material versus natively digital objects with regard to materialiy and reproduction (see e.g. Benjamin, 1936; Cameron, 2007; Daniels, 2004; de Mul, 2009; Depocas, 2001; Latour & Lowe, 2010) but also with regard to exhibition practices (see e.g. Beil, 2001; Frieling, 2007; Groys, 2003; Rollig, 2003, 2004).

[127] With regard to the critique of the institution Carmen Mörsch (2011) points in her article "Allianzen zum verlernen von Privilegien" to Andrea Fraser, who claims that institutional critique is not so much a question of being against an institution, as mostly the mediators are part of an institution. "It's the question of what kind of institution we are, what kind of values we institutionalize, what forms of practice we reward, and what kind of rewards we aspire to" (Fraser, 2005). Moreover, as the institution consists or is represented by the people, any critique of the institution within the institution is always aimed towards oneself (see Fraser, 2005).

information space this approach also deconstructs the social setting of a museum through "reception", for which Krasny refers to the concept in Cultural Studies or Visual Studies, where reception is understood as an active negotiation of meaning between the visitor and the item on display, an interaction within a specific framework, or as the German Duden defines it "verstehende Aufnahme eines Kunstwerks, Textes durch den Betrachtenden, Lesenden oder Hörenden"[128] (Duden, 2013). In the visual realm this relates to what Marita Sturken and Lisa Cartwright (2001) define as "looking", which according to them is an active practice like speaking or writing and "involves learning to interpret and […] relationships of power. To willfully look or not is to exercise choice and influence. To be made look, to try to get someone else to look at you or at something you want to be noticed, or to engage in an exchange of looks, entails a play of power" (Sturken & Cartwright, 2001, p. 10)[129]. And thus Krasny defines the function of a museum object to attract gazes, to bear them, to adhere them long enough that the visitor wants to know more and then reveal their narrative (see Krasny, 2006, p. 41). The critical gaze also means to critically reflect the visitors' own way of looking but also the strategies, which guide your gaze in a specific setting. A critical strategy against the guided gaze is distraction, diversion, comment, or creating a context for showing an item, which allows a differentiated interpretation, diverse points of view (see Krasny, 2006)[130].

Another critical practice[131] is the already mentioned "critical mediation of art" by Carmen Mörsch. Looking at it as practice of institutional critique and as participatory

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[128] transl. by F.W.: „the understanding uptake of an artwork, text by the viewer, reader or listener"

[129] They differentiate therewith between "conscious and unconscious levels of looking" (Sturken & Cartwright, 2001, p. 10).

[130] Analytical approaches to visual material were already develped by art historians such as Aby Warburg or Erwin Panofsky, Marion G. Müller developed these approaches further for the social scientific approach of visual communication (see M. G. Müller, 2007). Her approaches of contemporary analysis of visuals deriving from iconology and iconography towards what she calls „political iconography" are summarized in her German textbook „Grundlagen der visuellen Kommunikation" (M. G. Müller, 2003).

[131] With regard to mediation as a critical practice Mörsch (2006) argues that it needs to fulfill several criteria: "Active engagement with the modes of perception and interaction of the visitors. Constitutive inclusion of the diverse contextual knowledge of the visitors. Critical mediation of the provided authorized knowledge. Reflection and transparency of the modes of operation of an institition(s). Participation in the sense of the represented in the work of the representation. Interdisciplinary approaches with regard to all of these aspects" (Mörsch, 2006, p. 182/183 translated by the author).

practice of critical investigation, one of the goals besides fostering engagement with art and culture is to create new knowledge together with the visitors. Besides valuing and strengthening their own interpretation this means very literally, that the museum also opens up its research function and includes the visitors as co-investigators by conducting “research” in collaboration with the visitors. This is not limited to understanding artworks or culture but also the museum’s own practice. An example for such a on the one hand a selfreflexive on the other hand a collaborative practice is the research project “Tate Encounters: Britishness and Visual Culture” at Tate (2007-2010)[132], which aimed to find out “how narratives of Britishness are contained, constructed, and reproduced within the curatorial practices and collection of Tate Britain, and of how such notions are received and valued by different migrant and diasporic family members within the context and cultural practices of their everyday lives” (Tate, 2013a). This project did not only do research about the visitors but in collaboration with the visitors, by letting them document their encounters with Tate Britain as well as responding in various media – image, sound or text – to publications of the institutional research team, setting up a dialogic structure (see Tate, 2013b).

2.6. Artistic Strategies

One way of putting critical viewing into action is to use artistic strategies. An example is a series of workshops for stop motion animation for school kids held by museum educators at Edith Russ Haus in conjunction with the exhibition “MyWar. Partizipation in Kriegszeiten” (10.6. – 29.8.2010), which showed artistic statements about the “new” mediated war (Lüth, 2011). The first step was to show selected artworks in the exhibition without reveiling their title but to discuss from the works what they may show and are about, before reveiling their background. After a tour through the exhibition the educators presented diverse other visuals, which took up and symbolized war activity, authority but also the protest against the same as well as pacifist symbols. Moreover they displayed and discussed historic and contemporary war photography, which then was used as starting point for animated movies produced by the participating children. The kids were introduced to basic stop-motion techniques that they were asked to employ in order to tell alternative stories to the shown war imagery or to symbolically disarm. Thus the goal of this workshop was to allow and try

[132] see http://www2.tate.org.uk/tate-encounters/

out “ungehorsames Sehen” [disobedient looking, transl. by F.W.] (Hentschel, 2009) and to translate the results of this act into the children’s own visual production (see Lüth, 2011, p. 83).

Also Carmen Mörsch is taking up artistic strategies for the mediation in her approach of “artistic mediation of art” (see Mörsch, 2006). She refers to deconstruction as a creative process, which – in relation to literature – creates a own text by engaging and deconstructing another text. The strategy of deconstruction, that is a critical outlook on the relationship of text and meaning that empowers the recipient was mainly inspired by ideas of the philosopher Jaques Derrida (1997). This critical outlook as a way of thinking and approaching cultural expressions can be applied to other modalities but also institutions. It builds the basis of Mörsch’s approach of critically mediating art. Thus departing from British “Gallery Education” (see Allen, 2008; McLaren, 2006; Mörsch & Sharp, 2003) she sees mediation of art and culture as field of practice for artists, which has the potential of transforming an institution or give impulses. According to Mörsch one reason is the position of artists between the fields of art and its mediation, which renders them at least partially outside of the artistic master narrative or myths as well as institutional control, which allows them to develop “cooperative, critical, artistic practices” (Mörsch, 2006, p. 184). This practice blurs the boundaries between art and its mediation. An example for artistic mediation in Germany is the group “Kunstcoop©”[133] at the Neue Gesellschaft für Bildende Kunst (NGBK) Berlin. They take up artistic methods used in exhibitions and works they mediate in order to not only mediate an exhibition verbally in order to get information across, but to make the complex content- and media structures of it experiencable and include the visitors into an exhibitions and artistic scope for action. An example of their work are performative guided tours for the exhibition “Joan Jonas – Performance Video Installation” (5.4.-5.5. 2001) by Ana Bilankov and Bill Masuch, where they took Jonas’ approach of designing complex experiences that use the elements of deconstruction, irritation and involvement of the visitors. As in Jonas’ early work the mirror as medium for image creation played a major role, the gallery educators handed each participant of the tour a mirror in advance and invited them to perform exercises or disruptions of perception or self-reflection during the tour. Thus they integrated the visitors into the exhibition setting, opening up performative spaces and spaces for visual experiments

[133] see http://www.kunstcoop.de/

inspired by the artistic strategy employed in the exhibited projects. With this intervention the group transformed the exhibition into a space to experience and experiment with the artistic strategy, to take it apart and transform the view on the artistic work of the exhibited artist, the instead of only informing them about the projects. Moreover the guides acted as performers (see Mörsch, 2006, p. 186) trying to break up the classical role-conventions during a guided tour using the same methods of disruption. The documentation of this intervention describes one of the guides standing with the back to the public, observing the public through the mirrors while another is reading aloud a statement of the artists about performance as art form from the exhibition catalogue. This artistic mediation practice of taking up artistic strategies to mediate an artwork goes full
circle with Eva Sturm's claim "starting from art".

3. Challenges for Cultural Institutions in the Changed Media Ecology

As can be seen throughout the examples of mediation strategies: mediation of art and culture is much more than mere transmission of knowledge. It is about shaping the interface for art and culture, be it through shaping the physical or media interface; by shaping the content through curatorial practice, which recently is said to be marked by an "educational turn" (see O'Neill & Wilson, 2010); or by explicitely or implicitely shaping the visitor's mindset, to give people the ability and possibility to critically think and look for themselves. Through the mediation practice visitors should be empowered to co-create new knowledge together with the institution, the community and other visitors, to experiment with forms of expression, to understand artistic strategies as well as the societies and cultures surrounding us and the power-structures at play through the display-settings and items on display, but also to understand something about themselves and what influences them. Last but not least, in order to achieve these goals mediation of art and culture is about creating a rich experience of art and culture. Thus mediation as knowledge generation about and with art and culture in form of an open process, an open space for exploration and engagement as well as informal learning are shaped by four interconnected activity fields. These fields describe different functions and tasks of mediation of art and culture: displaying, thinking, discussing and learning (see Figure 9)[134].

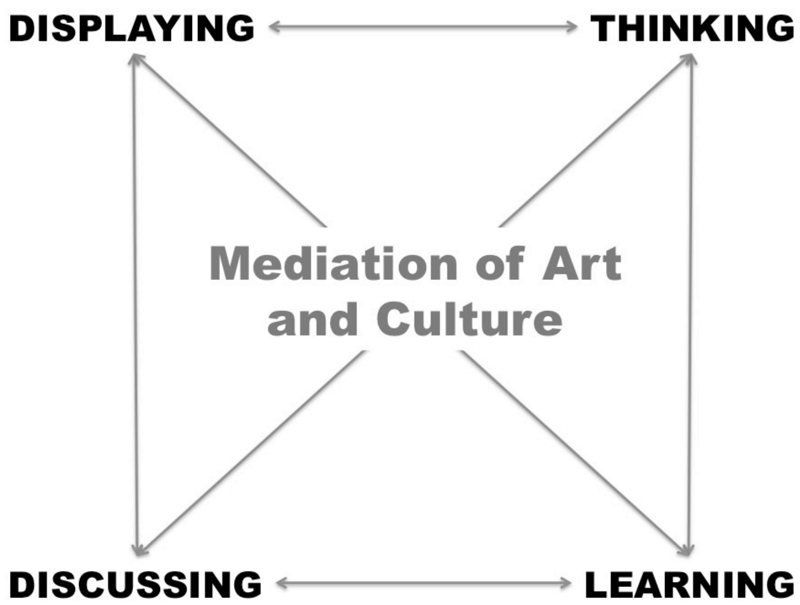

Figure 9: Four intersecting areas of Mediation of Art and Culture. Graphic by Florian Wiencek.

Displaying encompasses the interface component of mediation of art and culture, the in-between between art and cultural artifacts and the audience, how it is presented or represented, how people can access and interact with it, but also how the display shapes and is shaped by the other three areas.

Thinking lays the focus on individually deliberating on art and culture, methods to reach to insights about and with art and culture, research and knowledge generation involving all parties of cultural mediation but also the question of how the display as well as learning or new knowledge shapes the visitor's perception and the insights one gets, the way one thinks about art and culture. But it also encompasses how the artistic strategies or cultural strategies / norms / values may shape one's way of thinking and / or expression. This notion stems from what Martha Fleming calls "thinking through objects", where she defines display – especially exhibitions – as a intellectual practice (see Fleming, 2010).

[134] This classification was designed inspired by the abstract of KUMATalks 2.0, Talk Four on "Digital Mediation of Art: Usage and Perspectives" (Wiebke Stadler for KumaTalks 2.0, 2012)

This is closely interlinked with the area of **Discussing**, which encompasses the social, communicative and discursive dimension of the engagement with art and culture and with other persons involved in the mediation process as well with communities and society at large. This communicative process allows to generate new knowledge co-creatively including different individual points of view, which in turn can have an influence on the display and contextualization of the cultural heritage as well as our thinking or shape and change communities, societies, cultures. But the communicative structures also allow community-based learning processes.

The **Learning** about and with art and culture thus includes approaches of cultural learning and education as described above, and it became evident that the differentiation of learning and education is a fundamental one within the approaches.

All these different aspects are affected when mediation of art and culture with a focus on critical mediation and thus knowledge generation with users and visitors as well as informal learning and participative strategies is moved into a digital environment. The changed media ecology outlined in Part III also challenges cultural institutions. They need to react to the altered world around them: to the increasing digitization of practices on the one hand and on the other hand to the increasing demand of their audiences to not only be presented with cultural objects or with readymade information but to participate, to have a choice what, where, when and how to learn, to communicate, to access information, to interact with and personalize it. Or as Merete Sanderhoff writes:

> "The future is now. The Internet and digital media have already changed our field of operation. User behaviour has changed. Expectations of what cultural institutions have to offer, where they can be approached, and how their content can be used are different now compared to the decades that went before" (Sanderhoff, 2014b, p. 111).

And at another section of her essay she formulates it even harsher: "If we [the cultural heritage institutions and people who work in this field, F.W.] do not evolve along with the technologies that shape user behaviour, then the institutions for which we are responsible will at best become relics of a bygone era, at worst stagnant and forgotten cultural archives" (Sanderhoff, 2014b, p. 30). The change of the media ecology and its new mindset poses several challenges for cultural institutions:

1. harnessing the value of their long-tail content within stronger competition in information economy;
2. the digitization of cultural objects to make them available online, with all its associated costs, manpower and digital infrastructure;
3. securing longterm accessibility of digital data;
4. opening up the data, which needs the open licensing and wrestling with copyright laws but also providing interfaces for easy access of the data and ways for the users to interact and engage with it;
5. opening up the institutions, that requires a change of mindset to position a museum away from only safeguarding the collection from damage, misinterpretation or abuse and keeping the interpretive authority with experts and the institution towards a culture of co-operation, generosity and participation, that allows a multiplicity of voices and active engagement of the users with the cultural objects such as creative work, re-use or sharing – analog as well as in the digital realm.

For better or for worse, museums become part of a larger knowledge network that is ideally interconnected. On the one hand it is a big chance, as the Web opens up a door to a larger community interested in niche content what is commonly called "Long Tail"[135]. And this scales with the amount of content available online, as Merete Sanderhoff argues. "[…]when more and more works from our collections become digitised and available online, the greater the chance that someone will find niche works that have special value for them" (Sanderhoff, 2014b, p. 49). But as places for

[135] Through the ease of duplicating and transmitting media products in the digital world as well as reaching a wider (possibly global) audience with offers (also physical products) online, products which are usually little demanded and therefore not regularly offered (as distributing them would require extra cost, like keeping an item in stock, or operating a movie theater, etc.) can still be made available in an online market place to a geographically dispersed target audience and result in a profit. The information industry is becoming a "boutique business", as Negroponte (1995, p. 84) calls it. This phenomenon called "Long Tail" increases the variety of products being sold in the marketplace and therewith the choice for the customers. Another interesting trend in the area of news-content is news with a micro-local focus, which is of interest for a very small community of users, a concept which can be applied to other content outside of news as well. In his definition of Web 2.0 Tim O'Reilly states, that small websites oftentimes covering niches make up the bulk of the Web's content, and thus the majority of possible applications would target narrow niches and not the mainstream content (see O'Reilly, 2005).

informal and life-long learning they compete not only with established providers of knowledge such as universities, providers of adult education and community driven initiatives, but also with a range of new forms of free-choice learning offered online, such as online lecture series like TED talks[136], iTunes U[137] or MOOCs (Massive Open Online Courses) on platforms like Coursera[138], Udacity[139] or Khan Academy[140], which offer talks and university-lecture-style courses held by proven experts in their fields[141]. Thus in general the born analogue and natively digital cultural objects collected by cultural institutions compete with all findable digitized information in a search engine driven culture, where whatever is not findable via major search engines such as Google or Bing does not exist on the radar of many people. As Jos de Mul (2009) argues, in what he calls "age of digital recombination" – or remix culture, as for example Robert K. Logan (2010), Eduardo Navas (2012) or Lawrence Lessig (2008) name it: the value of a cultural object is not only to look at it or to be in its presence, but also "the extent of its openness for manipulation" (de Mul, 2009, p. 102) and the way you can interact with it, reuse and share it to contextualize the object and make meaning in form of an own, new cultural expression by the user or audience, expressing one's own thoughts, interpretations and experiences.[142] But to allow this openness for digital manipulation the cultural object needs to be made present in the information space by the cultural institutions in form of cultural data that is freely available to the public, as demanded for example by Peter Weibel (see Kuri, 2013) or a consortium of media artists and media art historians (see Media Art History, 2011)[143].

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[136] http://www.ted.com/talks

[137] http://www.apple.com/education/itunes-u/

[138] https://www.coursera.org/

[139] https://www.udacity.com/

[140] https://www.khanacademy.org/

[141] In case of the MOOCs the experts are mostly university professors or professionals of a particular field. This is paired with a massive amount of other material available on social media platforms with varying quality and origin, but which is retrievable by search engines

[142] To cite Michael Edson, director of web and new media strategy at Smithsonian Institution: „culture only has meaning when it is alive in our minds, re-worked by our hands, and loved in our hearts“ (Edson, 2014, p. 15)

[143] see also the discussion of „Open Data“ in Part IV, chapter 3.3.

3.1. Cultural Data

The first step to take is the digitization of cultural heritage objects. In the last two decades many prototypical projects developed within these parameters, starting from offering electronic catalogues to physical archives or libraries until the early 1990s, and moved towards the digitization of the items thereafter (see Bibliotheksportal, 2012b). What they produced with regard to cultural heritage is subsumed under the term "cultural data", which is according to Mia Ridge

> "data about objects publications (such as books, pamphlets, posters or musical scores), archival material, etc, created and distributed by museums, libraries, archives, and other organizations. Data can refer to different types of content, from metadata or tombstone records (the basic titles, names, dates, places, materials, etc of a catalogue record), to entire collection records (including data such as researched and interpretive descriptions of objects, bibliographic data, related themes and narratives) to full digital surrogates of an object, document or book as images or transcribed text" (Ridge, 2013).

Thus cultural data encompasses digitized physical cultural objects, natively digital objects as well as their metadata. The digitization and documentation itself is oftentimes already a first hurdle for cultural institution as it does require technological infrastructure, manpower and last but not least financial means, to not only translate physical objects into digital data but also to annotate and make them available long term in a way that allows reuse. The latter also includes data-preservation that John Mackenzie Owen (2007) summarizes with 3 core tasks: a) selection and storage of data in digital repositories, b) data maintainance to ensure the data can be interpreted technically long term (through conversion, migration or emulation) as well what he calls c) services provision, like indexing or access services. These are widely discussed topics (see e.g. Bibliotheksportal, 2012b; Boehler & Marbs, 2004; Conway, 2010; Depocas, 2002; Grau, 2014; Lynch, 2002; Manoff, 2006; National Library of Australia, 2003; Pavlidis, Koutsoudis, Arnaoutoglou, Tsioukas, & Chamzas, 2007; Rothenberg, 1999; Vajčner, 2008; Wiencek, 2012a, 2012b), but as the technicality of digitization and sustainability of cultural data is not at the core of this thesis, focusing rather on the "afterlife" of data, it will not discuss this topic in depth but leave it at acknowledging it as a major challenge.

3.2. Opening Cultural Data

Another challenge for institutions concerns opening up the cultural data once it is available. More often than not GLAM[144] institutions restrict access and reuse of their cultural data – also of data, which is already in public domain.[145] Merete Sanderhoff defines several issues with restricting the access and reuse of digitized cultural heritage in public domain:

> "1. We are pushing interested users away from the authorised source of information about the works in our collection.
> 2. We are missing out by not using our potential for becoming a central hub for motivated users who wish to learn about and work creatively with art.
> 3. We are undermining our own raison d'être as public cultural institution"
>
> (Sanderhoff, 2014b, p. 40/41)

Thus Sanderhoff argues strongly for opening up cultural data. When this cultural data is made openly available it is referred to as OpenGLAM. OpenGLAM is a reaction to demands of participatory culture; "an international grassroots movement which endeavours to make openness the standard for the GLAM sector and to establish shared principles for a new OpenGLAM practice based on the culture of sharing found within the social Internet" (Sanderhoff, 2014b, p. 23/24). The Open Data movement in general advocates for the free availability of certain data, to republish and reuse without copyright restrictions[146], patents or other control mechanisms (see e.g. Bizer, Kobilarov, Lehmann, Cyganiak, & Ives, 2007; Wikipedia, 2013h). Open data is not a clear term in itself and it is contentious – according to Mia Ridge (2013) – what degree of openness data needs to be called "Open Data". In its simplest form she describes open content as being "[…] available for use outside the institution that

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[144] Galleries, libraries, archives and museums are since a few years summarized under the acronym GLAM that serves as umbrella term for memory organizations.

[145] One way of preventing dissemination and use is for example by charging unnecessary fees for image-rights of artworks in public domain that drive potential users to look for any copy of an artwork on the Web, which they can download for free (see Sanderhoff, 2014b).

[146] examples are Creative Commons licences (http://creativecommons.org/) or public domain. Public domain are all works for which the intellectual property rights have expired in the "source country", have been waived or are not applicable – for example for a lot of governmental works. When the copyrights expire differs in different national regulations and is usually in the range of 50 to 100 years after the death of the author of a work (see Wikipedia, 2013f).

created it […]" (Ridge, 2013). This can be as easily realized as making the data downloadable and therewith enable a third party to use it. The Open Knowledge Foundation has a stricter and more exhaustive definition of what "open" means in their OpenGLAM Principles:

> "1. Release digital information about the artefacts (metadata) into the public domain using an appropriate legal tool such as the Creative Commons Zero Waiver. […]
> 2. Keep digital representations of works for which copyright has expired (public domain) in the public domain by not adding new rights to them. […]
> 3. When publishing data make an explicit and robust statement of your wishes and expectations with respect to reuse and repurposing of the descriptions, the whole data collection, and subsets of the collection. […]
> 4. When publishing data use open file formats which are machine-readable.[…]
> 5. Opportunities to engage audiences in novel ways on the web should be pursued."
>
> (Open Knowledge Foundation, 2013)

Therefore the open definition also refers to publishing in an open licence and – if possible – releasing all public domain material as such openly into the public. But it also refers to the use of an open fileformat, meaning the specifications of the format are openly available and therefore can be freely used in any software. This does not bind the data to proprietary third party software. Moreover the fileformats should also be machine readable. This opens up a whole new "target group" for GLAM-data, namely computers, and acknowledges their role as agents in the process of mediation of art as well as for interacting with and making sense of the data. A study by Kristin Kelly (2013) showed, that open licencing and open access as well as user-friendly access to the cultural data are key behind all digital efforts of a museum and lead to greater awareness of the museum, its collection and brands. Thus a win-win situation for institutions and users.

3.3. Opening Up the Institution

But openness also refers to the mindset of the institutions to not only make the data available, but to also foster and enable new ways of engagement of the users with the data, and therewith puts the mediation of art and culture in the way it is defined in this thesis at the core of the OpenGLAM requirements. And this translates also to what Merete Sanderhoff regards as an open definition of museums or "digital mindset". It does not only refer to open access of the museum's digital assets, but also "[a]n open and welcoming attitude towards the users' approaches and contributions to the work of GLAM institutions (such 'user involvement' encompasses popular designations such as crowdsourcing, crowdcuration, citizen science, citizen exploration etc.)" (Sanderhoff, 2014b, p. 24). Moreover such an attitude involves a spirit of co-operation rather than competition – between institutions themselves as well as between museums and their audiences. Museums need to have trust in their audiences and respect for their knowledge and creativity (see Sanderhoff, 2014a, p. 26). In the digital age knowledge and culture is not something that is created by experts and professionals, but rather everyone can contribute.

Thus what is the role of a cultural institution in this media ecology? How and to what degree does their role change from their previous position as gate-keepers, as one of the main providers of cultural knowledge, of access to cultural objects, as preservers of the past? What happens when the voice of an institution cannot take it's earned reputation from the established institutionalized hierarchy system for granted and might become just one voice amongst many, needing to build and keep their reputation anew within the digital ecosystem, such as all other actors as well?

Cultural heritage work was until now mainly about safeguarding "objects from the past along with the memories and meanings that go with them, preserving them for future generations. However, the ways we do that must be in keeping with the life as it is lived outside the museum walls" (Sanderhoff, 2014b, p. 22). As argued above, opening up collections is a central starting point for digital museum practice. The adaption to meet the contemporary challenges of the information society and participatory culture needs to go far beyond the political or corporate effort to make data available and therewith re-usable and being a player in the global information economy. It is much more about creating an environment, where participatory practices can happen, where a meaningful interaction and engagement with cultural heritage can take place – online and in the real world. Thus the adaption needs to begin in the daily practices of each individual cultural institution, which also brings with it a shift in how we approach cultural learning.

As Anna Cutler writes: “The development of technology and user generated material, the emergence of the knowledge economy and the need for creativity (as means to generate innovation) has meant that models of learning that sought to impart information and prepare and develop a workforce for known industry (that is manufacturing /industrialised labour) are no longer sufficient for our social needs” (Cutler, 2009, p. 59/60). Thus she describes the necessary shifts in the practice of cultural institutions as follows:

- From the passive to participative learning that involves participation and hands on activity.
- From standardised delivery to personalisation, one size does not fit all and different learning programmes are required that can be tailored to individual needs.
- From the didactic to co-learning, a shift from the transmission model of learning with a single expert/tutor, to shared learning that is guided in response to the needs of the users and shaped in collaboration with them.
- From knowledge acquisition to knowledge application, the movement away from learning information for the sake of doing so to understanding how to use knowledge across different settings and in original ways for valued outcomes." (Cutler 2009, p. 60)
- From a single authorial voice to plural voices, the development of collaborative practice and production.
- From private knowledge to public access, best exemplified through the web/Open Source etc. but relating to the ways in which private knowledge of individuals and institutions has been opened up and has tacitly shifted power relations away from closed knowledge holders.

(Cutler, 2009, p. 60)

Also Bianca Bocatius describes the changing role of museums in the knowledge society in her essay “Education and Learning in Museums 2.0”, where she stresses the increasing importance of “a discursive, communicative and participatory relation between museums and their visitors” (Bocatius, 2011, p. 8), emphasizing the importance of mediation of art and culture and moderation having active exhibition participants in mind. She moreover stresses the importance of the Web as extension of the museum space and as display, which integrates educational activities and communication and participation on-site as well as online instead of seeing it as a dichotomy. Besides guaranteeing public access to cultural heritage beyond the museum walls the website can also be used "to enable visitors to prepare and review their visits individually [,] to offer participatory opportunities [, and to] […] activate dialogues" (Bocatius, 2011, p. 8, commata added by the author). Thus as Fiona Cameron also argues, the museum not only moves from a central repository of objects towards a place for disseminating information (see e.g. MacDonald & Alsford, 2010), but with digital media it makes the information more accessible, opens up the museum for a global audience and facilitates social interaction at the same time (Cameron, 2007, p. 51).

Through the virtues of participatory culture the dissemination becomes a different character than the traditional push-model of disseminating a cultural narrative in the museum (see Part III, chapter 2.2) In combination with the strengthening of the remix as recombinatory cultural form, Henry Jenkins (2006a) describes the emergence of a "new 'folk culture', a cultural system in which narratives have no definitive form but are continually being retold" (Waal, 2007, p. 22). The multiplicity of voices and pluralistic narratives, which "arrange information into galaxies of relationships and links" (Cameron, 2003), are strengthened and welcomed over the "grand narrative" as traditional mode of cultural narrative. Fiona Cameron argues, following postmodernist and post-structuralists theories, that there is no one fixed truth, actually no truth at all, but „[r]ather, particular interpretations of phenomena are individually and socially determined“ (Cameron, 2003). And in that way history is also not a single narrative, but rather consists of multiple points of view, which can be and often are contradictory. Thus history can be seen as a network of people, stories, facts, ideas or points of view. Or as David Atkinson (2005) argues, heritage is socially constructed. "[…] there is no single 'heritage' but, rather, versions of the past constructed in contemporary contexts" (Atkinson, 2005, p. 141). And he writes further: "Accomodating 'dissonance' means recognising the complicated histories of our communities and their places, while simultaneously accepting parallel and competing accounts of this past" (Atkinson, 2005, p. 146). Thus the task and the challenge for cultural institutions with adapting to or reacting to participatory culture and the information structures of multimedia and the Internet – which are according to Fiona Cameron (2003) enabled by poststructuralism and postmodernism as theoretical structures – is not only to allow but to welcome, embrace and foster the multiplicity of viewpoints with regard to their collection or topic and their own narrative and point of view, while ideally giving the visitors room and tools to express these. They should foster the visitor's critical analysis and engagement with the practices of institutions and even their own practices[147].

Besides this change in the mindset of cultural institutions there needs to be an adaption of the strategies with regard to the information flow between them and the visitors to get away from the traditional way of pushing information in form of "traditional exhibits and programs, the institution provides content for visitors to consume" (Simon, 2010, Chapter 1). This can be compared to practices of mass media and should guarantee a consistent experience for all visitors. Instead the institution should rather employ pull strategies – which also match the strategies of adaptive mediation practices as well as common social media practices – in order to support "multi-directional content experiences. The institution serves as a 'platform' that connects different users who act as content creators, distributors, consumers, critics, and collaborators" (Simon, 2010, Chapter 1). The museum becomes a place for participation, a place for the visitors to generate and exchange content, to connect with each other and to connect with the institution (see Simon, 2010, Chapter 1). In other words: museums become not only resources for high quality information and visual material, but rather facilitators as well as "catalysts for the users' knowledge and creativity" (Sanderhoff, 2014b, p. 96).

This focuses clearly on the museum as a social space (see also Falk & Dierking, 2013, as discussed in Part III, chapter 2.3). The experience of an art project in an exhibition setting is also mediated and shaped by social interaction and conduct and the visitor's communication about the experience (see Baxandall, 1987; Falk & Dierking, 2013; Galani & Chalmers, 2010). Areti Galani and Matthew Chalmers see information as source for interaction (see Galani & Chalmers, 2010) and artifacts are transformed into social objects (Simon, 2012). Thus according to Nina Simon the engagement with the artifacts but also of the visitors with each other is in the center of cultural mediation. The purpose of the a cultural institution as a space – be it a physical, virtual or hybrid space – is to bring together people through a cultural experience (see Simon, 2012). Museum artifacts, but also cultural data, are "opportunities to mediate conversations between strangers" (Simon, 2012) which otherwise would not happen. "Museum artifacts have the power to expose the big conversations we have to be having, about where we have been, where we are now, and where we are going to go" (Simon,

[147] see also the concept of critical mediation of art by Carmen Mörsch (2011) (see also Part III)

2012). Thus the mediation of art and culture is not so much only about connecting with and learning more about the objects, but also about sparking conversations, about connecting visitors "with people who are not like them, and learn about each other" (Simon, 2012).

Opening up the museum to participatory culture also means to invite the community[148] as co-creator of the experience, of the museum and its content. It means to invite them by design to add something meaningful from themselves, their point of view, their own creative expression, their own thoughts and interpretation (see Simon, 2012). Something beyond what other stakeholders of the museum could contribute, and at the same time something meaningful for the visitor as well, which gives them an valuable experience by doing so – following the principles of the network effects. Nina Simon (2012) gives the example of asking visitors to write a poem about an object, to craft a personal memory for others to see, to share their opinion in a vote or to simply ask for input for the museum to improve. By using the Web as an additional or hybrid platform as well as display for the museum, it enlarges the community reached by the work of the museum, as the web-presence of the museum can be visited anytime, from anywhere and by anyone who has Internet access. High quality digitizations allow the access to a representation and therewith ideally some form of contemplation of a work online, given an adequate online presentation[149]. Implementing functionality from the social web, the "users can act as ambassadors for content they appreciated" (Sanderhoff, 2014b, p. 50) for example through commenting on it or sharing content with their network, which brings the collection of museum in circulation online and increases the likelihood that new audiences get to know cultural objects from the collection (see Sanderhoff, 2014b, p. 50).

[148] Soren Kaplan an Julia Lynn Ashley define a communities as follows: „They are held together by distinct operating norms; members are distinguished by their formal and informal roles; trust must be built to ensure quality interactions; and a shared sense of purpose serves as the glue that bonds the community together. Communities are only ‚communities' if they possess these characteristics and engage people in collaborative processes over time" (Kaplan & Ashley, 2003, p. 40). The bottom line of their definition is, that a community is not defined by what facilitates it or brings it together, but it is a mindset.

[149] What an adequate digital presentation means, depends very much on the type of work to be represented. Flat media like paintings or drawings require a different treatment than time-based or process-based works in terms of presentation and interaction for the user in order to be able to understand and interpret the artistic project and get a sense of a possible experience of it. For time- and process-based art documentation is crucial for this matter. The author discusses different approaches of formal and informal documentation in a series of short essays – see Wiencek (2012a, 2012b).

To do this successfully a museum needs to move "[…] away from a classic stewardship approach, which is mainly about protecting the artworks against damage, misrepresentation and abuse, towards a growing awareness of how we can maintain public interest in the collections, keeping them relevant by setting them free to be used for creative work, re-use and sharing on the users' own terms" (Sanderhoff, 2014b, p. 100). According to Nina Simon all of this transforms the museum from something which is "nice to have" to an institution that matters: to the community and to the world, as it has the power to potentially change and transform the society – not only by the experiences happening inside the museum in its physical or digital realm, but by how these transform the people's experiences and actions outside of the museum (see Simon, 2012).

4. Online- and Distance-Learning at Cultural Institutions

Web-based technologies can be used to addressed the outlined challenges for cultural institutions and support cultural learning. But how do cultural institutions actually use Internet-based technology and outlets for facilitating learning? And what does digital mediation of art entail?

In an analysis on the Internet use by museums in Germany, Bianca Bocatius (2011) states that the Internet is mainly used for public relations activities such as "posting general information about events and other press releases to advertise activities of the real museum" (Bocatius, 2011)[150], to inform about ongoing and past exhibitions, to indicate educational programs on the website and increasingly to showcase (parts of) their collections. Andrea Prehn (2002) distinguished in an already a bit dated study from 2002 different levels of museum-educational offers of German museum-websites, which range from a) general information such as contact data of the educational

[150] Bocatius distinguishes between the museum in the virtual and the physical space, referring to physical museum as „real". I would question this dichotomy, as with the intertwining of data space and physical space in our contemporary media ecology there is no absolute distinction between physical and virtual space. Rather they influence and augment each other. Also is a virtual presence less „real" than the physical, since it features assets and communicates with the voice of the same institution. For people who don't have a chance to visit the physical site of the museum, this is the way they are encountering the museum. I would argue that the physical site and the online-representation are part of the same reality, they are just different representation of the same institution.

department; over b) further information about educational programs and projects including ways to register online; to c) “Educational support and learning opportunities through information about the collection or exhibitions, on-line games, databases, on-line exhibitions, download center, detailed explanations and general information about the educational program” (Bocatius, 2011). This general distinction still seems to hold today. Where the first two options only refer to on-site educational option, the third option offers opportunities for cultural learning online and therewith uses the website or digital media as starting point for cultural learning, which ideally complements or even integrates with the on-site educational offers. Especially the last area evolved and diversified since 2002. “A museum's digital presence today includes not only a website, but also social media presence, mobile tools and apps, electronic fundraising, and much more” (L. Johnson, Adams Becker, Estrada, & Freeman, 2015, p. 22), as the authors of the NMC Horizon Report Museum Edition of 2015 argue. And that breadth is reflected also in applications for digital cultural learning.

Lisi Breuss (2003) argues that online-mediation of art is an offer on its own complementary to offline learning programs, and goes beyond transferring objects, content and methods of offline mediation on the Web going beyond the work with predetermined group structures such as school classes or special interest groups within a specific timeframe and often as part of a one-time visit to the museum. And also John H. Falk and Lynn D. Dierking (2013) argue, that Internet and distance learning technology makes it possible for museums to provide experiences beyond the physical visit to the museum, and therefore reach a wide variety of audiences, from local, national to international. By now one can argue, that digital mediation offers surpassed their status as an extension of the on-site mediation and became a form of mediation of art and culture in its own right. Especially in the US (and UK), museum’s web presences are becoming more and more dynamic participatory experiences (see Welch, Hawley, & McCormick, 2013).[151]

[151] Survey data from 2009 by Kris Wetterlund and Scott Sayre (2009) showed, that in the USA all surveyed museums (n=98) had websites, 64% of museums offered some kind online activities or lessons, 53% had an online collection, and 23 % offered online exhibits and online interactives and games, 13% offered personal collections, and 11% video conferencing paired with e-learning. These numbers were oftentimes significantly lower for the participating European museums (n=62). The starkest difference was in some of the more interactive categories, namely online activities or lessons (EU 29%), online exhibits (EU 11%) and video conferencing and e-learning (EU 3%). The latter is not surprising, as there is a better developed public transport system in Europe in comparison to the rural United States (see Welch et al.,

The goal of digital mediation of art and culture as defined in this thesis is to learn from and about art and culture by employing digital media and re-using items of digital cultural heritage and to allow the user to access and engage with art and culture through digital interfaces. For this endeavor it is important for a cultural institution to focus not only on visitors of the physical space[152] but treat online- or virtual visitors in the same way as physical clients. At the same time it is important to understand the physical and digital space as distinct displays for art and culture in their own right, at the same time being two sides of the same museum and not two separate entities.

Greg Welch, Leslie Hawley and Carina McCormick, researchers at the Nebraska Center for Research on Children, Youth, Families & Schools (University of Nebraska-Lincoln) point out in a recent report on distance learning for the Crystal Bridges Museum of American Art, that by now there exist many ways to "expand exposure to museums' collections, including wide- ranging resources as simple as digital images of objects housed in the museum or as complex as complete multimedia lessons organized around collection highlights" (Welch et al., 2013, p. 9)[153]. Thus the technology-enhanced mediation ranges from simply providing access to digitized items of the collection, their contextualization either through enabling to traverse the content network of the cultural data and metadata in the database, through narratives or through communication around the data.

2013), allowing schools to access museums. In the offer of online collections Europe and the US were nearly equal (see Wetterlund & Sayre, 2009, p. 29). The survey also showed that there was already activity in social media use in 2009. 60% of the US museums had a Facebook page, 21% used Twitter, 20% MySpace, 32% of the museums offered podcasts, and 30% kept a blog. For the European museums there was only very low social media use registered in 2009 (the highest number was 18% for podcasts, and 16% of European museum were using Facebook) (see Wetterlund & Sayre, 2009, p. 30). There might have been other social media sites in use in Europe though, which were not registered in the US survey. These numbers are expected to have grown in the past four years. However they do not say anything about the quality of these experiences with regard to online learning. Therefore an analysis of exemplary case studies is needed, to get an insight into the forms of online-mediation.

[152] The focus on physical visitors oftentimes happens due to fact that the amount of physical visitors is still a very important factor for the funding many museums, as got evident in conversations with museum employees during many conferences.

[153] This report focuses on challenges in relation to providing access to museum resources for schools in rural

This is also what Lisi Breuss (2003) emphasizes in her definition of online-mediation as service, communication and fiction (play with reality). The first definition – mediation as service – entails the development of information material, such as preparation- or wrap up material for on-site workshops, the production and distribution of e-learning-resources or the provisioning of displays for outcomes of these workshops, in order to make the results of different mediation formats produced by the participants visible for the public. With online-mediation as communication Lisi Breuss – like Falk and Dierking – addresses on the one hand the possibility to reach a broader, potentially global audience with the mediation efforts, and to expand to new or other target groups as well as age groups. Additionally, Breuss highlights online mediation as personal mediation with new, digital tools, meaning that art educators and learning curators are actively supporting and creating the online learning opportunities. But it also entails the active involvement of the users and fostering synchronous and asynchronous communication between institutions and users but also between the users themselves, enabling to ask questions, to discuss and exchange and at best also to contribute own content. Also media theorist Marc Ries (2003) emphasizes the importance to employ the Internet as social space, where sharing, exchange, participation, communication and cooperation are in the foreground. Thus the main challenge he poses for mediation of art and culture online is, how it can go beyond presenting, but towards actively integrating the user into the mediation process, by using the interactive and participative possibilities of the web to build a social-media space (see Ries, 2003, p. 41).

Most interesting with regard to cultural learning in institutional context and in the particular context of this thesis are trends in web-based learning experiences, which are most of the time asynchronous. A good framework for getting an overview of the different directions these projects can take are the categories of the "Media and Technology MUSE Award", which is awarded yearly since the year 2000 by the American Alliance of Museums for outstanding achievements in the use of media by or for Galleries, Libraries, Archives or Museums (short GLAM) (see American Alliance of Museums, 2015b).

Many learning applications are building up on existing cultural data for example from museum collections, and therewith are taking the databases and online collections (see Part VI, chapter 1. Classifications of Online Repositories and Platforms for Cultural

Data) as a basis, but oftentimes with the goal to tell multiple stories with and around the cultural data. Forms can include "digital presentations, applications and mashups that utilize existing data and online resources to transform content into new meaningful tool or experiences" (American Alliance of Museums, 2015a), as the American Allicance of Museums defines in their category "Applications and APIs". These projects build up on the foundation of **technological infrastructure**[154] in order to make the cultural data accessible to different audiences, telling multiple stories in diverse settings based on the data as well as fostering and encouraging reflection and dialogue around the data. Examples of such foundational technologies besides the databases and database-interfaces themselves include Applications Program Interfaces (APIs)[155], Content Management Systems (CMS)[156] and open standards for data exchange. They

[154] According to the Software Studies paradigm by Lev Manovich (2013b) these technologies are themselves cultural products and do not only shape how users can access and interact with cultural data, but are themselves shaped by decisions of technologists as well as by the real usage not only in the field of mediation of art and culture, but in various fields together with the conventions and demands of a digital society.

[155] As discussed in Part III, chapter 2.1.3., an API gives programmers the ability to access the therewith reuse the data in their applications. It "is a set of routines, protocols, and tools for building software applications. The API specifies how software components should interact […]" (Beal, 2015). It provides building blocks for developing a program, such as specific operations on datasets, inputs, outputs, datatypes as well as functionalities that are independent of specific implementations of a software. One example is a secure access and reuse of cultural data without knowing the underlying database-structures of a museum collection. APIs are basically encoded archive-politics, technically determining and governing the way programmers can access and re-use digital cultural data. But these encoded mechanisms also free the data and add value to it, since the digital cultural data therewith can be re-used in new contexts that are unforeseen of the collecting institution, adds new possibilities of interaction with the data and therewith possibly additional interpretations and new points of views on the data. And that without the institution having to provide all the applications fostering these actions themselves, APIs offer the possibility to build new platforms and interfaces around the same body of cultural data, since it separates content from presentation and enables a dynamic delivery of content whenever it is needed, while storing it remotely at the server of the collecting institution.

[156] The development of Content Management Systems (CMS) specifically for the needs of cultural institutions can be seen as ground-work for enabling a digital and web-based mediation of art and culture. One example is the Enterprise Content Management System (ECMS) at the Canadian Museum for Human Rights, which was built to enable transmedia storytelling in diverse settings around the museum, being accessible to all visitors regardless of age and ability as well as to foster reflection of the material and dialogue (see Timpson, Gillam, Funke, & Rivers, 2015). The software "is designed to manage the full life-cycle of digital storytelling, including creation, exhibition, dissemination across all Museum offerings, and archival storage" (Timpson et al., 2015)[156]. This all is made possible through a central digital repository that is also available through a web-interface and through providing an API the system allows museum-internal and external programmers to create various kinds of user experience through employing different platforms and user interfaces to roll out the experience. Another basic and open CMS project includes for example "TAP into Museums" by the IMA Lab at Indianapolis Museum of Art, which builds up on the free and open source content management system Drupal and is basically a collection of open source tools that supports creating and delivering

also ensure the interplay and exchange of data between different databases and institutions. But also social media platforms as well as generally the networked infrastructure of the Internet are employed for learning from and about art and culture and provide access as well as foster the engagement with them through digital interfaces. The NMC Horizon Report 2015 Museum edition is very specific when they talk about "educational technology" as the technological foundation of digital cultural learning. Educational technology "is defined in a broad sense as tools and resources that are used to improve learning, and creative inquiry" (L. Johnson et al., 2015, p. 34). This includes

- **Consumer technologies:** such as drones, electronic publishing, mobile applications or wearable technologies. They were originally created for other purposes such as recreation or professional use, but can be easily adapted also for educational usage or the use in museums. They are brought into institutions because people are already using them (see L. Johnson et al., 2015, p. 34).

- **Digital strategies:** such as bring your own device, flipped classroom or gamification. These are not so much technologies per se but "ways of using devices and software to enrich education and interpretation, whether inside or outside of the museum. Effective digital strategies can be used in both formal and informal learning; what makes them interesting is that they transcend conventional ideas to create something that feels new, meaningful, and 21st century" (L. Johnson et al., 2015, p. 34). This reflects the need for cultural institutions such as museums to react to the digital transformation of the contemporary society as discussed in Part III, that is going on around the institution. And as the institutions are oftentimes regarded as mirrors of the contemporary society, which is developing in a direction of being participatory, networked and open source, they need "to be more aware and responsive to their audiences' evolving behaviors to stay relevant. As a result, they are being urged to shift their attitudes to balance digital infrastructure and digital mindset in equal measure" (L. Johnson et al., 2015, p. 22). Thus a digital strategy does

mobile tours. This follows the philosophy that "[f]reely available tools and standards are essential to the museum community to promote the adoption of best practices, to facilitate collaboration, and to encourage the creation of potential avenues for future content sharing". Therefore the toolset also supports a specification called "TourML". This XML schema allows to build, share and preserve mobile tours in a way that makes the content portable to other applications supporting the same content-standard. Besides many open projects there are of course a myriad of commercial solutions emerging in the market.

not only include decisions with regard to hardware, software, networks, critical tasks like digitization of cultural items and collections or the development of new workflows and staffing requirements, which inevitably go along with the technological changes in the museum environment. It also entails the expansion of the meaning of “digital” “to include the adoption of digital values such as agility, flexibility, and usability”. Therewith they are not only about platforms and technologies, but essentially about people.

- **Enabling technologies:** such as affective computing, geolocation, location based services, machine learning, mobile broadband or natural user interfaces. They include tools where substantive technological innovation becomes visible and which are able to boost the usefulness and capability of existing tools, expand their reach and improve their usability (see L. Johnson et al., 2015, p. 34).

- **Internet technologies:** such as cloud computing, the internet of things or syndication tools. These “include techniques and essential infrastructure that help to make the technologies underlying how we interact with the network more transparent, less obtrusive, and easier to use” (L. Johnson et al., 2015, p. 34/35).

- **Learning technologies:** such as badges or microcredits, Massive Open Online Courses, online learning or virtual and remote laboratories. These include tools, resources and technologies that were developed specifically for educative purposes or were adapted and paired with educative strategies to support learning (see L. Johnson et al., 2015, p. 35). These technologies make formal and informal learning more accessible and personalized.

- **Social media technologies:** such as collaborative environments, collective intelligence, crowdsourcing or social networks. Even though they could be seen as consumer technologies, these technologies are so present and widely used in all parts of the digital society, that the authors of the NMC Horizon Report 2015 Museum Edition made them their own category.

- **Visualization technologies:** such as 3D printing, augmented reality, computer vision or information visualization. These technologies range from simple information graphics to complex visual analytics (see L. Johnson et al., 2015, p. 35). These technologies tap on the ability of the brain to "rapidly process visual information, identify patterns, and sense order in complex situations" (L. Johnson et al., 2015, p. 35) and are used for data mining of large datasets, exploring dynamic processes and datasets as well as depicting something complex in a simple and understandable way.

Table 1: Educational Technologies. Source: NMC Horizon Report 2015 Museum Edition (L. Johnson et al., 2015, p. 35).

Consumer Technologies	**Enabling Technologies**	**Internet Technologies**	**Social Media Technologies**
3D Video	Affective Computing	Cloud Computing	Collaborative Environments
Drones	Cellular Networks	The Internet of Things	Collective Intelligence
Electronic Publishing	Electrovibration	Real-Time Translation	Crowdfunding
Mobile Apps	Flexible Displays	Semantic Applications	Crowdsourcing
Quantified Self	Geolocation	Single Sign-On	Digital Identity
Robotics	Location-Based Services	Syndication Tools	Social Networks
Tablet Computing	Machine Learning		Tacit Intelligence
Telepresence	Mesh Networks	**Learning Technologies**	
Wearable Technology	Mobile Broadband	Badges/Microcredit	**Visualization Technologies**
	Natural User Interfaces	Learning Analytics	3D Printing/Rapid Prototyping
Digital Strategies	Near Field Communication	Massive Open Online Courses	Augmented Reality
Bring Your Own Device (BYOD)	Next-Generation Batteries	Mobile Learning	Computer Vision
Flipped Classroom	Open Hardware	Online Learning	Information Visualization
Games and Gamification	Speech-to-Speech Translation	Open Content	Visual Data Analysis
Location Intelligence	Statistical Machine Translation	Open Licensing	
Makerspaces	Virtual Assistants	Virtual and Remote Laboratories	
Preservation / Conservation Technologies	Wireless Power	Volumetric and Holographic Displays	

Despite all the technology that pushing into the realm of mediation of art as a facilitator and agent in the learning process, the collection of a museum is at the core and center of any cultural learning effort and mediation practice as co-creative knowledge generation, often in form of a dedicated online collection and information, exhibits, activities, lessons, or interactives and personalization options involving the digital collection material (see Wetterlund & Sayre, 2009). Its individual collection is what makes a museum unique and gives it a unique role for cultural learning. This is also because of the nature of the original in art, where an original artistic project usually cannot belong to two different museums[157]. Where an online-experience cannot and does not want to fully replace an on-site visit and a direct engagement with artistic projects and cultural objects, it can provide a different form of access and interaction with these items and with other visitors or interested people. Moreover through the digital format and the fact, that the data lives in an digital, networked media ecosystem, it can be put into wider contexts beyond the individual museum collection and serve as reference and context for other collections itself. As already argued, the interaction with digital objects can highlight different aspects of the items and lead to new, or at least different insights in comparison to a physical visit to the museum. In a discussion Lev Manovich pointed out that the virtualized or digitized encounter of cultural objects becomes the only encounter for many people, especially those, who cannot visit a specific museum collection in person, for whatever reason, be it because of geographical distance, economic constraints, or the like. Thus instead of emphasizing the physical encounter of an original artwork as "real" encounter of a cultural object and looking at the virtualized encounter of a digitized version as inferior, one rather has to look at them as two different but equally valuable ways of accessing, interacting with and learning from and with art and culture.

[157] Editions are of course an exceptions of this case.

V. From Archives to Databases. Setting the Basis for Digital Mediation of Art and Culture

1. Cultural Repositories as Context and Basis for Cultural Heritage and Mediation of Art and Culture

A central instrument to address the described challenges of the museums and mediators thus can be cultural repository such as collections, archives or the media scape and their digital counterpart: the database. In their digitized form these will build the basis for mediation of art and culture as knowledge generation and meaning making processes as well as cultural learning in the digital realm by providing raw material and information to depart from. They will continue their central role for these processes that they already established in the analog environment.

Wolfgang Ernst argued: „Nie war die Rede vom Archiv so inflationär wie heute“ (Ernst, 2002a, p. 137)[158]. Archives, or in more general terms “cultural repositories”, are a „hip topic“ at the beginning of the 21st century. As Marlene Manoff states, “[t]here has been a striking growth of interest in the concept of the archive outside of the library and archival communities. In the past decade historians, literary critics, philosophers, sociologists, anthropologists, geographers, political scientists, and others have wrestled with the meaning of the word ‘archive’” (Manoff, 2004, p. 9). Sparked by German *Kulturwissenschaften* and their focus on collective identities in the aftermath of reunificiation and accompanied by the then “new wave” of media digitization, the academic discussion has since embraced the topic of “archives” and “archiving” as an element of collective memory research (see Drechsel, 2005, p. 94). Wolfgang Ernst states that questions regarding memory, remembering and securing of evidence in relation to archives got nearly an obsession (see Ernst, 2002a). Archives serve as resources for the construction of histories, to base an understanding of our culture in the past and the present on and as a source to build the future. They are the backbone of mediation and they are sometimes also directly shown or bleeding into it the mediation work. Practices of mediation of art and culture activate the archive material,

[158] „Never before has the talk about archiving been as inflationary as today“ (Ernst, 2002a, p. 137, transl. by F.W.).

bring it back to the active memory and reuse it in order to generate new meaning and knowledge. It becomes clear that "archiving", "collecting" and "recollecting" are intrinsically linked phenomena (see also Wuggenig & Holder, 2002). Formerly separated discourses on collecting images – or more generally "cultural expressions" – and recollecting memories have approached one another, finally fusing in the technological digital revolution that makes formerly analog media forms and cultural objects digitally accessible on a global scale (see Drechsel, 2005, p. 94) – a phenomenon that will be discussed in a separate chapter in depth. Thus it is important to understand how "collections" and "archives" work that are re-used today. To outline the theoretical boundaries the terms "archive" and "collection" will be introduced, to distinguish the fuzzy borderline between the two terms and to define the role of collecting and archiving within cultural heritage.

1.1. Collection

The word "collection" or "to collect" has a Latin root in the verb colligere which means "to gather together" but also to hold together, to combine, to pick up, to harvest. Everybody collects something, sometimes for a short period and without being aware, sometimes consciously and with a long term strategy (see Winzen, 1997). It happens in everyday situations be it collecting trash in the house before it goes out into the trash bin, or having more than one actually use of something. According to Matthias Winzen it seems to be a natural reflex to group dispersed things together in ones field of perception, following gestalt psychology. He describes collecting as materialized association (Winzen, 1997, p. 10). Other collections are more conscious, be it music, books or photographs, but also art. Thus on a conscious level collecting means not only to gather whatever one can find, but to pick with a purpose, to have criteria, a plan for the selection[159], but also to hold the collected items together, to keep them.

The practice of collection is not restricted to anything specific. People collect all kinds of things. Krystof Pomian states that any kind of artifacts a human can possibly know are represented in a collection of an individual or a museum (see Pomian, 1998, p.

[159] An example is the collection of Thomas Olbricht, a chemist and medical doctor as well as a patron of the arts, who has assembled one of the largest European private collections with works from the 16th century to contemporary art. The choices he made on what to collect were subjective, however he follows the objective to discover and understand human nature (see Me Collectors Room, 2013).

13)[160]. Roland Albrecht made clear in his definition of the "Museumsding", that these objects lost their initial designated use and are collected to be looked at and to represent. They are preserved, conserved, if necessary restored. In short they are protected, they are regarded as something of value for various reasons ranging from aesthetic pleasure or prestige to potential historic or scientific insights, which these items could bring. They are taken out of the regular economic circulation but enter a specialized collectors market, on which they have rather a exchange value than a present utilization value (see Pomian, 1998, p. 17). They have value because they represent something invisible, which cannot be witnessed directly – in other words they are mediators between the beholder and the invisible: the potential meaning these cultural objects are carrying. Therewith they become semiophores that are brought together to be examined and looked at in order to derive a meaning and object-stories inherent in the object[161]. This is a very typical concept of Western material culture. The value of a collection is therefore rather directed into the future than into the present when they are collected.

In a German cultural studies oriented perspective, the act of collecting in general is according to Matthias Winzen (1997) an attempt to deal with the fact that time goes by. Collecting tries to secure identity over time, be it the personal identity, the identity of an organization, a nation, a culture, a society. Time flies by, "[…] aber ich kann Fotos, Spuren, Dokumente, Erinnerungen, aufbewahren oder im Nachhinein erfinden" (Winzen, 1997, p. 10)[162]. "Die Sammlung soll als zeitüberwindender Spiegel dessen dienen, der sie anlegt und der selbst weniger dauerhaft ist als sein Spiegel" (Winzen,

[160] Besides contemporary collection contexts there were a wide range of reasons to gather items. Krysztof Pomian walks through the history of collecting from ancient times to today, shedding light on the question, why humans collect (see Pomian, 1998, p. 20 ff). For pre-Renaissance collections he names burial objects, offerings, loot that became the basis for private collections, the cult of relics and sacral objects, the treasuries of rulers.

[161] People who cannot afford to have these cultural objects on their own, demand at least in many European countries from the state to get access to these goods and their values via gaze (see Pomian, 1998, p. 18). Thus it becomes duty of the state (and with that of museums as cultural institutions under state administration) to collect, preserve and provide access to these collections, physically as well as intellectually. The latter is where mediation of art and culture comes into play.

[162] „[…] but I can keep photographs, traces, documents or memories, or reconstruct or retroactively invent them" (Winzen, 1997, p. 10 transl. by F.W.).

1997, p. 10)[163]. Thus a collection does not only have a dimension of protection but also of fear of what could get lost from the past and of the unknown future yet to come. "Sammeln trägt Sinn, Ordnung, Begrenzung, Zusammenhang und Erklärung in das Zerstreute, Unübersichtliche, Konturlose, Zufällige oder Bedrohliche hinein" (Winzen, 1997, p. 11)[164].

1.2. Archive

The collection can be viewed as preliminary stage of an archive, where an amount of artifacts is selected using a set of specific criteria, gathered and stored (see Assmann, 1999, p. 344). But an archive brings scientific rigor and methodology to a collection through classification, by sorting and arranging the collected material in a certain way, under defined criteria using a classification system[165] and defined vocabulary – a taxonomy – that fits the purpose of the archive and ensures that items can be retrieved again. Or as Peter Haber (2006) writes, only the conscious act of ordering and sorting transforms a collection to an archive, which administers the items and authenticates them through documentation of their original context, that is lost in the process of archiving and replaced by the archival context.

The nature of an archive is already revealed in the origins of the word, which actually comes from an administrative context. The earliest root for the word "archive" is the Greek "arkhē", which has two meanings: a) beginning or origin, and b) sovereignty, dominion or authority (see Liddell & Scott, 1940; Online Etymology Dictionary, 2013; Wictionary, 2013). Related to the first meaning is the Greek adjective "arkhaios" meaning "ancient" (Online Etymology Dictionary, 2013). The Latin word "archivum" or "archium" denominate the "place where the records are kept" (Latin-Dictionary.org,

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[163] „The collection should be a mirror that overcomes time, reflecting the collector who is less durable than the mirror"(Winzen, 1997, p. 10 transl. by F.W.).

[164] „Collecting brings sense, order, boundaries, cohesion and explanation into what is dispersed, confused, contourless, random or threatening" (Winzen, 1997, p. 11 transl. by F.W.).

[165] Anika Heuserman, Gesine Märkel and Karin Prätorius argue that especially for private archives the criteria for archiving and the order and classification of the objects are not always planned out in advance, but it rather is developed through the inductive work with the material over time. But the classification system and order of the archive determines the usability, readability and findability of an archive. Thus for an institutionalized archive which focuses on external visitors a comprehensible and documented order is key, even though it might limit the way an archive can be used (see Heuserman et al., 2002, p. 229).

2008b) or "public records office" (Latin-Dictionary.org, 2008a), which relates to the Greek word "arkheion" meaning "a house, a domicile, an address, the residence of the superior magistrates, the *archons*[166], those who commanded" (Jaques Derrida & Prenowitz, 1995, p. 9). The archive is therefore is a place, an address and therewith a reference point where documents or things are filed, meaning they are stored following a particular system, which is documented and allows the things to be found again[167]. Usually the stored items are from the past, but an archive is not a static entity, its structure and functions are not carved in stone, but they are subject to constant change while the archive is in use (see e.g. Heuserman, Märkel, & Prätorius, 2002).

An archive can be considered a storage facility of potential knowledge used for various purposes ranging from collective memory over research to mediation-tool[168], for personal use or even as a basis or tool for art, to name just a few applications (see e.g. Batchen & Schaffner, 1997). Thus an archive is the beginning for something, rather than the end, a source for example for multiple (hi)stories encompassing different points of view, a beginning for understanding, thought into the future. It is a construction tool for perceived past and present reality. This construction of reality depends on the examination and activation of the archival content, on the scientific interpretation or reconstruction of the knowledge of the archive, which is left to the user. The item and information itself is stored with an open meaning, without a certain perspective (see Assmann, 2004, p. 59)[169]. Also Wolfgang Ernst argues, that "the

[166] *archon* relates to the Greek word „arkhon", which on the one hand means ruler, on the other it denominates one of the nine magistrates of the ancient Athens (see Online Etymology Dictionary, 2013)

[167] Deriving from the two meanings of "arkhē" which Derrida (1995) states as commencement and commandment, he defines two orders of order for an archive: sequential – following a physical, historical or ontological principle – and jussive – following nomological principles, which sorts exercising existing physical / natural and logical laws and conventions, and maybe also a (social) order, commanded by a human authority (see Jaques Derrida & Prenowitz, 1995, p. 9). Peter Haber (2006) differentiates also two systems of order: a) a pertinence system which sorts archive items according to criteria derived from the items, such as geographical aspects or thematic keywords; b) a provenience system which orders the items according to their origin, but ignores semantic relations. An analogue archive has to follow one or the other principle, in a digital system these can be easily combined. Haber also claims that there cannot exist a standardized classification system for every archive, but the principles of order need to be fitted to a specific archive and its purpose (see Haber, 2006).

[168] I use the term „mediation" in the sense of the German word „Vermittlung" (see the previous section on mediation of art and culture).

[169] This refers to Aleida Assmann's definition of „Speichergedächtnis" as opposite to „Funktionsgedächtnis" (see Assmann, 2004, p. 59)

archive is not dedicated to memory but to the purely technical practice of data storage: any story we add to the archive comes from outside" (Ernst, 2004, p. 46). Thus remembering or recreating the past with an archive goes beyond the mere retrieval of information stored in the archive, but rather needs "[…] the putting together of a claim about past states of affairs by means of a framework of shared cultural understanding" (Halbwachs, 1992, p. 43; see also Schwartz & Cook, 2002). As Jacques Derrida (1995) states, an archive stores the potential, the "not-yet", the potential knowledge of the future which cannot be known in the present (see also Holert, 2002). The archive is therewith not a repository of existing knowledge but rather a basis for the generation of new knowledge. In the terminology of Michel Foucault (1973) every record in the archive is a statement in itself, and through activation of these statements and recombination the user can assemble one of many possible stories hidden in an archive, waiting to be brought to life, revealing as a part of the archives meaning. Tom Holert (2002) writes, that – at least for the physical archive – its complete representation is nearly impossible. "Der Anschauung präsentiert es sich allenfalls in Ausschnitten: als Bild einer Architektur, einer Kartei, eines Magazins, eines Verweissystems, eines Suchprogramms. So bleibt das Archiv–Ganze jenseits dieser Konkretionen und Teil-Repräsentationen zuallererst ein Raum der Möglichkeiten" (Holert, 2002, p. 161)[170].

An archive also has power and authority over what users of the archive and society at large are able to know from the past, from a culture, from a society through the mechanisms and politics of inclusion and exclusion of what is collected and therewith preserved for the future. The French philosopher Michel Foucault defines an archive as "Gesetz dessen, was gesagt werden kann"[171] (Foucault, 1973, p. 188), the entity that forms the discourse. Foucault also mentions the function of selection, conservation and the necessity to draw links between the information or statements (instead of items) stored in the archive. Archives – as records – "wield power over the shape and direction of historical scholarship, collective memory, and national identity, over how we know ourselves as individuals, groups, and societies" (Schwartz & Cook, 2002, p.

[170] „The view presents itself at best in excerpts: as visual of an architecture, a file, a magazine, a cross referencing system, a search program. Thus the whole of an archive stays beyond these concretions and partial representations in the realm of the possible" (Holert, 2002, p. 161, transl. by Florian Wiencek)

[171] „the rule of what can be said ", transl. by Florian Wiencek

2). Thus the archive is a technology of power but it gets clear that it is also a social construct (see Schwartz & Cook, 2002, p. 3). Derrida claims, that an archive does not only record but rather produces an event and its understanding in the future with its technical structure, and he also hints to news-media as following the same mechanism of creating an event through processing and staging the information, and create a new archival record with it, which can also include already archived material if it is reused (see Jaques Derrida & Prenowitz, 1995). Tom Holert calls this "archival epistemology" (Holert, 2002, p. 162).

1.3. Archive as resource for knowledge generation

One central role for Mediation of Art and Culture but also for research in Art History, Visual Studies or Cultural History is the archive as central resource for knowledge generation. This follows the already mentioned Foucauldian archive definition as defining what can be said about a specific field, time, area of knowledge. For Art History and Visual Studies the Kulturwissenschaftliche Bibliothek Warburg (KBW) is a poignant example for an archive or collection as research tool, as the influential art historian Aby Warburg built his research method of interdisciplinary cultural studies (interdisziplinäre Kulturwissenschaft) based on the KBW as research instrument (see Drommert, 1995).

Thomas Hensel names Warburg as "spiritus rector" of an historic image science, since he regarded himself more as an image historian instead of an art historian, trying to bridge what was commonly separated as high- and low-art (see Hensel, 2011, p. 12). As Huisstede (1995, p. 131) formulates it, Warburg perceived the most important task of an art-historian to describe artworks or visuals of all sorts as part of their cultural background. Thus he looked at artworks as historic phenomena of which he analyzed meaning as expressions in a social memory with a socio-psychological angle: using concepts like expressive quality, pathosformula or gestural language (see e.g. Hensel, 2011, p. 13; Huisstede, 1995, p. 133). Therefore Warburg focused on the cultural context, in which the artists but also the viewers of an artwork were or are acting. For Aby Warburg artworks but also interpretations of artworks are emerging under the impression and in reflection of or relation to previous cultural expressions and their forms, that are known to the person. With his project of the Mnemosyne Atlas Warburg aimed to build an inventory of images that allow the proof of visual influences within a corpus of cultural expressions, in Warburg's case study works from the Renaissance period. Moreover it was important for Warburg's iconology[172]as method of visual interpretation (see e.g. M. G. Müller, 2015, p. 3) that he analyzed images not only using keywords and terms but rather the images with their visual vocabulary themselves (see Hensel, 2011, p. 16). Therewith he transformed the method from a tradition used by collectors and archivists in order to systematize their collections (Warnke, 1980, p. 55) to a method that enables researchers to trace the history of motifs, but according to Marion G. Müller (2015) even more to shed light on social and political processes and history through image-driven argumentation. In this method images were therefore not only regarded as an object that can be a source for new insights, but it is rather a medium for insights and spreading knowledge itself. Or as Andreas Beyer (1997) formulates it, Warburg thought through images, not through a translation of images into language. He rather used their mediality, their specific characteristics as space to think, which had an influence of shaping the KBW and his central work – the Mnemosyne Atlas – as the visual research instruments they became.

Ernst E. Gombrich described Mnemosyne Atlas as "Denkraum": a metaphorical space that defines the "'moment' of reflection before taking action" (Wedepohl, 2015, p. 141). Peter van Huisstede (1995) calls it a "laboratory of image science", which brings the terminology of natural sciences into humanities research. According to Thomas Hensel Warburg himself characterized not only his flagship project but rather the whole KBW as laboratory (see Hensel, 2011, p. 22). He therewith related his method of interdisciplinary Cultural Studies to laboratory work in natural sciences. In his laboratory Warburg worked with the idea of reconfiguring natural and social orders and their relations (Hensel, 2011, p. 22). As Hensel (2011, p. 22) describes it, Warburg collected cultural objects such as books, images or newspapers in his library, where he not only decontextualized them physically, but also orders them in space and time – thus recontextualizes them by having them in his system of order in the library space. The links to classical points of view on a museum or an archive become clear already, as they work in the same way. This act of collecting and ordering the cultural objects isolates the cultural objects and enables them to be used and handled for scientific work, to be related in new ways, to be part of different discourses. And Warburg went

[172] previously called „iconography" in his early writings (M. G. Müller, 2015)

even beyond working with the collected objects in their original state. For analyzing the cultural objects he turned them into what Hensel calls “object signs” that he extracted from the “originals”. As example Hensel names the pathos formula. He further isolated single artworks and images from their publishing or exhibition contexts and original materiality by not working with with reproductions that not only isolate and miniaturize the images to make a large amount of them handleable, but also allow to isolate and highlight important details and reduce visual attributes that he did not regard as important for his analysis: color values for example. Thus in modern language he manipulated and cleaned the data to allow a certain angle of analysis, as the method of using miniature reproductions of visual cultural objects brought different kinds of objects, from newspaper ad over sculpture to painting together into the same medium and visual space, in a similar size that could be easily handled and reconfigured. The focus on the depicted motif and not the media attributes of a visual artifact clearly supported Warburg’s work on the visual vocabulary.

In addition to the extensive use of image reproductions and the influence of reproduction techniques on Warburg’s thinking about images, according to Peter van Huisstede a central method of Warburg’s research was his work with schematic visualizations of artworks. He used “storyboards” to relate artworks that caught his attention into a spatial relation that he marked in parts with lines in different colors. Moreover he worked with keyword-lists to annotate topics of motifs he wanted to work on and with (see Huisstede, 1995, p. 130). Thus Warburg used a very inductive method that was moreover subjectively led by his research interest. Woolen threads marked formal and content-related relations between the images also through space like a network of images – something that can hardly be reproduced in a print version of the Mnemosyne Atlas. Additionally to the storyboards literature was added as context to the visualizations of photographic reproductions pinned on dark panels (see Huisstede, 1995, p. 142), following the Warburg’s rule of thumb “Zum Bild das Wort” (see Huisstede, 1995, p. 153). The panels stayed a work in progress during the process of compiling the Atlas, but were in-between photographed in different stages as snapshots of version at a specific point in time, but also for Aby Warburg to take the panels with him during his travels, to show the panels to colleagues but also to cut them up and change the order of the images while he was outside his library. Therewith Warburg took advantage of the possibilities of photographic reproduction and the available media-technology at beginning to the 20th century in twofold way: through using photographic reproductions of the artworks on his panels, and by using photography to reproduce the panels and for the representation in his book and as working version for travel. Thomas Hensel (2011, p. 16/17) even argues that starting at Warburg's work of forming historic knowledge based on technological media the methodological backbone of modern image science is based and formed by media technology, that enables viewing and detailed analyzing images as well as the construction of historical and genealogical narratives. And these media technologies for image storage, transmission and display influential at the time were not limited to photography, but also included technical images like cinematography or x-ray as well as transmission through image-telegraphy.

The last paragraphs describe very roughly Warburg's method as well as the according laboratory setup of KBW, that includes photography as important reproductive method, but also other instruments such as the notation system, keywording and schematic visualizations thinking-space and visualization of research results at once, while also representing Warburg's methodological and theoretical concept (see Huisstede, 1995, p. 131). Thus it gets evident that experiments in the humanities and especially in image science take place in an imaginary space but are also fostered by the infrastructure of tools such as the collection, the library as well as visualization and reproductions as tools to order thoughts, to aid memory, to put the collection into a temporary order, to help to think, to spur ideas. Therefore the humanities laboratory aids the functions of discovery, learning about a subject as well as problem solving (heuristic function – Huisstede, 131). Ideally it would lead to questions that the researcher could not yet formulate without the research setup and lead to yet unknown answers of these questions, as Thomas Hensel (2011, p. 23) brings to the table, referring to Rheinberger (1992, p. 22).

Image Science scholars such as Martin Warnke as well as Marion G. Müller have adapted the Warburgian approach to address contemporary visual scapes. Warnke claimed according to Müller (2015) that nowadays the socio-politically relevant motifs are not predominantly found in art but rather in the imagery of mass-media (see Warnke, 1993b, 1994, 2007), and in the 2010s definitely digital media outlets such as the World Wide Web and diverse social media channels. Art historian Martin Warnke therefore developed his approach of political iconography (Fleckner, Warnke, & Ziegler, 2011), which moved an art-historical method into the present where, following

Warburg, the method can be used to analyze also current problems that are common research subjects in fields such as social sciences (M. G. Müller, 2015, p. 11). In what Müller calls the "new Warburgian school", that formed around a DFG graduate school under the same title as Warnke's methos – "Political Iconography" (1990-1999) –, the person of Martin Warnke and the reopened Warburg-Haus" in Hamburg through the 1990s, scholars used non-artistic images to analyze contemporary socio-political and cultural issues (M. G. Müller, 2015, p. 11). Marion G. Müller is one of the researchers coming from this circle of scholars that follow the Warburgian tradition and spend their scientific career to build up on Warburg's methods and develop and adapt them to work for contemporary image scapes (M. G. Müller, 2003, 2007), amongst others what she calls "cyber-imagery" (M. G. Müller, 2015, p. 24). Therefore both work with a large image-corpus as a starting point that was collected over tens of years isolating images and motifs they find in different contexts and ordering them according to a specific inductively driven and motif-based order system. For this purpose Martin Warnke developed the "Bildindex zur Politischen Ikonographie" (Warnke, 1993a) for his Political Iconographic Archive, containing over 500 000 cards with annotated images. Based on his method Marion G. Müller developed the "Political-Iconographic Archive of Vision" and an inductive motif- and theme-based annotation and indexing system to order Müller's research collection of press-photographs from newspapers and online sources. The system comprises of four big thematic sections and motif-areas: politics, culture, science and life. The archive grew in different directions following her research interests and projects and is fed besides by images from the specific research projects and systematic short-term sampling for these projects since the 1990s by systematically filtering fixed sample of German serious newspapers for images falling in the established categories over a long time period. These images together with their immediate context such as captions are cut out and filed as original with one or multiple motif-annotations, but not before they were previously photo-copied and now scanned, reproduced on cards and stored with thumbnail-metadata such as the source of the image and the caption under the same one or multiple motif-annotations in filing-boxes (Zettelkästen), following the role-model of Warburg, Heckscher (Schoell-Glass & Sears, 2008) and Warnke. Moreover the images were partially digitized and stored in an image-database for digital retrieval and further digital annotation and possibly computational analysis[173], as for example in the project "Visual Film

[173] Both Warnke's and Müller's corpora are however isolated systems that are not

Discourse" (Bateman et al., 2016; Bateman, Herzog, Malaka, & Müller, 2009). Where the two mentioned archives themselves employ classical Warburgian research instruments, even though making use of the reproduction methods and image sources of the time, the latter project also ventured into digital annotation and retrieval methods with the aim to capture the iconographic essence of a motif in a computer-readable and analyzable format and allow for an automated or semi-automated motif research.

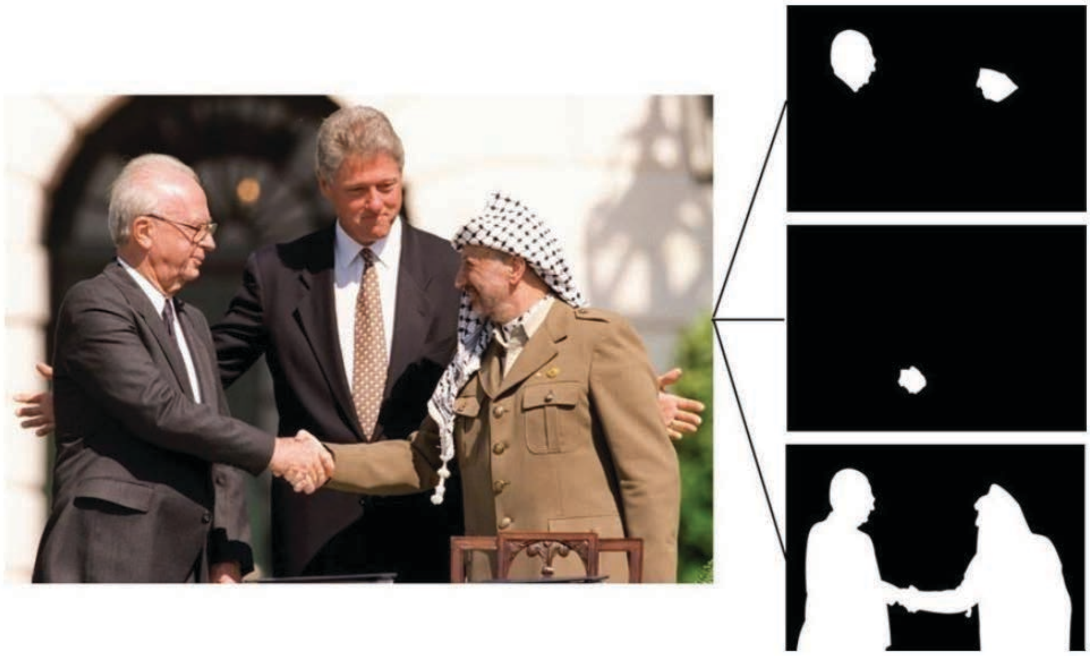

Figure 10: Segmentation of a motif "handshake" (PIAV-Index A.4.3.a) during the project "Visual–Film–Discourse". The photo shows a handshake of Israel's president Jitzchak Rabin and Palestinian leader Jassir Arafat in the Rosegarden of the White House after signing the Gaza-Jericho treaty in September 1993. Photo: Ron Edmonds / AP. Source: Müller (2015, p. 7).

The segmentation was done in Adobe Photoshop using paths, that mark iconographically relevant areas in the image: in this case a) the heads of the two people shaking hands; b) the hands of the two handshakers (not of president Clinton though, as a handshake is always between two people); and c) the shapes of the two people shaking hands. The feature-shapes were highlighted in white while the rest of the image was filled with black. The aim of this was to aid machine learning of relevant features for our research partners to develop an algorithmic framework for an automated motif search. This kind computational analytical tool can be part of a digital experimental setup for an image science laboratory.

Looking at the laboratory setup of Warburg and contemporary scholars following his role-model of working, it becomes also clear, that visual research and the questions that can be asked and theories to be developed are very much dependent on the media

available online for further research (M. G. Müller, 2015, p. 13) technologies as technological basis to conduct an analysis. In the latter the technologies and hardware – to use this contemporary wording – are the material basis for knowledge generation (see Hensel, 2011, p. 20). This follows Hensel's (2011) hypothesis that Warburg used the dispositives of technological media apparatuses of the time as context for and as structural formation of his thinking about and constructing image history based on their contexts, but also as technological basis for conducting analysis. Following that train of thought, the progress from analogue to digital media as tools for image science but also mediation of art as a form of knowledge generation with visitors today does immensely impact the way knowledge based on visuals can be generated as well as how people can access, view and interact with visuals and therewith perceive them within the highly technologized contexts of their daily lives and the media-ecosystem of the 21st century (see Part V). Thus the KBW can be very well regarded as an analogue prototype of today's digital visual laboratories that are step by step manifested in the field of digital humanities. Cultural databases and digital collections therefore need to be understood as starting point for further "experiments" in visual knowledge generation and meaning making.

1.4. Media-Scape as Cultural Repository

But not only museum collections or archives play a role for cultural heritage and knowledge generation with and about visuals. Also the media scape can act as a cultural repository and is in direct interplay with the institutional archives.

Media forms such as the film – or nowadays also digital media – have along with their products established themselves as "imaginary archive of cultural production" (Pauleit, 2006, p. 113). According to Joanne Garde-Hansen "[m]edia […] are the main sources for recording constructing, archiving and disseminating public and private histories in the early twenty-first century. […] Moreover, they form the creative toolbox for re-presenting histories from periods and events long before, of which those media forms were not a part." She names costume dramas, history documentaries and heritage centers as examples for popular forms of history representation and moreover claims that we seem not to understand the past without media versions of it. Also Andrew Hoskins (2004) argues that "[t]echnological advances that have transformed our experience of time and space over the centuries have also fundamentally altered the constitution of what has been called 'collective memory'" (Hoskins, 2004, p. 109). Maurice Halbwachs is a prominent theoretician working on collective memory, who argued that individual memory relies on "frameworks of social memory", thus the reconstruction of the past is a collective effort by all social groups and individuals reconstructing their own past (see also Assmann, 1999, 2004; see Halbwachs, 1992). Hoskins argues that these frameworks are nowadays extensively mediated, or, to go a step further, suggests that media operates as "'framework' of memory, as they assist continuously the reconstruction of our past by dominating the present" (Hoskins, 2004, p. 110), and "remembering is a process that today is increasingly media-afflicted" (Hoskins, 2004, p. 110).

Joanne Garde-Hansen describes the dynamic of media and memory as follows: "[…] media collect, store and archive memories (privately and publicly) and […] offer one of the main public manifestations of mythology, tradition and heritage in the twenty-first century. More importantly, media produce collectives at precisely the same moment they transmit collective memories" (Garde-Hansen, 2011, p. 38). She identifies three different dynamics of media and memory:

> 1) "Media as recording of events and as a record of the past is the driver of institutions of memory from news corporations, newspapers and news broadcasters to museums, heritage industries and archives" (Garde-Hansen, 2011, p. 52).
> 2) "Media forms are memory aids, tools or devices thus making media mnemonic, mnemotechnical or mnemotechnological" (Garde-Hansen, 2011, p. 53).
> 3) "Media as memorial or as working through the past are the key driver of memory practices both publicly and privately" (Garde-Hansen, 2011, p. 53).

Therefore media cannot only act as archives or representations of past historic events but they are constantly evoking memories and are also actively producing new ones. Garde-Hansen calls media "the first draft of history", as it "report[s] history as it happens" (Garde-Hansen, 2011, p. 3), and she refers to "media witnessing" as key concept "for understanding the relationship between experiences, events and their representations" (Garde-Hansen, 2011, p. 3). Media can on the one hand initiate our memories of an event, but also sustain and collapse the memory later on. Thus "the first draft of history" is setting the agenda for what later should be considered and can become part of memory, as it mattered in the present and was therefore selected to be featured in the news (see Kitch, 2008)[174]. According to Garde-Hansen "[m]edia (texts, photographs, cinema, television, radio, newspapers and digital media) negotiate both history and memory" (Garde-Hansen, 2011, p. 6). She understands history as the narrative or writing of the past which is more authoritative, and memory as "the personal, collective, cultural and social recollection of the past" (Garde-Hansen, 2011, p. 6), and thus a more private, person-related view on the past. Both are mingled in media as "we understand the past (our own, our family's, our country's our world's) through media discourses, forms, technologies and practices" (Garde-Hansen, 2011, p. 6). But in order to understand media accounts as cultural expressions and creative products in their own right – be it of past or current events – audiences bring them together with their own background, their life histories, our memories, our knowledge, which they acquired by what they saw and experienced in person or in mediated form and even other media products we remember. Thus when audiences see media reports of events, these reports "[…] intermingle in our minds with multimedia national/local museum exhibits and heritage sites, community history projects, oral histories, family photoalbums, even tribute bands, advertisement jingles and favorite TV shows from childhood" (Garde-Hansen, 2011, p. 6). Increasingly an audience's understanding of personal and public history – but by these means also of the present and the future – is shaped and structured by what José van Dijck calls "mediated memories", comprising diverse items signaling the past, from photos, albums, letters diaries, clippings, notes, audio and video recordings (and nowadays also all their digital counterparts) produced by amateurs – and increasingly prosumers – or media professionals, which are collected and cherished by individuals and institutions (see Dijck, 2007). "These items mediate not only remembrances of things past; they also mediate relationships between individuals and groups of any kind […], and they are made by media technologies […]" (Dijck, 2007, p. 1). Thus oftentimes these media items are either related to specific events and trigger memories, or they capture and therewith translate an event into a media format such as text, image, audio or audiovisual media with all its characteristics and affordances.

[174] This role of a filter was traditionally taken over by journalism. However this role is challenged nowadays by the change from consumer to prosumer with easy publishing tools in the Web 2.0, which allows ideally everybody to easily publish something. Nowadays this filtering and sorting huge amounts of data is rather done by software (see e.g. Lev Manovich, 2013b).

As the relation between mediation of art and culture and the media ecology becomes evident, the question opening up at this point is how changes happening in the current media ecology affect the work of memory-institutions and cultural learning?

2. Database as Nexus for Digital Mediation of Art and Culture

The digitization and virtualization of museum practice strengthened the impact of the archive as central instrument for Mediation of Art and Culture and in addresssing necessary changes in the work of cultural institutions that arose with the changing media ecology. Open archives and shared data are an important basis for all activities around cultural heritage at large as well as for knowledge generation with and about art and culture.[175] Thus the database became an important agent on its own in any mediation process and can be seen as a nexus for the digital museum practice, which according to Merete Sanderhoff "[…] encompasses museum work that uses digital tools or is realised on digital platforms – i.e. everything from entering artworks into collection databases, digitizing works, building websites, developing digital presentation and interpretation efforts in the galleries, to webcasts of museum events, and the use of social media" (Sanderhoff, 2014b, p. 25). And also in the definition of digital cultural heritage from the area of IT research by Nina Zschocke, Gabriele Blome and Monica Fleischmann (2004) the database is central, as it is encompasses the digitization of archives and therewith the creation of a database which includes the digital reproduction and reconstruction of cultural objects, the preservation of digital data and the networking of information or knowledge. All these tasks can potentially be united within a database-framework.

In the 21st century databases became and will continue to be the major repository of individual as well as collective social memories. Gaining knowledge about databases gets all the more important as the information the users have access to and the

[175] Data in general became of increasing importance. Tim O'Reilly claims "Data is the new intel inside" (O'Reilly, 2005). He talks about Web 2.0 applications as "infoware", where he claims that the application does not only need to be backed by specialized data in order to function but, if the infrastructure is open source, data is what makes a service stand out between competitors. Lev Manovich (2013b) argues in a similar direction, that beginning of the 21st century data leaves the professional domains and becomes relevant and interesting for the society at large.

information they are able to actively retrieve shape the knowledge, predetermine what they are able to know. But often the knowledge available is driven by hidden archive politics of inclusion or exclusion at the stage of the collection, and – in the digital age – also politics and functions of search engines at the stage of retrieval: be it ranking algorithms such as Page Rank or personalization of search results, which are not obvious to many users. The following chapter will therefore discuss, how archives develop in mediated and especially digitized forms within today's participatory culture and knowledge society.

2.1. The Digitization of Archives

What happens to an archive when it is digitized? Or asked differently: What is a database? How does it differ from a traditional, analog archive? And how does it change the ways users access information or media?

As defined previously digitization can also be perceived as an abstraction process in steps leading from items to information, and finally to data. Following an argument by Lev Manovich (2001), analog "archives" are being transformed into "databases" with the digitization – the two terms will be used throughout this thesis almost interchangeably. Digitization has led to a format change in visual archiving with huge implications for the concrete usage but also for the structures and functions of contemporary visual archives. A database is in a very basic understanding "a structured collection of data stored in a computer system" (Snickars, 2009, p. 304). Lev Manovich (2001) argues, that with the development of automated media creation, such as photography, film, audio and video recording people accumulated an unprecedented amount of media material in their own archival structures, which in consequence led to "the need for new technologies to store, organize and efficiently access these materials. The new technologies are all computer-based – media databases; hypermedia and other ways of organizing media material such as the hierarchical file system itself; text management software; programs for content-based search and retrieval" (Lev Manovich, 2001, p. 35). In short after media production the media access became automatized. "The emergence of new media coincides with this second stage of a media society, now concerned as much with accessing and reusing existing media objects as with creating new ones" (Lev Manovich, 2001, p. 35/36).

Lev Manovich's thesis in his book "The Language of New Media" is, that the database is one of two main "forms" of digital media (see Lev Manovich, 2001, p. 218) besides the navigable space, both of which are "already traditional methods of organizing both data and human experience of the world itself" (Lev Manovich, 2001, p. 214)[176]. Or as Harald Hillgärtner puts it, in its core every computer is a database, which is central to understand the computer as medium (see Hillgärtner, 2008, p. 191). Jos de Mul calls databases "'ontological machines' that shape both our world and our world view" (de Mul, 2009, p. 101) with a computational point of view, as with the migration to the computer the forms of collection and navigable space incorporated the "computer's particular techniques for structuring and accessing data, such as modularity, as well as its fundamental logic – that of computer programming" (Lev Manovich, 2001, p. 214). Jos de Mul refers to four basic functions of any computer software, which are also at work in a database as a specific kind of software, and define the database ontology:

> The "[…] ABCD of computing consists of the operations Add, Browse, Change, and Destroy. Together these four operations – which correspond to the structured query language (SQL) commands Insert, Select, Update, and Delete – constitute the dynamic elements of what we might call a database ontology. In a basic sense the word 'database' can refer to any collection of items that is ordered in one way or another. In computing, a database can be defined as a structured collection of data records that is stored in a computer, so that a software program can consult it to answer queries. With the four basic operations all possible combinations of records can be retrieved in principle. Database ontology is dynamic, because the data elements can be constantly combined, decombined, and recombined." (de Mul, 2009, p. 99/100)

In Lev Manovich's definition a new media object does not necessarily employ such a highly structured databases as usually referred to in computer science, to which Jos de Mul hints.[177] In 2001 he referred to new media as a more basic form of database – to break them down to the least common denominator: "They appear as collections of items on which the user can perform various operations – view, navigate, search" (Lev

[176] „After the novel, and subsequently cinema, privileged narrative as the key form of cultural expression of the modern age, the computer age introduces its correlate – the database. Many new media [...] are collections of individual items with every item possessing the same significance as any other." (Lev Manovich, 2001, p. 218).

[177] in the sense of a structured collection of data streamlined for a fast retrieval and therefore not being a simple collection of data.

Manovich, 2001, p. 219). A database differs from a traditional collection of documents as "it allows one to quickly access, sort, and reorganize millions of records; it can contain different media types, and it assumes multiple indexing of data, since each record besides the data itself contains a number of fields with user-defined values" (Lev Manovich, 2001, p. 214). From this perspective it can be seen as a radicalization of the traditional archive or "Zettelkasten" (see Schoell-Glass & Sears, 2008). Storing digital data the archive items as well as the database in itself follow the key principles of digital media.

But as Wolfgang Ernst argues: "It is not the digitality of the so-called digital archive that is new, but the fact that what is involved is the binary code, the smallest information unit being the 'bit,' through whose duality words, images, sounds, and times are archivally encodable" (Ernst, 2010, p. 83). Lev Manovich (2001) referred to this circumstance as "numerical representation". The digital nature of its content affects the archive in different ways, for example with regard to the order of content. David Weinberger (2007) establishes three orders of order: The first order of order is the order of physical things themselves (books in a shelf, physical photographs in an image archive), the second order of order is a tool to enable to find physical objects and a tool which gives us information about an object (metadata). This can be for example an archive catalogue or "Zettelkasten". The objects and information about objects are separated this way. While the first two orders arrange physical objects, which have to follow the limitations of the physical world – for example one item can only be in one spot at a time, items take up space which limits the size of the collection etc. – the third order of order deals with digital data, which removes those limitations. In the relation to the order of data this can mean that digital data is not limited to one way of order, it can possibly be ordered in a multitude of ways and be dynamically rearranged and re-ordered.

The digitality has also implications for the accessability of data. As Weinberger describes digital access in comparison to the access of physical items: "Instead of making us walk long aisles, in the digital world everything is only a few clicks away. Instead of having to be the same way for all people, it can instantly rearrange for each person and each person's task" (Weinberger, 2007, p. 6). With regard to archives Wolfgang Ernst argues: „Archiving with analog storage media (for instance photographed texts on microfilm) has distinct advantages over digitization as far as quality and shelf-life are concerned. The strength of digitized archivalia lies not in their (highly vulnerable) migrability into the technological future, but in their substantially potentized present online accessibility. Longevity is rooted in the materiality of archivalia—discourse in their immaterial circulation as information" (Ernst, 2010, p. 90). Thus the accessability makes it possibly easier to know about the information encoded in data, but – provided a uniform way of access and methods of reuse and embedding, for example in form of an API as an encoded form of archive politics – also to easily embed the data into an ongoing discourse, re-contextualize it and generate new meanings on its basis. The possibilities defined in Robert K. Logan's principle „Ease of access to and dissemination of information" apply. And another access mode is made possible by the digitality of data, which is random access of linear, time-based media, such as film or audio. Another implication of digital archive content is its machine readability of the data and its metadata. Thus the public of such an archive does not only consist out of humans, but out of machines alike, which affects the way data is interpreted, activated, related as well as its retrievability through intelligent search algorithms due to the processability of the data.

In a database it is not only possible to store data but also to actively (manually by humans on the basis of knowledge) and passively (algorithmically, based on automated or semi-automatic semantic analysis by computers) establish relations between the data, which is in itself a re-contextualization, and produces information dynamically through algorithmic analysis and processing of the data[178] instead of referring to static data as traditional archives do.[179] The linkage is inherent within the design of relational databases[180], which "are extremely flexible, because they enable the users to define queries that were not anticipated by the database designers" (de Mul, 2009, p. 100). "The new archive's task is to meaningfully link up different information nodes […]. […]

[178] This is referred to as data mining, which "enables the automatic classification, cluster, and finding of associations between the clusters in large amounts of clean data from which to extract information" (Rusinaite, 2010, p. 329).

[179] The price to pay is the eventual loss of information – especially related to materiality, feel, space, experience of interaction in an environment or the like, which is if possible replaced or described by metadata – during the digitization-process.

[180] The relational model is not the only existing model for electronic databases. "From the 1950s on new types of electronic databases have been developed, the hierarchical model in the 1950s, the network model in the 1960s and the relational model in the 1970s. The last model, which is based on predicate logic and set theory (Codd 1970), contains multiple tables, each consisting of a 'flat' data- base of rows and columns"(de Mul, 2009, p. 100).

It is no longer a question of reactivating objects here, but of relations" (Ernst, 2010, p. 84). Thus Ernst establishes the understanding of a database as a network and compares it to the networked structure of the World Wide Web, which is not defined by its content but by its protocols, its infrastructure. In the same way "[t]he primary operations of the archive are no longer the contents of its files, but rather their logistical interlinking […]" (Ernst, 2010, p. 84/85), the relation of documents or raw data.

By comparison to the traditional analog archive, the digital archive or database becomes even more an "arbeitende Struktur"[181] (see Ernst, 2002b, p. 144), which is internally constantly in flux. Joanne Garde-Hansen (2011) and Wolfgang Ernst argue that the archive moves away from the read-only memory towards "a generative, participative form of archival reading" (Ernst, 2010, p. 81). "[N]ew archives are successively generated according to current needs" (Ernst, 2010, p. 81), which can also involve linking up several formerly disparate archives into a bigger structure resulting in a broader basis for search the ability to crosslink relevant information. This is happening for example within national or subject gateways such as Europeana[182]. Besides the fact that prosumers are easily able to build and feed "archives" by virtue of available Web 2.0 applications for content creation and sharing[183], which all have a database-structure in their backend, the participative aspect comes into play in the fact that "[t]hrough their queries, users then create further archive elements to be digitized and stored. With the aid of agents and filters, the object-oriented archive thus takes shape cumulatively. […] Source-oriented stock and classical file-oriented archive practices yield to the use-oriented ('to be completed') 'dynarchive'" (Ernst, 2010, p. 81) [184]. The main focus is not so much on the storage of content anymore but it is focused on the ease of data retrieval (see also Lev Manovich, 2001, p. 35), which is determined by underlying technology and by the interface, which usually hides the internal

[181] „working structure"

[182] http://www.europeana.eu

[183] An example of an archive fed by a commnity is the „Archive of Digital Art" (ADA) – https://www.digitalartarchive.at/.

[184] Ernst relates the dynamism of "digital archives" and their temporary restructuring through queries to the processual memory concept, which is inherent in the so called "von Neumann architecture" of a computer: "namely, a principle of memory […] that facilitates self-accessing of temporarily stored data during computation itself […] —a dynamic memory culture in contrast to resident archive memory, which is updateable but not permanently and dynamically regroupable" (Ernst, 2010, p. 82).

structures of the archive, and a fast and targeted access to information. Dynamic information rasters and new search methods emerge, "that go beyond the rigid indexes of traditional finding aids" (Ernst, 2010, p. 81). These new methods can include the use of software agents for the automation of the search process for relevant information (see Lev Manovich, 2001, p. 35), media related searches beyond text, such as searching for a particular image or sound by a visual or auditive example[185] or for images or video sequences with a specific semantic content[186] [187].

All these facts on digital data and archives merge in the 'superstructure' of the Internet, which nourishes the old dream of mankind of a homogenous storage of all knowledge. The dynamic structures described for databases are also inherent in the architecture of the World Wide Web. As Wolfgang Ernst writes:

> "In 1991 Tim Berners Lee defined the new medium for communicating scientific information as no longer the static accumulation of dossiers but (directly in line with Ted Nelson's hypertext vision) as the dynamic connection of documents and links. While their indexes are primarily search-oriented, unlike traditional archive repertoires they are not passive but themselves constitute a logistical document containing links to the pertinent data records —a finding aid in the documents themselves, a self-referrent archive" (Ernst, 2010, p. 85).

Also Christiane Paul argues that "[t]he Internet is a network where a different context is always only one click away, and everyone is engaged in a continuous process of (re)contextualizing. Linking to and commenting on other websites creates information filters, portals, and new contexts" (Paul, 2010, p. 103). Thus databases, which are made accessible online, become part of an environment, a network of dynamic and potentially ever changing contexts. Therefore they ideally form an inter-network of

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[185] examples are TinEye (http://www.tineye.com/) or Soundhound (http://www.soundhound.com/)

[186] A research group from University of Bremen and Jacobs University under the management of Prof. John Bateman – including Prof. Dr. Marion G. Müller, Dr. Ognyan Seizov and the author of this thesis – was researching amongst others on the automatic recognition of image motifs and narrative structures in films for later retrieval in the project „Visual–Film–Discourse: A Novel Integrated Approach" (2008-2011). The project was generously funded by the German Federal Ministry of Education and Research (BMBF). For further information see http://dm.tzi.de/en/visuals-film-discourse/.

[187] These methods are made possible by the processability and algorithmic analysis of the media data. For further information on image search please see for example the book "Suchbilder" (Ernst, Heidenreich, & Holl, 2003).

networked data that in reality is mostly in need of translation between the different data structures of the various connected archives or collections in order to work – an entity that is at the core of a subject gateway. Moreover online content can be seen by a larger trans-local, potentially global community and according to Paul is „ archived indefinitely (until some party fails in sustaining it)“ (Paul, 2010, p. 103). But can the Internet including its layer of the World Wide Web and the Web 2.0 services actually be referred to as an archival structure?

2.2. Does the Internet Have an Archival Structure?

Nowadays users use archival practices and mechanisms on a daily basis, integrated in their everyday life and in diverse software services on the Web as well as offline. Using the Web they collect all the time. They accumulate URLs into lists of bookmarks, maybe even organize them and share them with their peers using services such as Delicious[188]. They accumulate documents and notes in read-later-lists such as Pocket[189], in note taking applications like Evernote[190] or citation managers such as Mendeley[191]. Users compile playlists and favorite lists on our preferred video sharing of photo sharing platforms[192], associate their content to groups of similar or related content for example on Flickr, which can be called collaborative collecting. They subscribe to RSS-feeds and therewith pre-filter the content they are reading. They connect to diverse people on social networks, and this selection with regard to the virtual social network users surround themselves with on diverse platforms predetermines the personal opinions and content selections they are exposed to socially. And there are software agents which voluntarily or involuntarily collect data about the users in order to create profiles of them, their behavior, their preferences or our location and decide on this basis what content would be most relevant for them at a specific moment and that they therefore should see first or that they should see not at all. These agents might recommend what else could be interesting for the users in

188 https://delicious.com/

189 http://getpocket.com/

190 http://evernote.com/

191 http://www.mendeley.com/

192 video: for example YouTube (www.youtube.com), Vimeo (www.vimeo.com); photo: for example Flickr (http://www.flickr.com/), Picasa (http://picasa.google.com/) or Instagram (http://instagram.com/). A lot of these services converge photo an still image sharing.

question. Users create folder systems, filter mechanisms, add metadata and keywords to all kinds of files, from notes, over documents, photographs, music or videos locally on their computers or in web applications in order to sort these files and make them retrievable. A lot of the mentioned services do not only include data sharing and annotation capabilities, but also production and editing functions as well as social and community components, which allow users to interact with the media material through liking, commenting, sharing, interlinking. Thus the contextualization of data, the building and extension of content- and data networks, relations and meaning making of data is integrated in general use cases of social media applications and in the user's daily routines. On this superficial level one could argue that a lot of archival practices can be found in one'sa daily use especially of web-based or web-extended infoware applications.

According to Lev Manovich (2001) different web-sources like home pages, search engines, web-based TV, etc. can all be seen as collections of photos, texts, links, moving images, etc. put into a specific structure. "A site of Web-based TV or radio station offers a collection of video or audio programs along with the option to listen to the current broadcast, but this current program is just one choice among many other programs stored on the site" (Lev Manovich, 2001, p. 220). Thus where in the first case the structure of the Web itself becomes a multimodal structure of media objects, which stem from a database of media and are brought in relation to each other[193], the website moreover offers different modes of access to memory simultaneously in the latter case: from live-broadcast[194] to archived media content. All in all he sees the Internet as a medium "[w]here the database form really flourished" (Lev Manovich, 2001, p. 220).

Manovich seems to use the term Internet synonymously with the term Web or Web services at this point. Because if one looks at the core Internet as a network technology, it can hardly be seen as a storage medium but it is rather a medium of transmission which only permits temporary storage of the data packages travelling on the network from one destination to the other and is moreover limiting the lifetime of data on the network (see e.g. Warnke, 2002, p. 271ff). And also Wolfgang Ernst argues:

[193] Lev Manovich (2001) refers to this as modularity in his five principles of new media.

[194] see my references to Jaques Derrida (1995) and Joanne Garde-Hansen (2011) in the previous sub-chapter.

> "If we disregard the metaphorical use of the word 'archive' for all possible forms of memory and cultural memory, and use it to mean the specific agency of a memory technology, then the Internet is not an archive. Yet the Internet constitutes a new type of trans-archive already present in Ted Nelson's conception of hypertext and hypermedia: a dynamic archive, the essence of which is permanent updating […]" (Ernst, 2010, p. 85).

It is important to keep in mind that according to Wolfgang Ernst "Net archives are a function of their software and transmission protocols rather than of content, to which technology is indifferent" (Ernst, 2010, p. 85). Thus instead of storing data, the Internet and Web technology and its protocols and indices store the connections between data, the hyperlinks, and this comes into full bloom in offerings of the Semantic Web and search engines. In Ted Nelsons concept of hypermedia each side of the link would know about its linkage and thus something like link rot is not possible – one of the challenges with changing contextualization in an online environment, according to Christiane Paul (2010), which can lead to a loss of context of web data. The latter is frequently the case in the current implementation of the World Wide Web, which on the other hand is less costly with regard to resources. This mechanism does however not comply to the classical role of preserving content, data and therewith possible archive-contexts long-term, which an archive usually fulfills.

In contrary: the Internet operates on a different temporal structure than the archive. The archive as a technical practice of data storage changes with the digital culture "from archival space to archival time, in which the key is the dynamics of permanent transmission of data" (Ernst, 2004, p. 46), and thus has only become a metaphor. Where archives work on a macro-temporal structure covering a rather vast temporal span, online media operate on a internal micro-temporal structure and are driven by actuality. This is the result of different modes of content production and the content variability, to say it with Lev Manovich's vocabulary. "The archival infrastructure in the case of the Internet is only ever temporary, in response to its permanent dynamic rewriting. Ultimate knowledge (the old encyclopedia model) gives way to the principle of permanent rewriting or addition (Wikipedia). The memory spaces geared to eternity are replaced by series of temporally limited entries with internal expiry dates that are as reconfigurable as the rhetorical mechanisms of the ars memoriae once were" (Ernst, 2010, p. 86).

Not long-term availability but "actuality" of content plays a great role in two ways: time-based sorting mechanisms and structures, reflected in social media interfaces such as the timeline, in their basic concept favor new entries to old ones[195] – even though the purest implementation of the timeline interface can be found mainly on blogs. But there is another aspect of actuality, namely the algorithmically assumed situational relevance. The latter becomes important especially with localization of search and data (see Gordon & de Souza e Silva, 2011) as well as the use of mobile media devices and is a result of customization and personalization efforts. For this concept time is not necessarily the most important factors for the relevance of content, but competes against location or personal interests of the user. And of course also sponsoring of a specific company or other economical and algorithmic influences affect the actual ranking of search results[196]. Thus to the classical archival ordering systems of pertinence and provenance – which according to Peter Haber (2006) are not that strictly separated in digital orders of data, but rather can be mixed – the temporary system of temporal and local relevance is added[197]. The results of these systems of order are perceivable by humans as well, even though they can be algorithmically influenced knowingly or unknowingly. However in the technological structure of the Web exists another layer of order which is only machine readable. This layer includes for example the relations between data in a database such as semantic relations

[195] As this is true in principle, this has lately become more complex as well, since for example Facebook has introduced filtering and algorithmic ranking of status updates in the news feed, which was until August 2013 hardly openly discussed (see Yeung, 2013). The user has a fuzzy influence on the importance of a person in his feed as he can favorite the person and can decide if he wants to see „All Updates", „Most Updates" or „Only Important" updates, which is a rather fuzzy categorization and leaves a lot of interpretation to Facebook. And of course one has sponsored status updates sprinkled into the feed, an additional advertisement to the ads in the sidebar. In August 2013 Facebook introduced two new factors for newsfeed ranking: „Story Bumping" and „Last Actor" (see Wiese, 2013a; Yeung, 2013). „Story Bumping" ranks stories more on top, which the algorithm beliefs we might have missed at our last look at the news feed. The „Last Actor" principle determines, which people show up in our newsfeed at all. According to Wiese the last 50 people and pages we interacted with on Facebook get a special status with regard to inclusion in the feed (see Wiese, 2013a).

[196] For more discussions on online search see for example the conference series „Society of the Query" by the Institute of Nework Cultures, Amsterdam (http://networkcultures.org/wpmu/query/).

[197] Even though the question is, which status these search results have with regard to the archive concept, which is thought towards the future. They are a temporary outcome of queries involving stored data or information – as much in flux the data is as well, as the each query itself even adds to it. Thus it is a temporary activation of archived material. But this activation is for immediate consumption and might only of temporary relevance. The results are also not stable, as due to the fluid nature of the database, the constant change, the next search with the same parameters might bring a different result already. The pace is much quicker.

encoded in the RDF-format – a standard format for semantically linked data. But also relations established by algorithmic analysis can form machine-readable metadata or pointers within a database.

A change to the Internet environment in relation to the storage-aspect of archives came about with the concept of "cloud computing", which is very prominent since a few years and describes the virtualization of resources, for example data storage[198] or applications[199] by the use of an internet-infrastructure. "With the emergence of standards-compliant Web services and dynamic cloud computing, massive data sets can be shared and accessed across networks. Web services are essentially machine-to-machine communications that allow various types of data to be accessed through specific queries" (Burdick et al., 2012, p. 57). Basically this means that data is stored and processing is done in huge datacenters – connected to the user's device via the Internet – and not on the private computer, which allows the computing power of private computers to potentially decrease – a trend which started with the hype of cheap netbooks and continued with the tablets and the increasing number of smartphones users with comparably small internal storages as access points for data and services from the cloud (see also Snickars, 2009, p. 296)[200]. Through media-sharing-sites like YouTube or Flickr media-storage is increasingly moving online. Where the Internet stays a medium for data-transmission, it now paves the way for

[198] e.g. through services like Amazon S3 (http://aws.amazon.com/s3/) or Dropbox (https://www.dropbox.com/).

[199] examples are web-office-programs like Google Drive (http://drive.google.com, which combines editing with storage), media editing tools like Adobe Photoshop online (https://www.photoshop.com/) or even whole „web-operating-systems" such as glideOS (http://www.glidedigital.com/) or eyeOS (http://eyeos.org/).

[200] Snickars also described a contrary movement in the beginning of the iPod culture, where the size of the internal storage was an argument for sales besides the well designed interface. With 160 GB of internal storage in the iPod classic one could possibly hold ones entire music library and have it available on the go. Thus Snickars argued „[t]he iPod culture could po also be said to be archival in nature" (Snickars, 2009, p. 305). Another example he brings up are e-readers such as Amazon's Kindle, which should bring you the library at your fingertips. Not only can one hold between 1100 and 2200 books on the device itself (depending on the model), but all the purchased books are available in the cloud as well and any book available in the Amazon content universe is a fingertip away with built in mobile data access (or WIFI) so that it can be purchased basically whenever there is data access. Snickars cites Jeff Bezos from Amazon with a quote that says that the ambitious goal of Amazon is on the long run they want to have every book, which was ever printed to be available on the Kindle within 60 seconds. Besides a purchazing model they also offer subscriptions, which amongst others allow a "lending system", which can be compared to instant streaming services for video such as Netflix (www.netflix.com).

services to provide a infrastructure for remote data storage and distribution / sharing, which also offers defined ways between different services to exchange and access each others data – so-called APIs.

Referring to Snickars (2009) cloud computing will have great influence also on institutional archives, amongst others, as they can't ignore the component of access because of its value-generation, even though their initial role is the preservation of content (see Snickars, 2009). Thus cloud-services could be an easy way to outsource huge parts of computing and storage costs for traditional archives when digitizing their assets and making them accessible online[201]. There were first collaborations also with social media platforms such as Flickr with the rise of "Flickr Commons", where archives can make available their visual material under the Creative Commons licence. But can platforms like Flickr or YouTube be considered archives?

As already argued before, the term "archive" is often used as metaphor for the digital media landscape in general and for different forms with regard to memory and storage in specific. And according to Pelle Snickars "[m]edia archive websites such as YouTube and Flickr are symptomatic of the way in which the Web is recasting today's media forms in an archival direction" (Snickars, 2009, p. 303). The same could be argued about file sharing services as well as instant streaming services such as Netflix for video and Spotify[202] for music, which move the users' video- and music libraries online. While all media sharing platforms and instant streaming services incorporate basic archival practices such as storage, providing access to data, interlinking and order of the data to ensure findability, they go beyond what an archive usually does in some ways and fall short in others.

As first point the access to content is transformed. As Geert Lovink argues with regard to YouTube: "We no longer watch films or TV; we watch databases" (Lovink, 2008, p.

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[201] Pelle Snickars is pointing out some crucial factors for such a move: such as Internet connection speed, reliability of the hardware and the Internet Service Provider (ISP), the questioning of permanence with regard to digital storage formats, which is often criticized. An alternative to the „public" cloud is offered by the popular Linux distributor Ubuntu (www.ubuntu.com) with the „private cloud", running on your own hardware, or a „hybrid cloud", which can outsource storage and processing to public cloud services if needed (Canonical Ltd., 2013).

[202] www.spotify.com

9). The software and hardware interfaces define how a user can find, access and interact with the content and also plays an integral role in the meaning making process. In general one finds two main modes in interfaces for data access: search and browsing – both freed from physical constraints, usually visualized by a GUI (graphical user interface). The first retrieves content on basis of search terms or other media search examples. Depending on the configuration of the search engine a search is more or less accurate. Browsing is less targeted. The users are traversing content from a starting point, lead by relationships of data, by system recommendations[203] and by their interests. YouTube enhances the archival functions by giving the user the possibility to comment on, rate or share the items for them to become part of the social recommendation system. That makes the platform a "community space" in the terminology of Lawrence Lessig (2008), and not an archive, which according to for example Wolfgang Ernst and Aleida Assmann does not combine data and meaning making in itself.

If one looks at the aspects of preservation and therewith ensuring access to history, Rick Prelinger (2009) gives a definite answer by stating that platforms like YouTube are not archives, as preservation is neither their mission nor their practice. What is allowed to remain on the platform after the initial upload remains a corporate decision also influenced by big corporations, who hold copyrights to some copyright restricted materials and thus demand their deletion, as well as users who might feel offended by specific material and thus flag it as inappropriate[204].

Another difference between social media platforms and institutional archives is the quality of material. Where archives are usually committed to offer high quality material, but then limit the access to it, YouTube offers instantaneous access, but often in reduced quality – even though by now the quality of YouTube videos has increased a lot in comparison to 2009 when the statement was written. Prelinger calls this the "permanent preview mode" (Prelinger, 2009, p. 271). However he makes the argument that for the public these distinctions do not matter. "When hardly anyone remembers

[203] In YouTube these can take for example the form of a sidebar with suggestions.

[204] For an analysis of the mechanism of flagging system of YouTube see the essay of Minke Kampman (2009). For a history of deletion see Jens Schröter's essay „ Notizen zu einer Geschichte des Löschens" (2004). See the essay „Navigating YouTube" by Frank Kessler and Mirko Tobias Schäfer (2009) for a general discussion of different YouTube features with regard to archival practices and information management.

the distinction between film and video; when a soon to be majority of younger people has grown up in an environment where video is born digital; and when degraded low-resolution and immersive, high-quality media coexist without conflict the fine points of archival definition disintegrate into noise" (Prelinger, 2009, p. 268).

Prelinger rather argues that "YouTube might as well be an archive; that in the public mind it is not simply an archive but an ideal form of archive; and that it problematizes and threatens the canonical missions of established moving-image archives throughout the world" (Prelinger, 2009, p. 268). In his argument YouTube is nearly to be read as a critique to the little efforts of big institutional archives to make their material accessible digitally, and especially their "reiterating what seem to be eternal cultural divides between access and openness, between control of records and proliferation, and between casting archivists or archival users as central figures in archival practices" (Prelinger, 2009, p. 268). Prelinger describes common worries of archives with regard to digitization: the worries about copyright holders, losing full control over the collections and qualification of the users. This results according to him in restricted access bound to specific institutions or the educational sector, as he states in 2009. In so far the private sector and commercial services at that time worked counter to what was generally perceived as an archive with radical openness: to access, to contribution, to meaning making and even to order by the move from taxonomy to folksonomy[205], a bottom up vocabulary in form of a set of keywords or so called "tags", to describe material. This builds up a set of vocabularies, which are not centralized and standardized – as is the taxonomy – but which stem from the actual subjective use of the people who tag the objects[206]. Being similar to the cataloging and documentation traditional archives perform, this crowdsourcing effort can in the best case go far beyond what archives could achieve with their specialized staff in terms of volume of annotated material, which in the end makes it findable and heightens the chance for it to be activated and part of the functional collective memory (see also Prelinger, 2009).

But collaboration is not limited to the collection and order of content, but extends also to the meaning making – also referred to as harnessing collective intelligence (see Lévy,

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[205] This is also known as collaborative tagging or social classification (see Wikipedia, 2013b).

[206] For more information on the dynamics of collaborative tagging see Halpin, Robu, Shepherd, & Hall (2007).

1997) – which can be traced in discussions (such as the discussion pages of Wikipedia) and in the comment space of social media platforms such as YouTube. Moreover the publication of institutionally or corporately validated and valued material – uploaded either by the institution itself or in a user-curated process by other users – next to prosumer-generated material, which might remix the institutional material, adds value to the prosumer-content. This happens amongst others by showing up next to each other in search results and makes according to Prelinger (2009) commercial platforms so attractive to the prosumers. This process can be seen as another media specific form of meaning making, of activation of the archive material. The source material is published directly in the context of its activations and re-contextualizations. A different way of re-contextualization outside of the host-platform is to embed the media items in other webpages, for which most sites offer easy to use features. On top this practice widens the reach of the media items and heightens their accessibility.

Rick Prelinger closes his 2009 essay with a call for action:

> "YouTube implicitly recognized that archives were not the end of the media lifecycle, but rather the beginning. Corralling the labor of millions of users to curate, select and upload videos from every kind of source, YouTube new gave life to the moving-image heritage and exposed archival material to a vast audience. It is now up to the archives to decide how best to fulfill their canonical mission" (Prelinger, 2009, p. 274).

And indeed some things changed since then. The rise of these models of commercial platforms led subsequently also to a slow but steady adoption of social media mechanisms by cultural heritage institutions. This starts with the advent of more and more online collections on museum websites, making the collections visible in a very basic form, to subject gateways such as Europeana, bridging hundreds of European collections, fostering the digitization of cultural heritage material and making it searchable, accessible and reusable not only on their platform but also via an API.

This discussion is based on a rather small convolute of essays dealing with this topic. But in general the literature is at a consensus that neither the Internet nor webbased platforms nor cloud-services are archives in the sense of the classical definition. The closest they could come would be to denominate them quasi-archival or neo-archival practices or call the social platforms like YouTube a repository. But all these analogies and comparisons fall short to describe the novel characteristics of these practices and services (see Kessler & Schäfer, 2009, p. 277). Also the database as digital archival form shows some fundamental differences from what was previously conceived as archive, strengthening relations and dynamic order and with its operation on digital data all the characteristics of these media objects discussed previously. To move forward with digital museum and mediation practices based on archives, it makes sense to follow Frank Kessler and Mirko Tobias Schäfer (2009) in their argument to let go of comparisons and see these Web platforms and services as database driven digital media practices in their own right and with their own characteristics and functionalities that focus on the manipulation value and value of immediate possible interactions with the cultural data, rather than on preservation and longevity.

VI. Data-Based Practices of Mediation of Art and Culture

The previous chapters defined the characteristics of digital media, which contain the database as a cultural form. Part IV defined mediation of art and culture and different basic approaches and settings and examined the changed media ecology and consequences for the museum practice and its digitization. Part V looked at the archive as an important actor, the backbone in the mediation process. Lev Manovich's argument in his 2001 publication that cultural institutions like libraries and museums are replaced by databases might go a bit too far, but there is an agreement in the literature on the fact that "a computer database becomes a new metaphor that we use to conceptualize individual and collective cultural memory, a collection of documents or objects, and other phenomena and experiences. Similarly, computer culture uses 3-D navigable space to visualize any kind of data – molecules, historical records, files in a computer, the Internet as a whole, the semantics of human language" (Lev Manovich, 2001, p. 214). The database and 3D navigable space (on the computer) have become cultural forms in the meaning of "[…] general ways used by culture to represent human experience, the world, and human existence in the world" (Lev Manovich, 2001, p. 215) in a digital format. Thus however these new developments are called with regard to archival practices and digital culture one can clearly see that the Internet and digital practices that come along with it extend "the classical space of the archive, library, and museum by an extra dimension" (Ernst, 2010, p. 86). Moreover databases and the practices based on them are deeply changing the way mediation of art and culture and cultural heritage works. At the same time these digital practices are extending and transforming the analog mediation practices. Thus the archive, or better said its digital form – the database – are indeed the nexus for the move from mediation of art and culture to its digital practices: **Digital Mediation of Art and Culture.**

A media notion of the term mediation widens the scope of what mediation can be in relation to culture that was discussed in Part III. In relation to media we have to move away from understanding mediation practices solely in relation to cultural learning and educational practice, but need to open it up towards mediation in the sense of translation, transformation or representation for example of the real world items or events into media as well as one medium into another. The latter is also referred to as remediation (Bolter & Grusin, 1999). Lev Manovich uses in "The Language of New Media" the term "representation" in the way that media – and especially digital media – "represent, as well as help construct, some outside referent: a physically existing object, historic information presented in other documents, a system of categories currently employed by culture as a whole or by particular social groups" (Lev Manovich, 2001, p. 15). Taking the literal meaning of re-presentation, one can see it as another presentation of an artistic project or a cultural object in a translated form, employing a different kind of display than in its original presentation. This ideally enables a "meta-encounter" with the cultural object (see Wiencek, 2012a). In that sense media can be understood as a display of art and culture, for past and presence in their own right.

Thus mediation of art and culture also encompasses the practice of translating art and culture into a mediated form, for example in the practices of formal or informal documentation (Depocas, 2001; see e.g. Depocas, Ippolito, & Jones, 2003; Fauconnier & Frommé, 2003; Grau, 2004; Rinehart, 2007; Vanegas, 2010; Wiencek, 2006, 2012a, 2012b), reproduction (see e.g. Benjamin, 1936; de Mul, 2009; Latour & Lowe, 2010; Trant, 2010) or remediation (see e.g. Wiencek & Lauke, 2011). For ephemeral artistic practices these mediation practices become vital for their preservation (see Daniels, 2004; Depocas, 2001; Paul, 2007a; Wiencek, 2009, 2012a), but they can also be important for cultural heritage at large, for example in form of a mediated restoration or reconstruction of built cultural heritage. These documentations and mediations can serve as basis for research and moreover allow the public to get an impression of a lost building and maybe even interact with it in a mediated form. In fact mediation practices can evoke the memory of almost anything, which is not directly experiencable anymore, by reusing and therewith activating archive data and bringing it to peoples' attention keeping this piece of history alive and in the collective memory. But the "translation into a mediated form" also refers to the mediatization or medialization[207] of the already defined mediation practices, emphasizing media as the

[207] Here I refer to the German meaning of these terms as "metaprocess by which everyday practices and social relations are increasingly shaped by mediating technologies and media organizations" (Livingstone, 2009, p. 4) (see also e.g. Krotz, 2001, 2007). The German terms "Mediatisierung" and "Medialisierung" are used synonymously by some, others use these terms to name concepts, which differ from each other, amongst others by the use of the term media, the understanding of Communication as discipline. For a detailed analysis see the article on "Medialisierung" by Michael Meyen (2009).

"in-between" between material cultural goods and the audience and provide an interface to interact with art and culture. Looking at mediation in this broader sense also means not to reduce the practice of mediation of art and culture to (museum) education, but rather perceive it in the sense of knowledge generation on the basis of art and culture in general, be it inside or outside of institutions, face-to-face or mediated.

As in today's world digital media are deeply integrated into the daily life, one cannot look at digital media and the physical world as a dichotomy anymore, but has to see them as deeply intertwined. Digital practices can evoke acts in the material dimension (see e.g. Hayles, 2002). Hence it is important to gain a deeper understanding about these novel practices enabled by digital media and how they transform previous practices with their affordances and characteristics.

The main questions therefore need to be what kind of (new) interfaces do digital media and especially cultural repositories as software products provide for art and culture? What kind of digital mediation practices emerge out of the discussed setting? What interactions do they allow the user or visitor and what is the manipulation value these approaches and the software offer? How can the collected data actually be activated in different interfaces for art and culture? And how can the previously outlined challenges affecting cultural institutions and cultural heritage at large be addressed by data-driven practices, forms and projects of digital mediation?

This chapter is going to present and discuss a trajectory of mainly webbased practices. The hypothesis of this thesis is that online repositories, -platforms and websites or webapplications play a central role in the practice of mediation of art and culture. In fact they are a specific form of digital mediation and digital museum practice. The specific questions to answer in this chapter are: How can they potentially act as technological agent for mediation? What tools do they offer? How do they allow participation and harness the manipulation value of digital media?

This part will start out with discussing classifications of repositories for cultural data and then analyze processes of meaning making within example repositories and platforms and their software interfaces. Throughout it will highlight web-based approaches for cultural learning in the museum and gallery context that utilize or depart from meaning-making mechanisms of cultural repositories.

However the chapter will not cover the full breadth of existing possibilities, but will give a good insight into current digital data-centered practices and strategies for the activation of cultural data, which will allow to pinpoint the changes of the move from analog to digital practices of mediation of art and culture, and the benefits and potential pitfalls of using digital media and their characteristics to their strength. Moreover the examples will allow to develop a preliminary definition of what data-driven practices of digital mediation of art and culture entail.

1. Classifications of Online Repositories and Platforms for Cultural Data

Looking back on the developments with regard to data-driven mediation, several key facts come to mind: a growth with regard to online learning and learning resources both in K12 and higher education, along with the demand of the learners to determine what, where and when to learn and access information; the rise of Web 2.0, also known as social media along with social recommendation systems as key currency (see Rogers, 2010), and a deep integration of social media platforms in the overall Web-ecology; the upcome of semantic web and machine-readable information as well as locative approaches made possible through a new class of mobile devices – smartphone and tablets – which along with an ideally always accessible mobile internet connection can bring networked information into new locative contexts.[208] Reacting to these trends in the Web-ecology a diverse range of online resources and cultural repositories developed in the 2000s.

The art historian Gabriele Blome, introduced a differentiation of online archives in a presentation at the European Media Art Festival 2009 as a part of her work for the project "GAMA: Gateway to Archives of Media Art". She distinguished distributors, institutional archives, archives in scientific context, collaborative online platforms and educational platforms (see Blome, 2009). Building up on Blome's basic categories the thesis will distinguish the following types of online repositories for cultural data to be discussed in the following section: commercial platforms and repositories, institutional archives and collections, national and thematic aggregators, collaborative platforms, social media platforms, self archiving as well as art discovery platforms.

1.1. Commercial Platforms and Repositories

Commercial platforms and repositories such as distributors or galleries focus primarily on sale and distribution of works but also serve as information resources and in parts adopt social media like features, which allow community building of artists and

[208] For a more in-depth discussion see Part IV.

collectors. An example is "Saatchi Online"[209], which is an online platform started by the renowned London-based Saatchi Gallery with the goal to bring emerging artists and

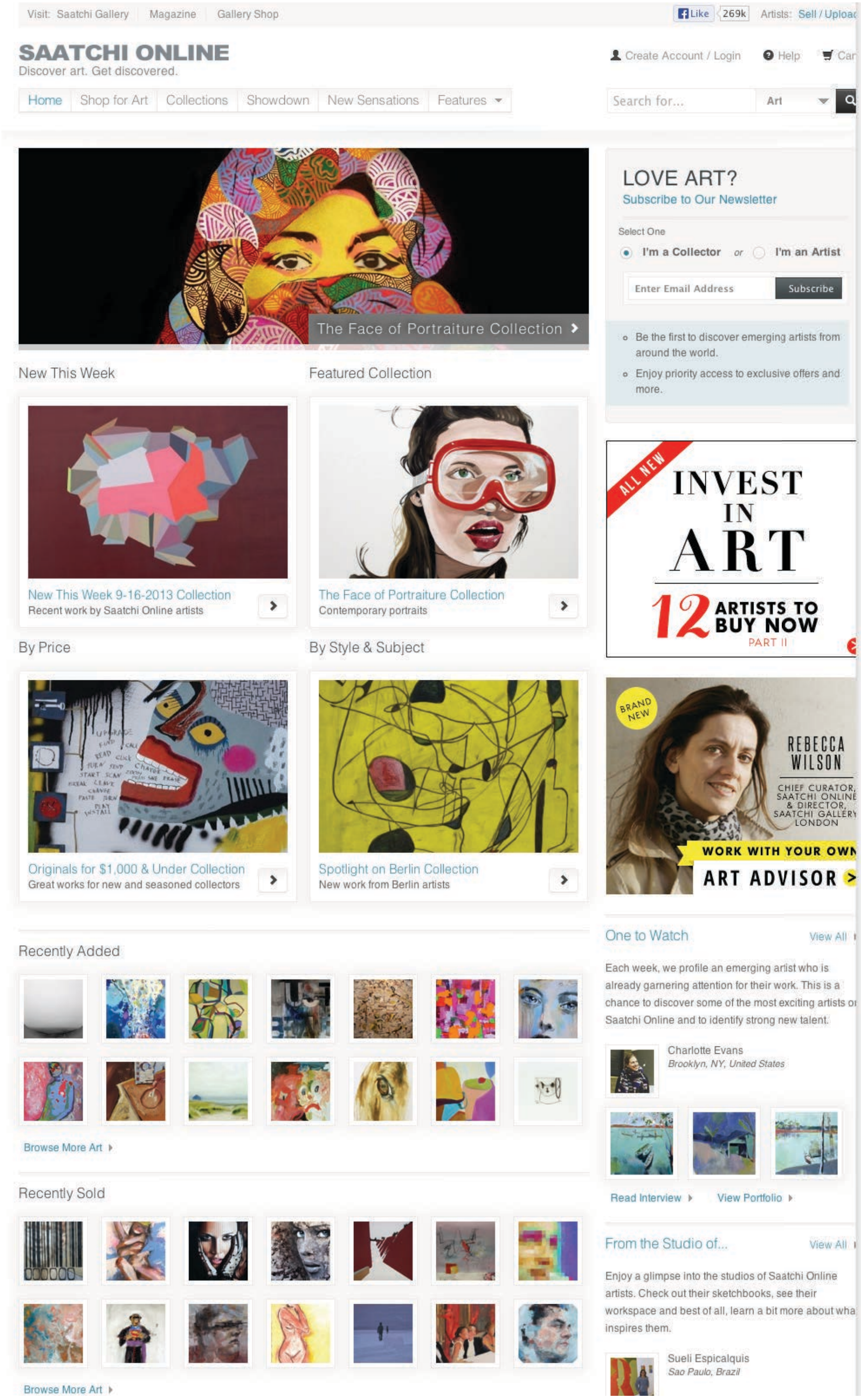

Figure 11: Screenshot of Saatchi Online from 18.09.2013

209 http://www.saatchionline.com/

collectors together. Saatchi understands it as an extension of their physical galleries: a curated environment, which should reach a wider audience of potential art collectors and collector novices[210], and make it easy for anyone to buy emerging art – direct delivery from the artist's studio to the buyers doorstep included. The artists manage their own portfolios and pricing. Therewith the web platform allows bypassing the formalities of the traditional gallery structure and leaves the impression of playing the same role for the artworld as Amazon is playing for books. Thus the platform is a marketplace for artists to sell their works and for collectors to gain insider access to new talents and be able to invest into them.

Besides being a marketplace, the platform is also a social network where a user can log on in the role of either a collector or artist. Both roles can upload either their own or collected work into a portfolio – in order to sell the works – give information about themselves and their work, education, link to other web-presences, and connect to other collectors and artists in order to get into direct contact. The platform also offers the regular social network interactions such as liking an artist or artwork, personal messages, commenting or sharing. Another feature of personalization is the ability to get personalized recommendations on the basis of a user's preferences. They are determined by having the user rate a number of artworks – a feature known from video-streaming or music-streaming services. Moreover the users can compile collections of works, which are either their public or private portfolio, or a group of images that curators, artists, or "collectors"[211] assemble for themselves or to share with the community.

Additionally to community driven content the "Magazine" section as well as curated collections offer curated content and therewith further the contextualization of the works in the database. A curated collection is compiled either by Saatchi Online curators, or by guest curators, who are also introduced in the "curator spotlight" as personalities of their own. In that way the platform resembles again a physical gallery space in its mechanisms. The magazine contains a section "one-to-watch artists", where each week one emerging artist is featured, who already garners attention. With

[210] For novices they even offer a brochure „How to Collect Emerging Art in 7 Easy Steps" (Wilson, 2013) upon subscription, and they make this a large part of their social media advertisement.

[211] „Collector" is a user-role, which conglomerates any user who is not an artist.

this section the site wants to help collectors to identify strong talents. Moreover each week a "studio visit" at an artist's studio is featured. This article format contains an interview with the artist, images from the artist studio with his/her work, "works in progress", a depiction of the "tools of the trade" of the artist as well as looks into the sketchbook. Thus in order to drive sales the platform engages in content marketing as a web-counterpart to regular events in offline galleries.

This is just one example of many emerging platforms that are disrupting the art market right now with business models coming from the music and film. "Sedition"[212], for example, is offering a subscription and streaming model similar to Spotify or Netflix, where subscribers can watch a stream of 12 selected artworks, that are updated weekly. Moreover users can buy digital limited editions (under 500) of artworks either curated by the platform or submitted by the artists for sale. These can be viewed within a walled garden environment on apps for smart-devices or the web-browser. The platform initially started to sell animated images, videos or JPEGs of works by famous artists, who initially created the works in different formats – from painting over sculpture to installation – in large editions for low prices. Later the platform introduced video-art as well as new media art and is at the time of writing focusing on art produced specifically for the platform, offering more and more smaller editions of emerging artists (Waelder, 2014). Thus the content moved from digital reproductions to forms of art that are natively experienced on a screen.

The goal of the platform is to provide a form of collectible art at a low price, which would make art and collecting art available to everybody. However the act of collecting and the product changed with the new business and distribution model. The collectors do not buy an artwork as a singular work or limited edition that they own and need to take care of, but they buy access to files representing the artwork and the right to experience and show it within the application environment of the platform. And also the artworks change their mediality, since a digital reproduction of a Damien Hurst sculpture or a non-interactive form of an interactive artwork offers a completely different experience than actually being able to experience works in their original form – even though Sedition is working on offering ways to allow interactivity in the works

[212] https://www.seditionart.com; similar examples of streaming distributions for art are FRM, Electric Objects, Meural, Depict, and DAD (see Waelder, 2016).

(see Waelder, 2014). And for performance art, for example, the makers of Sedition are – according to their director Rory Blain – experimenting with providing a “URL that will allow the collector to view it live and interact with it, and afterwards obtain a video file which will be the digital limited edition. So we’re getting closer to that interacting, real-time world” (Waelder, 2014).

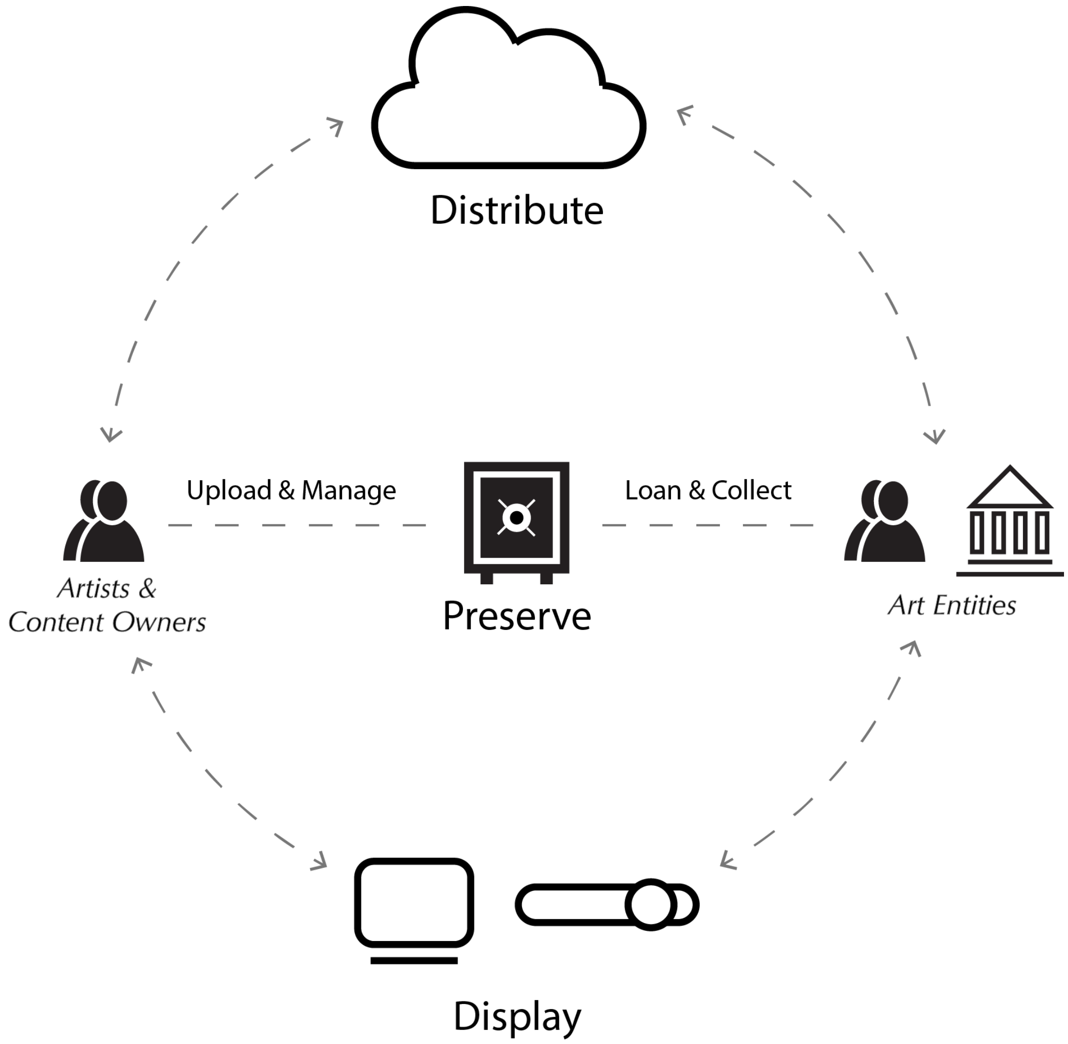

Figure 12: Niio End-to-End Workflow adapted from Niio (2016, p. 10). The graphic shows the centrality for preservation and the archive as nexus for all activities. Graphic by Florian Wiencek.

These new forms of distribution also have influence on the role of the database or digital archive and the preservation of these artworks. Since the collectors are not buying more than the access rights to the editions, the access to an artwork depends on the provider keeping a file of the artistic projects accessible on their server. Thus the online archive becomes the central point for the existence and access of the artistic projects or at least the specific versions distributed through the platform. And the collection of a collector can depend on the existence of a commercial company, that sold the work to him or her (see Waelder, 2016). Where this role is rather implicit with most providers, the platform Niio[213]puts the preservation and archiving of digital artworks at the core of their activity (see Figure 12). They aim to be an end-to-end provider, that gives individual artists as well as collections or museums the possibility to upload their master-files to the server for digital preservation and archiving of the files. They work with preservation specialists such as Ben Fino Radin (formerly working for Rhizome) in order to meet preservation standards. In its simplest form the service can be used as private backup and preservation. But in its core the platform is also a distribution, where artists and collection managers can register editions, manage copyrights and display rules and also categorize the artworks with curatorial meta-data. This allows to share the artworks with other people or institutions for exhibition and to rent or sell the artworks. The works are again displayed and managed within a proprietary application, thus the preservation, accessibility and transactions of viewing rights or files and therewith the digital marketplace depends on the existence of a private company and the possibility to run the software. Thus a private company and a platform puts itself into roles that were before separated between artists, galleries and museums or collections, as their service comprises of safekeeping, preserving and distributing and exhibiting artworks. The platform acts moreover as intermediate between these agents. Therefore the preservation, the distribution as well as ways to interact with and exhibit the works are controlled within a single proprietary technological and software infrastructure of a commercial platform and repository.

1.2. Institutional Archives and Collections

Institutional archives and collections concentrate on the documentation, showcasing and exploration of their own institutional work and – if the institution has a collection – their collection. Therewith these web presences mainly serve as information resource about the work of and around an institution. Examples are the V2_archive[214] and V2_Knowledge Base[215] as well as the Ars Electronica archive[216]. The structure and

[213] https://www.niio.com

[214] http://v2.nl/archive

[215] http://knowledgebase.projects.v2.nl/

content of institutional archives, but also of museum websites, usually reflect and depict the structure and the work of the particular institutions and therewith reflects also a specific institutional point of view, as the author of this thesis has argued previously (see Wiencek, 2008). For a museum the collection is still the number one motivation for a visitor to come to a museum or to use its online resources (see Welch et al., 2013). Thus one of the main tasks of institutional archives and online collections is to make digitized collection items or documentation material available, retrievable and at best reusable beyond the physical boundaries of an institution for a potential global audience. Therewith these databases serve as invaluable resources for cultural learning and being activated, reused and contextualized in educational activities as well as research.

As Gabriele Blome and Gaby Wijers (2010), the former Head of Collection and Conservation at the Netherlands Media Art Institute, argued, an institution needs to "contribute continuously to the processes of fostering attention for their artefacts, and their re-contextualization" (Blome & Wijers, 2010, p. 52) , in addition to collecting and preserving these items. According to the authors, traditionally this task was in the ballpark of researchers, teachers or curators. Bart de Baere, director of the Museum of Contemporary Art in Antwerp (Belgium) stated already 2002, that "[p]reservation is not secured by conservation procedures, but by the continuous resumption of a web of meanings given" (de Baere, 2002, p. 106). Thus the institutions need to actively work against the forgetting and for the remembering of the collection items or the archived material. Therefore it is not enough that the data is present in a repository, it needs to be used, it needs to get attention to be remembered.

To foster the re-use use of cultural data the Rijksmuseum in Amsterdam (The Netherlands) decided to make 125000 masterpieces of their collection available as high resolution images on their new platform called "Rijksstudio"[217], launched in 2012. The site offers the user to search or explore the collection online, deliberately abstaining from presenting rich information and meta-data, but focusing on the visuals

[216] Different versions of the archive are available. The old online archive of all the festivals and Prix Ars Electronica competitions is still available at http://90.146.8.18/de/archives/index.asp. A new interface for the Prix-Archive is available here: http://archive.aec.at/, and the catalogues can be found here: http://archive.aec.at/print/. The introductory page for the new archives is http://www.aec.at/about/de/archiv/.

[217] https://www.rijksmuseum.nl/en/rijksstudio

and providing an aesthetically pleasurable experience with them (see Gorgels, 2013). The user can personalize the collection by "liking" his or her favorite works and sorting them into public or private collections that can be shared via popular social media platforms, such as Facebook, Twitter or Pinterest. But the museum also allows to download all of the published digital reproductions in high quality to their computer, to use them for educational purposes, to print them for example as poster, on a mug or a tshirt, as decoration of your laptop, cellphone or car, even for commercial purposes. The site even links to print on demand services or services that produce photographic wallpapers or design skin for different products. And the institution also allows the appropriation and remix of the work into a new creative product[218]. It even fosters the creative reuse by asking the users to share images of their creations on the platform and launched a competition – the Rijksstudio Award – for the best design that is inspired by, remixing or reusing the Rijksmuseum's collection in Fall 2013 (see Rijksmuseum, 2013). Thus they try to build a community around the masterpieces of their collection and increase their visibility in various everyday contexts. Part of this endeavor is also to offer an API to the collection data, to enable developers to create third-party applications around the collection data, or reuse it in applications.

The "Smithsonian Cooper Hewitt, National Design Museum" in New York City is following the same path of making data openly available by offering an API and even offering the complete dataset of their collection as a download on GitHub[219], an online collaboration and code management platform for open source software projects. As Sebastian Chan, the Director of Digital & Emerging Media of said institution, proclaims:

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[218] The museum offers examples on their website (https://www.rijksmuseum.nl/en/rijksstudio-inspiration). A prime example for remix oft he work is a short videoclip produced by the Dutch art director Christian Borstlap for Rijksstudio, where he reuses elements from 211 artworks out of the Rijksmuseum online collection (see RijksmuseumAmsterdam, 2012).

[219] https://github.com; GitHub can be see as epitome of open source culture, as a model of thinking about opening up resources. On the one hand it is a versioning system for open source software projects. It allows developers to store and share documents (from source code to publications) within this system. Other users can download the documents as well as collaborate on it. Therefore a system of approval is implemented. Not every change every author makes automatically ends up in the final product. But rather an author can work on a contribution and then submit for integrating it into a project. An approval system for changes is integrated into the system as well. Besides collaborating with several authors on one specific branch of a project the platform also enables users to "fork" a project. This means that authors building up on a specific state of a project, which not necessarily needs to be the latest one. On this basis they can develop the project in a different direction, without affecting the main branch. Thus a new project is created building up on an existing one. This kind of mechanism is central to working and collaborating in open source software, publications or data.

"We need to not just be 'on the web' but we need to be 'of the web'" (Chan, 2012b). That means that the museum tries to not just have a web presence of the museum but to actively employ the mechanisms that drive digital, web-based communication. This starts with the use of agile, user-centered development methods for their online collection and launching an early "Alpha" version of it, to get user-feedback early on in the development process. This also includes allowing the active reuse of the data on other platforms and also embedding information from external websites and sources to contextualize the items of their collection. But for them it also means to bring the content to platforms on the web that people who might be interested in the collection items would already use. Therefore they are contributing to **art-discovery platforms** that aggregate collection resources and online exhibitions from cultural institutions all over the world – such as the Google Art Project[220] or Artsy.net. But as a design museum they also partner for example with Behance[221] – a platform for online portfolios of creative professionals, which sets out to showcase and find creative work more easily – to publish the works of the winners of the National Design Award in a branded gallery (see Chan, 2012a). As a side effect this allows the museum to use existing and widely used solutions and services rather than inventing the wheel anew and creating insular solutions for every tiny problem. Last but not least "being of the web" also means to cater to the "shareability" of collection items on social media, with tools like custom short URLs or offering an expanded bit of information including an object thumbnail and an attribution of the object to the social media handle of the museum, if one posts a URL of a collection item on social media platforms such as Twitter (see Chan, 2012a). These mechanisms help moreover to brand and preserve the recognition of the source of the shared cultural data item.

Concluding from these two examples the museum collection of the 21st century is ideally not a collection that just lives in storage rooms in the basement of an institution, but an open and at best linked dataset, which does not only put the assets on view but that facilitates reuse and active engagement with the cultural data in various, natively digital ways. However this is not yet the case for many online collections. There is still

[220] http://www.google.com/culturalinstitute/project/art-project?hl=en

[221] http://www.behance.net/

a lot work to be done to open up the resources and make them available in a digital format[222].

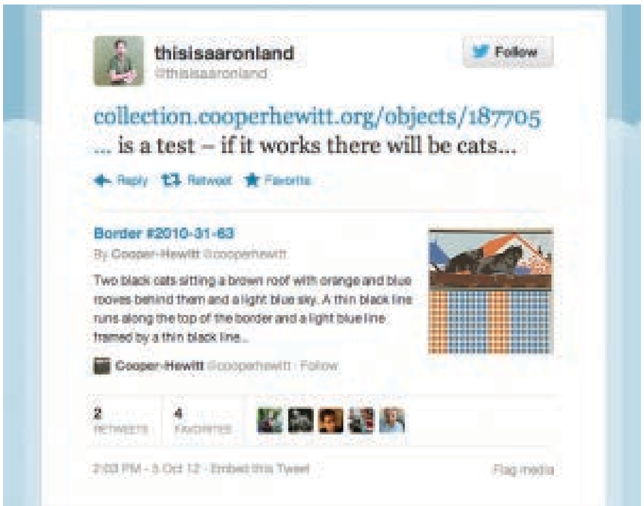

Figure 13: Screenshot of a test-tweet by Aaron Straup Cope (@thisisaaronland) on Twitter from Oct 5, 2012, proving the functionality of the "expanded preview" and automatic attribution to the Cooper-Hewitt, National Design Museum. Source: Sebastian Chan (2012a).

1.3. National and Thematic Aggregators

National and thematic aggregators go beyond an individual archive or collection and offer a platform to provide access to content of multiple collections and archives enable a search across this data. These bridge data collections either on a national or continent-wide level – for example “Europeana” for the EU or the “Deutsche Digitale

[222] Where according to the latest EU-wide ENUMERATE survey from 2012 on a wide range of cultural heritage institutions including libraries, 83% (n=1951) of cultural heritage institutions in the EU have digital collections, which on average each have approximately 20% (n=1626) of their whole collection digitized. Only 31% (n=774) of the surveyed institutions make the collection available on institutional websites, 22% on national aggregators, 14% on thematic aggregators, 15% on Europeana, and only 12% offer an institutional API for the access of data. The numbers for each of these access methods are expected by the institutions to rise significantly until 2014 (see Stroeker & Vogels, 2012, pp. 10, 11, 18). It is important to notice that museums rank usually significantly lower than libraries in these numbers, when it comes to access, but especially art-museums are above average (42%) when it comes to the percentage of items in their collection they have digitized. This might have to do with differences of collection size compared for example with a national library (3% of the collection digitized).

In a significantly smaller and less representative US-survey (n=98) by Kris Wetterlund and Scott Sayre on Education Programs with data from 2009 –not really comparable to the ENUMERATE survey from 2012 – 53% of the participating museums offered online collections, with the numbers being expected to rise (see Wetterlund & Sayre, 2009, p. 21). The study offer no comparable values to the other categories.

Bibliothek" for Germany – or on a thematic level, such as "GAMA" for the subject media art.

"Europeana"[223] is one of the most prestigious European digital library projects and first launched as prototype in 2008. The project stems from the Digital Libraries Initiative[224] (European Union, 2013) with the goal "to make Europe's cultural, audiovisual and scientific heritage accessible to all" (European Union, 2013), but also "easier and more interesting to use in an online environment" (European Union, 2013). Europeana is a gateway, bridging digital collections of a wide range of European galleries, libraries, archives and museums[225], making a wide range of media available. These include "[b]ooks and manuscripts, photos and paintings, television and film, sculpture and crafts, diaries and maps, sheet music and recordings […]" (Europeana, 2013), which are openly available to (re-)use for the public, usually licensed under a Creative Commons licence. Thus the project creates a single access point for European cultural heritage with the goal to make "the wealth of material contained in European libraries, museums and archives […] available online […]" in order to "[…] make it easier for citizens to appreciate their cultural heritage and use it for study, work or leisure" (European Union, 2013)[226].

The project does not stop there, but is continuously enhanced in different directions. To name two examples of recent developments: on the one hand currently the digitization of cultural objects to be incorporated into Europeana is furthered. An example is the project "Digitising Contemporary Art"[227], which aims to "create a digital body of high-

[223] http://europeana.eu/; the service is operated by by the Europeana Foundation (http://pro.euopeana.eu), which includes the search portal europeana.eu, its data service in form of an API as well as a pilot project to transform a large subset of Europeana's data into Linked Open Data (see Europeana Professional, 2013).

[224] The EU defines a digital library as "[…] organised collections of digital content made available to the public. The content is material that has either been digitised (copies of books and other documents) or that was initially produced in digital format" (European Union, 2013).

[225] The data of these cultural institutions is also commonly summarized under the acronym GLAM (gallery, library, archive, museum) data.

[226] In this funding scheme digitization is explicitly funded in order "to provide the widest possible access for the general public" and "to ensure their survival" (European Union, 2013), even though they acknowledge the challenges of long term preservation of digital data (see also e.g. Depocas, 2002).

[227] http://www.dca-project.eu/; the project is funded by the programme Information and Communication Technologies Policy Support Programme (ICT-PSP), with the aim to stimulate "a

quality reproductions of 26,921 artworks - paintings, photographs, sculptures, installations, videos and 1,857 contextual documents, which will become accessible and retrievable through *Europeana*; not only through the use of metadata and thumbnails, but also direct links to large-sized reproductions of each item" (Digitising Contemporary Art, 2013). This follows the trend of big corporate projects such as the Google Art Project. Besides enhancing the available digital content of Europeana, the project "EUscreenXL" also aims to develop pilot projects to test different ways of re-use of data in specific communities: general public, digital humanities researchers and creative industries (see Europe's Information Society, 2013), using user centered design approaches in order to take into account the needs of and work with the target-communities on the solutions. Thus the strategy of the European Union towards digital libraries in the moment goes clearly towards sustaining[228] and enhancing existing platforms and creating innovative ways to re-use the available data within different communities. At the same time the active reuse of the aggregated data is the biggest challenge they are facing.

Besides Europeana as a platform bridging European Cultural Heritage efforts there are national initiatives contributing to this platform[229] and having similar goals. The biggest state-funded initiative in Germany with regard to digitizing national cultural goods is the "Deutsche Digitale Bibliothek" (DDB)[230] – an Internet platform launched in November 2012 and run by the Stiftung Preußischer Kulturbesitz – which makes cultural and scientific heritage provided by German libraries, archives, museums, monuments cinematheques or scientific institutions accessible and experiencable online for everybody[231]. The focus is currently on the holdings of German libraries,

wider uptake of innovative ICT based services and the exploitation of digital content across Europe by citizens, governments and businesses […]" (European Commission, 2013b) in particular areas of public interest, amongst others digital libraries.

[228] One of the main challenges is to keep data sources alive and available after an active funding period ends, thus many funders also on a national level expect the projects to develop a business model for the repositories they build, in order to stand on their own feet financially after the funding ends.

[229] The contribution of DDB to Europeana has one restriction: only data with the „Creative Commons Zero Universal Public Domain Dedication" (CC0) are regularly transferred to Europeana (see Bartholmei & Schulze, 2013, p. 9).

[230] „German Digital Library", transl. by the author; http://www.deutsche-digitale-bibliothek.de/

[231] The German government also explicitely points out that not only do the digitized items will continue to be publicly owned, but the search results will not be influenced by commercial

since they started earlier than other institutions in Germany with digitizing their collections. But the DDB is not only offering digitized heritage data but also metadata of not yet digitized holdings, thus acting as a central bridge and research tool for digitized and not yet digitized German cultural heritage items[232]. This is hinting towards another main goal of the platform besides contributing to the growing global network of data and knowledge: to preserve the national heritage by its digitization, in case the physical objects are destroyed through tragedies as for example the collapse of the city archive of Cologne in 2009.[233] The web-platform is mainly a "metadata catalogue"[234] and conceptualized as a research-platform. However ideally it would also allow the exchange of users about topics related to the data should be enabled on the platform[235], at least through third party-applications made possible by an API.

GAMA – the Gateway to Media Art Archives – is another European project with a different scope: bridging and giving access to several individual European archives focusing on media art that are located at cultural institutions in different European countries under a single interface. The goal of the gateway is to represent a large spectrum of media art beyond the specialized (national or geographical) focus of the individual archives and rather highlighting thematic perspectives as well as the contexts framing different discourses around media art as well as their relations. Besides awareness raising for this specific art form the platform also aims to mediate media art through its interfaces and contextualization tools.

interests. Therewith they want to differentiate themselves from commercial platforms, which also host cultural data, such as Google, reacting on ongoing political debates on their activities.

[232] On 7 August 2015 the count of items inside the DDB was 15.906.988 items, of which 6.028.059 contained digitized media items.

[233] At the same time besides admitting the importance of digitization the government recognizes that only a small fraction of the German cultural heritage is digitized at this point due to constraints in financial resources for this rather costly endeavor. Cultural institutions are calling for a digitization funds from the federal or state governments, whereas the government is hoping on private funding for this enormous undertaking.

[234] Stephan Bartolomei in a personal conversation on 13 June 2015

[235] As it reads in a publication of Bibliotheksportal, this feature might be mainly intended for "scientific experts" (see Bibliotheksportal, 2012a). Thus it might not be as open as one might wish – a common problem of many digital platforms, which is on the one hand oftentimes due to copyright issues, on the other hand a result of the difficulties of many institutions to let go of the full control of what content might be posted on the platform in first place, before they could moderate.

As it gets evident from the brief descriptions of the three European example projects, the translation and mediation between individual existing databases is tantamount for these platforms. The existing archives and databases are in themselves incomplete, "[…] thus the archive is a form of understanding events and art works in an undisclosed, non-unified way, constantly adding other descriptions, formations or mappings, a way directly dependent on the material the archives are dealing with" (Hirsenfelder, 2015). On a digitally abstracted levels these archives, which are dependent on their physical collections and are therewith geographically dispersed, are bridged on these platforms. The access usually works via a common metadata model and – at least in the case of the subject gateway "GAMA" – "[…] the search function works with a homogeneous dataset whereas the original information of the archive is displayed. Maintaining each archive's individuality while displaying harmonized data in the portal is the general approach to dealing with the heterogeneity of sources" (Blome & Wijers, 2010, p. 53). Thus these platforms contextualize the datasets of individual institutions with the data of other institutions, which cover in the case of GAMA the same general subject area – media art. In the case of for example Europeana the field is as broad as "European cultural heritage". That way querying and mining the data of the gateways allows more general insights into a subject area than an individual corpus would make possible. Moreover they improve the visibility and findability of the cultural data belonging to the participating institutions. As Blome and Wijers argue, these gateways also allow to apply algorithmic analysis or automatic metadata creation and therewith a mining of textual and media content which usually goes beyond the abilities of an individual institution (see Blome & Wijers, 2010, p. 53). Therewith the institutions and scholars benefit from novel insights and the end user from more capable search and browsing tools. In essence a subject gateway is thus mostly a cooperation or collaboration between holders of archives or collections, technology providers and researchers.

As individual collections need to think about activation and contextualization of archive data so do subject gateways. A big part of Europeana's contextualization efforts invite input and meaning making efforts from the users. Besides collaborating with online-platforms such as HistoryPin (see Part VI, chapter 2.4.2.) to offer a digital environment for collaborative curating, this includes reaching out to potential contributors directly, giving them offline possibilities to come together and contribute to Europeana. Examples are events around thematic projects of Europeana, such as

"Europeana 1989"[236] or "Europeana 1914-1918"[237]. These events bring people and their memories about the respective times and historic events together in one place. The participants can bring artefacts that trigger memories and let a team around Europeana digitize them, but they can also tell the story behind or around an object. These stories are recorded and edited by professionals and then published online. So these events in the offline world do not only foster collective recall and memory of events but also generate high quality contributions to the thematic projects of Europeana and might motivate others to contribute outside of these events as well.

Europeana as well as DDB are also offering an API and are fostering the development of applications based on the cultural data provided by the platform. One way of doing so is again by organizing an event-format: the so-called hackathons. These are events where exploratory and playful software development is on the forefront. In these specific cases programmers and designers are invited to work for a set timeframe on ideas and prototypes of applications showcasing how the available cultural data could be reused. Besides the Europeana Hackatons a prominent German example is the cultural hackaton "Coding da Vinci"[238], where cultural institutions offered specific cultural datasets under an open licence for creatives to reuse and implement applications, mobile applications, services, games or visualizations around these datasets.

As Stephan Bartolmei, project coordinator for innovation at DDB, emphasized in a personal conversation, a real asset of these big gateways is that they are a potential bridge not only of data but also of different communities, from expert communities to interested users. Thus institutions behind the bridged archives get access to potentially a broad range of communities that might be interested in activating and interacting with the data, and the platforms can act as connection point for these communities as well. This approach gets evident in the goals of a hackaton like "Coding da Vinci", which explicitly wants to build a network and interactions between the usually separately acting areas of cultural institutions and data providers on the one side and and designers and developers on the other side, in order to develop new ideas and

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236 http://www.europeana1989.eu

237 http://www.europeana1914-1918.eu/en

238 http://codingdavinci.de

digital projects for the cultural sector together. But Coding Da Vinci also supports cultural institutions on their way to opening up cultural data and therewith bring the cultural institutions together not only with different platforms for publishing the data, but also with expert communities with regard to licencing or data-preparations, including metadatastructures or data formats (see Hahn, 2014, p. 5). Thus the bridging of different stakeholders would ideally lead not only to more open cultural datasets but also foster innovation in the employment of digital media in the cultural sector, which would benefit different user- and visitor-groups as well. Therefore last but not least bringing together disparate communities and methods can foster an exploration of digital possibilities of cultural heritage data and potential new perspectives and questions towards the data through gathering different points of view of the stakeholders, but also new ways of interacting with the data made possible by the emerging projects.

1.4. Collaborative Platforms

Where aggregator-platforms are established mainly through collaborations between cultural institutions, collaborative platforms build up a digital cultural repository collaboratively with their users. The word "platform" is taken literally in this case, as it usually provides the infrastructure for sharing, exchange and communication, but it depends on user-generated content. Well known examples for collaborative online-platforms are the online encyclopedia Wikipedia or media sharing platforms (Flickr, Vimeo, etc.). But there are numerous examples specific for the field of cultural heritage on the Web using the complete repertoire of the discussed participatory roles a person can take. Examples for the area of media art are "Rhizome"[239], netzspannung.org, as well as the Archive of Digital Art (ADA), which all "provide an online an publicly accessible infrastructure for storage and documentation" (Blome & Wijers, 2010, p. 54),.

"Rhizome" evolved out of a mailing list founded 1996 by artist Mark Tribe, where some of the first artists who worked on netart were subscribed. Having been a participatory endeavor from the very beginning, Rhizome offers an open platform for exchange and collaboration. As the organization describes the website, it "[…] is a

[239] http://rhizome.org

dynamic, interactive platform, rich in historical resources and updated continually with new art and commentary by a vast community" (Rhizome, 2013a). Besides curated content, the two most important sections in terms of collaborative efforts are the community section and the Artbase. The Rhizome "Artbase" was founded in 2009 and is in essence an online archive of digital art, with the mission to "provide free, open, and permanent access to a living and historic collection of seminal new media art objects" (Rhizome, 2013b). The focus of Rhizome lies on artistic projects that use materials such as software, code, websites, moving images, games and browsers for production of aesthetic and critical projects. Artists were able to submit their artworks for consideration for the archive until 2008, which were then reviewed by curatorial staff. Currently artworks are added to the archive on curatorial invitation only. Moreover all artworks commissioned by the organization as well as invited artworks are documented and entered in the ArtBase. Housing these works in a living archive also entails a good deal of preservation work (see Fino-Radin, 2011), as the archive works against the obsolescence of artistic projects through technological failure and preserves the works while respecting the intent of the artists (see Rhizome, 2013b). With its technical diversity the archive can be seen as a preservation laboratory "laboratory for the development of forward-thinking tools and strategies so that these works may be reperformed in legacy environments, giving contemporary users a sense of their initial form" (Rhizome, 2016).

The works are made accessible and retrievable through a search and browsing interface – using title, artists, tags and member favorites as entrypoints – and are contextualized on the Rhizome Artbase. The contextualization happens on the one hand through relations established by tags on the other hand through curated collections or online exhibitions or collections by staff and members on specific topics, such as "Formalism & Glitch" or "Digital Archivalism". The Artbase offers two ways of participation for non-paying members: the submission of artworks to be considered for the archive (until 2008) as well as leaving comments on the artwork and therewith contributing to a discourse around the work. As a paying member the user gets some more features to interact with the Artbase, such as saving artworks as favorites, viewing the full record of individual artworks, annotating them and curating online exhibitions. Where this section still seems rather restrictive with regard to participation, as interactivity that allows meaning making is behind a pay wall, the community section promises more openness for contribution. Here also the non-paying user can create an own portfolio of works, can start and participate in discussions, create announcements such as call for submissions or job postings as well as events. Thus the community functions like a social network around the topic of media art, including a newsfeed as landing page and profile pages for community members, which feature information about the persons, their contributions to the community as well as their portfolio. Therefore the community mainly stores communication about media art and at least has the goal to act as "community of practice".

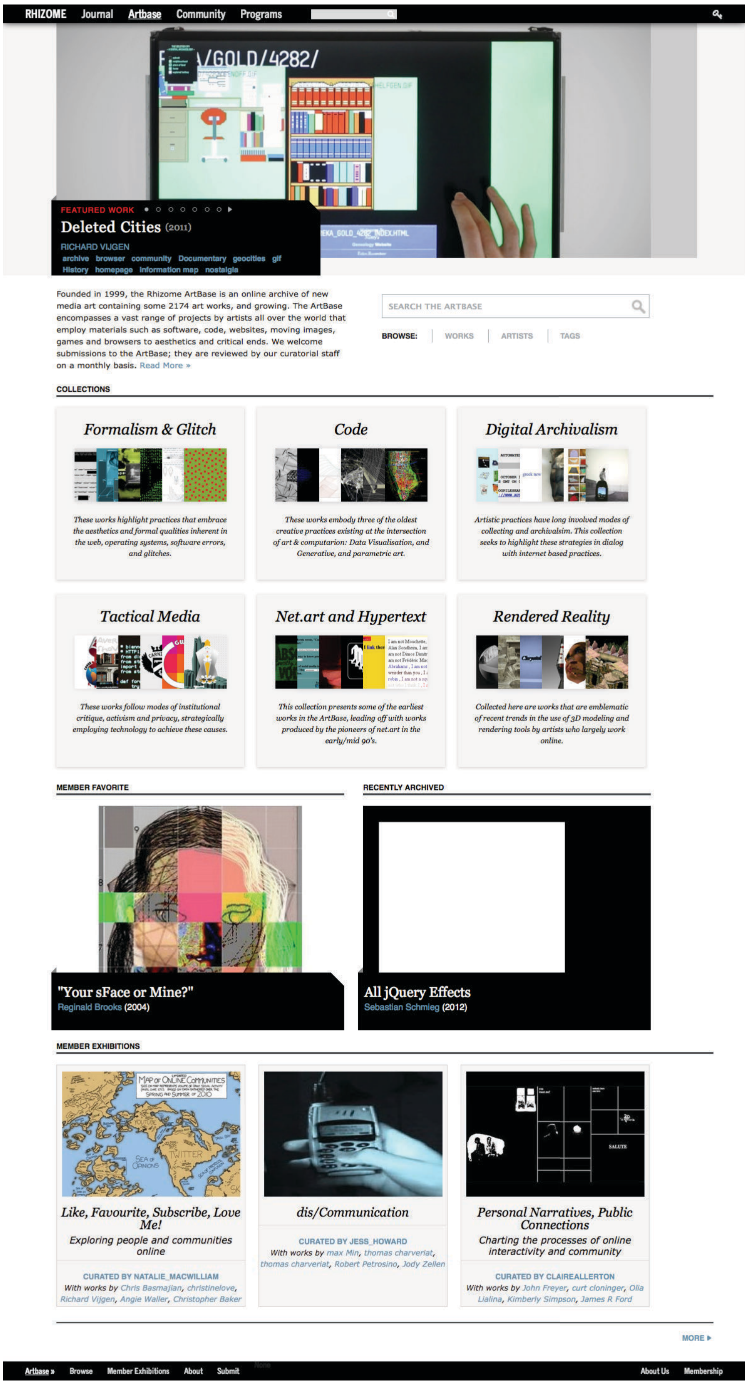

Figure 14: Screenshot of Rhizome Artbase from 09.12.2013

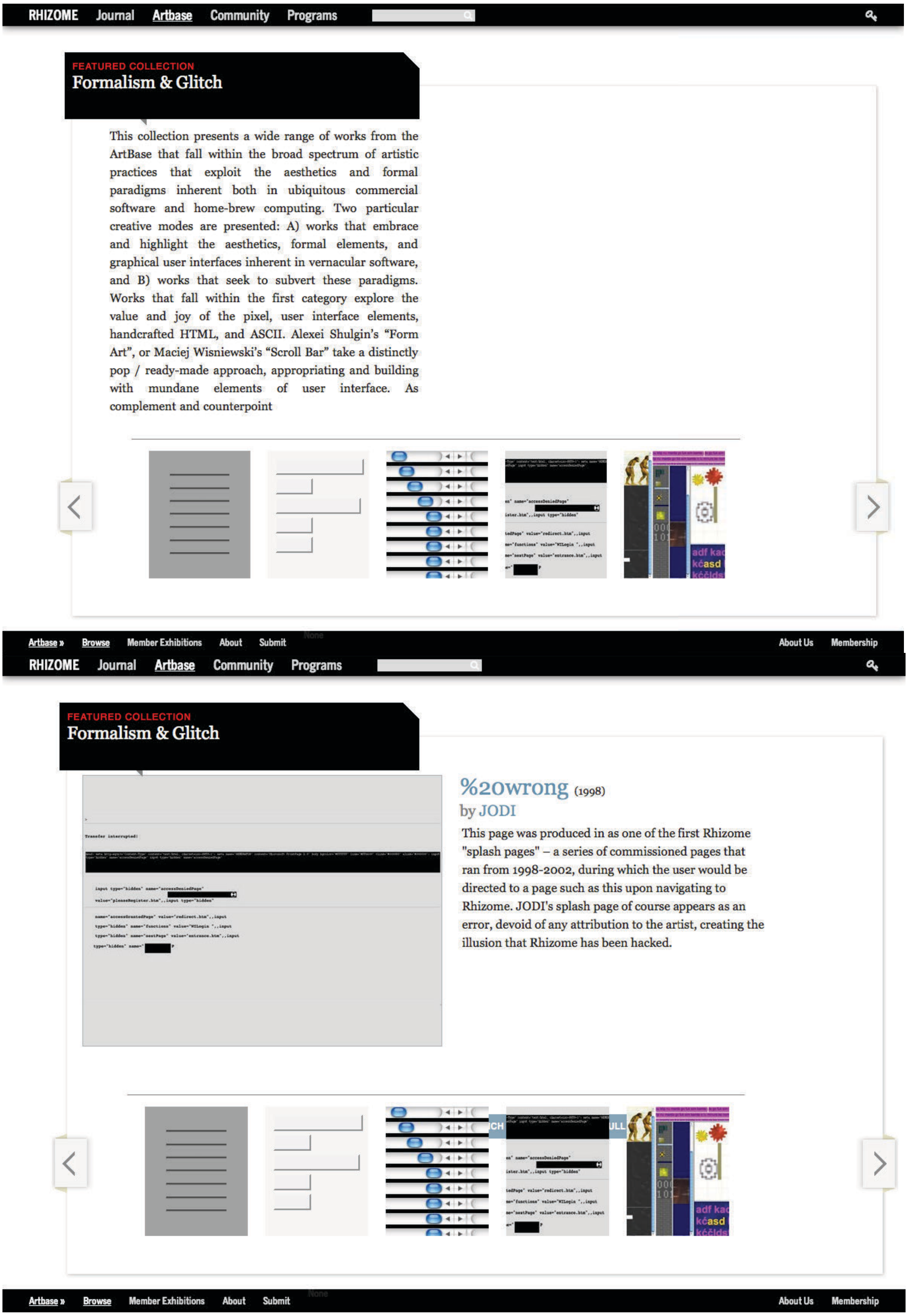

Figure 15: Screenshot of the featured collection "Formalism and Glitch on Rhizome from 09.12.2013. *Top*: introductory text to the collection. *Bottom*: view of a work within the collection.

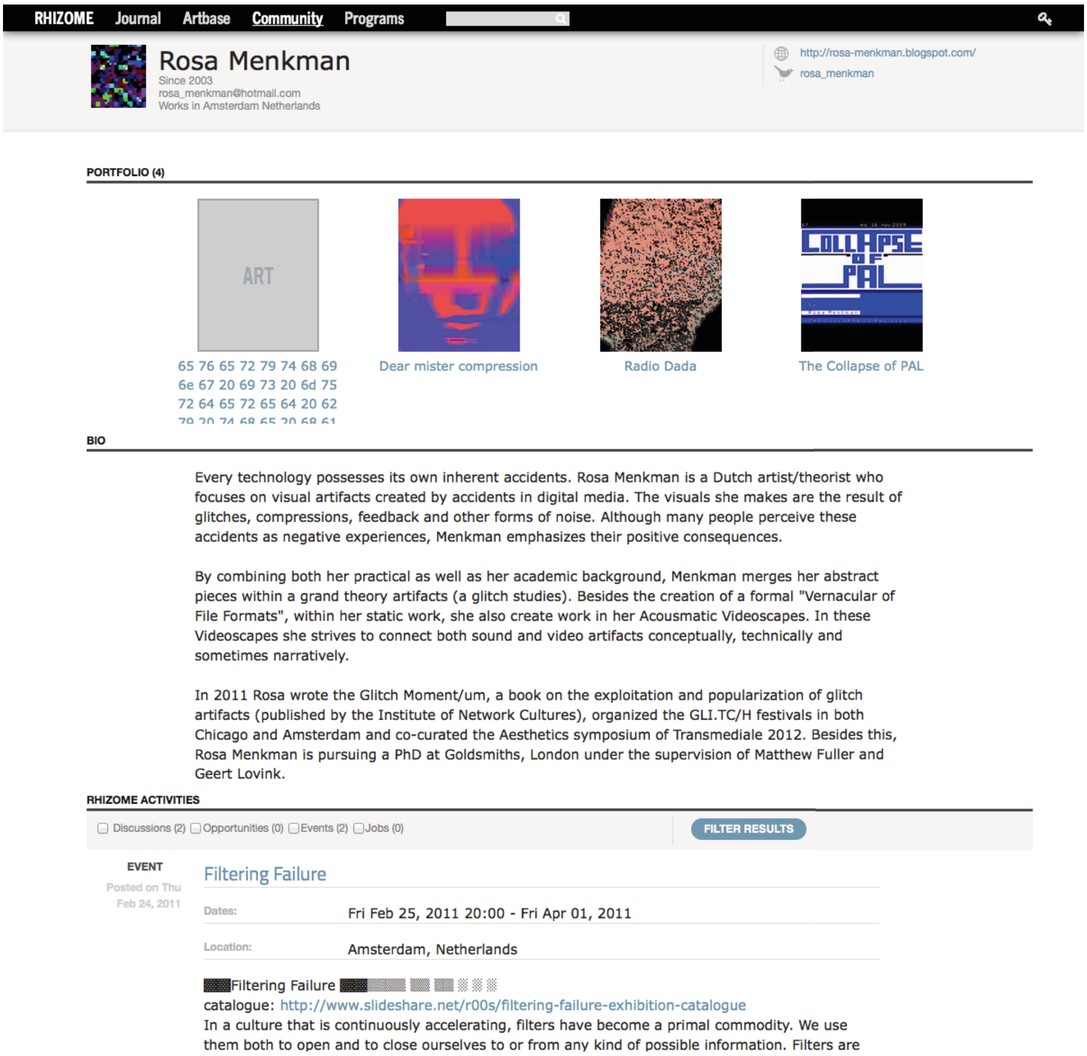

Figure 16: Portfolio of the Glitch-artist Rosa Menkmann on Rhizome, showing information about artworks in the portfolio, about the artist as well as her contributions to the community. Screenshot from 09.12.2013

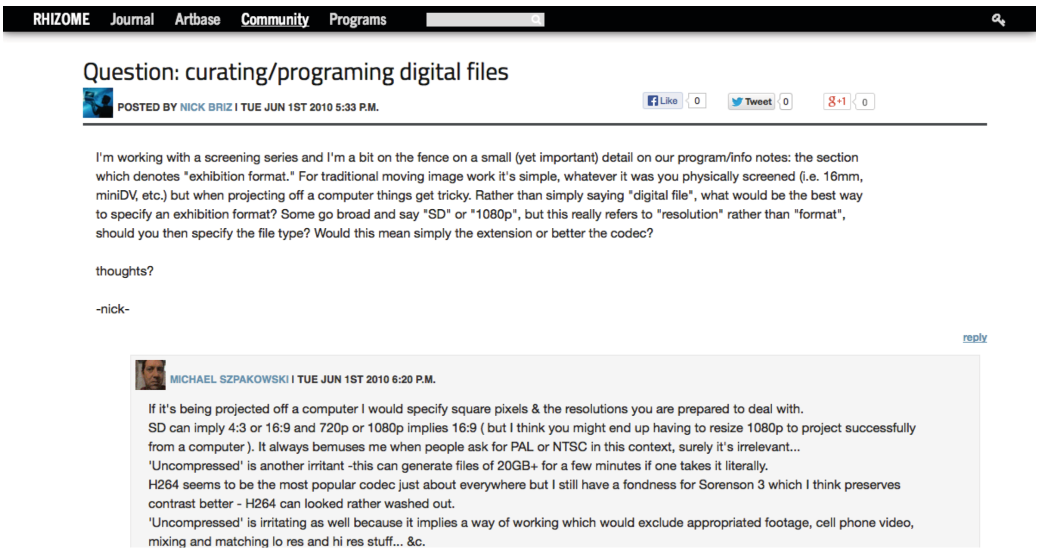

Figure 17: Discussion in the Community section of Rhizome. Screenshot from 09.12.2013

netzspannung.org had a slightly different mission, as it "was dedicated to storing and disseminating creative as well as scientific projects relating to digital culture, with the aim of monitoring contemporary production and developments in the field" (Blome & Wijers, 2010, p. 54)[240]. They self-defined as a "platform for interactive art and media art education" and as a tool to research, reflect on and mediate electronic culture. To fulfill their mission to cover the breadth of contemporary projects of digital culture they also implemented and advertised an open submission channel besides peer-reviewed content and editorial contributions by the makers of the project, namely the Media Arts Research Studies (MARS) Exploratory Lab[241]. And most importantly instead of going with the motto "build it and they will come" the organization sought to motivate users and whole user groups to participate. Examples are the collaboration with target groups such as conference organizers, curators, teachers or research projects that did not have the resources to document and archive their activities themselves in order to save the resulting documentation of conferences and projects as part of the netzspannung-archive[242] and to create a critical mass of content, ranging from tele-lectures[243], teaching concepts from teachers for teachers[244], or scientific essays to documentations of media art projects. These materials are to be used for interdisciplinary education between art, design and computer science. With the tele-lectures the platform was on the forefront of technology, since they offered streaming video since 2001, thus before major video sharing platforms such as YouTube or Vimeo entered the market. The platform not only allowed to archive important conferences about media art but also enabled live-streams of conferences. To establish streaming media as a cost-effective publication method through recording and archiving live-streams, aid the community and lower entry-barrier to this technology, the project developed a mobile streaming unit as a transportable webcast studio along with easy to use streaming software in order to aid the organizers of lecture series to record the events. And with "Hypermedia Tele-Lectures", where users were able to navigate lectures in single chapters as well as get additional images, texts or in depth information about artists, other relevant artworks, websites or textual sources synchronized with the video lectures, the platform

[240] Since 2009 an archived version of the platform is hosted by ZKM – Zentrum für Kunst und Medien, Karlsruhe.

[241] see http://netzspannung.org/about/mars/?lang=en

[242] http://netzspannung.org/archive/

[243] http://netzspannung.org/tele-lectures/

[244] http://netzspannung.org/learning/

aimed to develop a new online form of mediating media art projects. This prototypical educational format conceptualized with Art Historian Dieter Daniels was based on networking different online archives, namely netzspannung.org and Media Art Net[245] and made available openly to the community.

Moreover netzspannung.org created the student competition "Digital Sparks"[246] for media art, media design and media technology, that took place completely online, using the collaborative platform as infrastructure for submission review and publication. Besides the reuse of existing infrastructure this had the side effect of leading to a repository of student projects and teaching concepts over time (see Blome & Wijers, 2010). The competition sought "interactive, experimental and theoretical work which demonstrates an innovative approach to digital culture technologies" (netzspannung.org, 2009c) and served as a talent scout. Each year it focused on a different topic. Publishing all entries to the competition in the netzspannung.org repository gave the student-works a stage and made them accessible, visible and findable for the professional and interested community relevant to their work. For this competition the platform collaborated with a range of universities that offered programs relevant to the core fields of the competition. The lecturers of the students also played an important role in Digital Sparks, which set this competition apart from others: "higher education lecturers act as mentors commenting on their students entries within the context of their teaching. This presentation and the project descriptions show how lecturers and their students thematicise, research and reflect design and concepts in their work" (netzspannung.org, 2009c). Therewith the lecturers functioned indirectly as quality control and facilitators of the works entered in the competition. Production grants as prizes again advanced the generation of new work in the realm of media art practice and subsequently the community and field. Overall the competition was used to further the data-basis of the archive and show a breadth of works created by a young generation of upcoming artists, capturing trends and zeitgeist of teaching and research in media arts.

[245] Also this kind of web-lectures was a very early application of streaming video as educational tool that contextualizes the content of the lecture. A similar form of web-based educational resource is employed nowadays in webinars or MOOCS.

[246] http://netzspannung.org/digital-sparks/

The community section of netzspannung.org served a similar function to capture trends in the media arts scene, while being a "space for exchange with media artists, scientists, computer scientists, designers and all people interested in media art" (netzspannung.org, 2009a). Similar to Rhizome, the community-section served as social network and open channel for the media arts scene. Members were able to create a profile in order to publish their professional experience as well as upload documentation of their work to an open channel called "Netzcollector". On this channel the media-artistic projects, technological developments, texts and events were contextualized within a transdisciplinary and professional context. Logged-in users also were offered interfaces to re-find content they already looked at or searched for in order to aid research. And the section "Resources" offered the community "commented link lists on international events and institutions in the fields of digital art, culture and research as well as relevant information channels on the web" (netzspannung.org, 2009b) with the possibility for the community to add to these lists. Therewith the community section produced a crowdsourced overview over zeitgeist and trends in media art at the time when the platform was active and nowadays serves as archive of the developments of the field during the active time of the platform from 2004-2009.

Where the already described collaborative platforms are or were basically open to anybody who wants to participate, there also exist expert-communities. One of them is the "Archive of Digital Art"[247] (ADA) that claims to be the first archive in the fields of Art History and Media Studies that is both scientific and social. The platform was developed out of the former "Database of Virtual Art", which existed since 1998. The Database of Virtual Art was the first international database for media art and the only long running project. In 2016 it featured over 850 carefully curated artists out of 5000 applications, over 3500 articles, surveying 750 institutions of media art and 250 theorists and media art historians, working and publishing academically in this field (see Grau et al., 2017). The works of these artists are documented using a research oriented data model and what Oliver Grau named "extended documentation"[248] (Grau, 2004), which focuses especially on documentation of media art projects for a further reuse in research and teaching.

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[247] https://www.digitalartarchive.at

[248] the German original term is „erweiterter Dokumentationsbegriff" (see Grau, 2004)

Figure 18: Screenshots of Archive of Digital Art from 03.10.2016. The top image shows some of the social media features in the sidebar available to the user after login: for example a direct messaging system, newsfeed, or a directory of colleagues to whom one is connected in this social network. The bottom image exemplifies the lightbox feature of ADA as a research tool.

The platform has the goal to show the fast developments in the area of virtual art and its subcategories – which are mainly processual, ephemeral, interactive, context-dependent and contain multimedia elements – while maintaining a quick access to single projects. Therefore the documentation goes beyond a classical static documentation model that usually mainly contains tombstone information. ADA adds onto the basic information by also providing information on technological configurations such as the interface design and software, display technologies, inventions by the artist, interviews and recipient-experiences, information about the team behind the projects, exhibitions as well as literature discussing the works and last but not least institutions of media art involved in the production and exhibition. Also video documentations, partially produced in collaboration with the German-French TV-station “Arte”, were an important part of the documentation concept, to capture the project in performance as well as actual user-experiences of a specific instance of the project. Another core part of the documentation is a custom thesaurus of virtual art, built in collaboration between several media art institutions. Thus in the end the documentation model is a formal one aiming towards objectivation and comparability of the captured information, but also the contextualization through the growing number of exhibitions and publications projects are involved in, building up a context-network around single projects but also displaying the networks of production, reception and reflection within the field of media arts. As Oliver Grau names it, the documentation is transformed from a passive archiving of core data to an active process of knowledge transfer (see Grau, 2004, p. 4).

Besides the goal of expanding the documentation model to also document the work of curators and researchers in the field of media art the AT.MAR project (Grau, 2015) is building up on this notion of knowledge transfer. The Database of Media Art integrates web 2.0 features (see Figure 18) enabling recruited experts in the field of media arts to collaborate on the database content: from artists and scholars to curators and engineers. Thus the database has a strict gate-keeping system[249] in place and is controlled by an international board, to ensure scientific standard and citeable information. Meaning the still living artists can provide first hand information and documentation about their work into a fixed documentation scheme, and also scholars can document their work in the field of media art in a format not unlike big research social media platforms like academia.edu or research gate.[250] Therewith “ADA was

[249] contributors who want to apply need at least 5 exhibitions or scientific publications, awards and public presentations.

[250] Scholars can provide a self description about their work, a CV, exhibitions and conferences they participated in and upload or document publications and references. Also a news field is available to announce latest news.

established as a collective project in cooperation with renowned international media artists, researchers and institutions for the integration of a sustainable exchange between artists, experts and users" (Grau et al., 2017, p. 2 [manuscript version]). It therefore claims to be the first collective scholarly archive in art and media studies where documentation and access are not seen as static concepts but rather as a process that has in its core the continuous exchange between users, artists and experts. Therefore the policy of open access of the documentation data as well as providing the users with an active role is seen central for the sustainability of the archive and for creating not only a long lasting but also a continuously updated and up-to-date resource for digital art.

Additional to the possibility to document ones work, the platform offers the function to follow specific colleagues, has a timeline showing the latest news provided by colleagues as well as a direct message system to enable a direct exchange between experts in the field. The feature of a Light Box allows to collect documentation material from ADA for own research purposes, setup multiple desktops and dynamically arrange the selected multimodal documentation material of diverse projects freely on the screen for comparison using a desktop-metaphor. This interface directly translates established methods from comparative and art-historic or iconographic research based amongst others on the work of Aby Warburg or Erwin Panofsky into a screen-based interactive tool reminding of a card-sorting method, enabling to get an overview over a small and humanly analyzable sample of documentation material. It also enables to directly take research notes and set up online exhibitions with the database content, to exchange on and display the research.

Since the platform is – besides a small editorial team responsible for featuring content and further developing the platform – relying on contributions from the community, fostering community engagement is important for the platform. As part of the engagement and dissemination strategy to foster the selected experts to contribute their work as well as to enlarge the visibility of archive material, the editorial team regularly showcases online presentations of selected artists and scholars. This showcase to the peer community and beyond should motivate members to keep their profile up to date and add new documentation material. But they also rely on the "peer-accountability" within the platforms as a motivation to contribute but also as a measure of quality control, since the experts can hold each other accountable for entering correct information and updating it (see Grau, 2015). In Open Science terminology this allows the development of novel ways of peer-review specific for the field of Media Art Histories. Central for this application is the comment feature on the description within the detail view that serves as space for discussing an artistic project. But it can also be used for adding additional and alternative descriptions to a project and therewith is a tool for the community members to express their individual points of view about a project and capture their subjective experiences with it.

These collaborative platforms show according to Blome and Wijers "that collaborative documentation and archiving is a very successful strategy to preserve cultural heritage. The time to improve sustainable archiving and open up the archive to its providers and users is upon us" (Blome & Wijers, 2010, p. 55). Moreover tools enabling personal or community-based contextualization, collection and recollection as well as collaborative teaching and research across specific disciplines or cultural boundaries are gaining importance (see e.g. Blome & Wijers, 2010; Wiencek, Morbey, & Lombardi, 2012). The authors argue that with open structures of collaborative art platforms it may be easier today than in the past for projects or documents to be featured in a repository. Nevertheless appraisal, selection, and filtering and "gate-keeping" – the inclusion and exclusion into a body of content, and the decision what can be found – are still important for a curatorial process, giving platforms exclusivity and therewith acceptance from the users and potentially a desire to be part of for the artists. But also the potential for opening the curatorial process towards the public with collaborative platforms becomes evident. "With its inherent flexibility and possibilities for customization and indexing, the digital medium potentially allows for an increased public involvement in the curatorial process, a 'public curation' that promises to construct more 'democratic' and participatory forms of filtering" (Paul, 2006). Where on the one hand the authority for selection is distributed and users are allowed to expand exhibition concepts and content, the control over the visibility and presentation of content is on the other hand handed over to non-human actors such as software, which often invisibly filter content in the backend. Thus opening up the process of curation and meaning-making in a digital environment always includes human and non-human actors.

In summary these platforms can be described as "living archives". Not only are they organic in the way that their content is in constant flux and development through the user-contributions, but they also act as starting point for conversation or interaction based on the entries as well as contextualization and meaning making processes going on within the community of a platform. In the end the whole platform is designed as an ongoing process in which people can on the one hand continuously expand the available data basis. On the other hand users can work, engage and interact with the material and ideally enrich or activate the material or reuse it in meaning-making processes.

1.5. Social Media Platforms

Additional to using Social Media channels for dialogic communication that can be employed for contextualization of and engagement with cultural data (see Part VI chapter 2.4.3.), the platforms can also serve as repository[251] for cultural data, including media content, such as images (Flickr), videos (Vimeo, YouTube), or sound (Soundcloud). This does not only provide the benefit of saving the serverspace to store the media assets on the servers of the institution, but it also places the assets in a larger context of digital culture. This happens on the one hand by contextualizing the cultural data with other assets hosted on the platforms themselves through searching, browsing or recommendation systems. Through embedding or sharing the items can be easily re-contextualized by the collecting institution and other digital creators. In other words the assets become findable and shareable[252]. Social media platforms also provide their own crowdsourced infrastructure to allow collaborative meaning making, such as commentspaces or tagging. Moreover they enable users to contribute or associate own assets stored on specific platforms to larger institutional asset collections: related to a topic, to specific objects an institution holds, or their visit in general.

Besides using and re-using existing social media platforms as repositories, cultural institutions also reuse the strategies of these platforms for purposes of mediation of art and culture and for building communities around diverse media material either produced by cultural institutions or dealing with art and culture on a dedicated own

[251] As discussed in Part V, chapter 2.2. they do not „archive“

[252] To be sharable actually also entails that people are able to share content on social media platforms from the place they find it. Thus including a sharing mechanism on the institutional or collection website as well as modularizing the content and make it accessible by individual URLs has to be a standard procedure, to facilitate re-contextualization of any content and the engagement of it into online conversations.

platform. Such a platform can serve as a hub and discourse-space for example for museum-content. Amongst these platforms is "ArtBabble"[253] developed by the Indianapolis Museum of Art (Indianapolis, Indiana, USA) in 2009. It aggregates already available videomaterial about art and museum practice from different institutions and partner channels on its site, which otherwise would be scattered on the web. "ArtBabble" collaborates with over 50 institutions all over the world and can serve as educational resource. It adopted a concept similar to YouTube as video platform: being able to browse categories such as themes, the artistic medium a video portrays, period and style, location or people (artists and non-artists). The platform offers a recommendation system for related videos and for institutional channels, which can serve as a hub to video content from one particular cultural institution – the so-called "Partner Channel", a new feature introduced with the redesign of the platform in 2013.

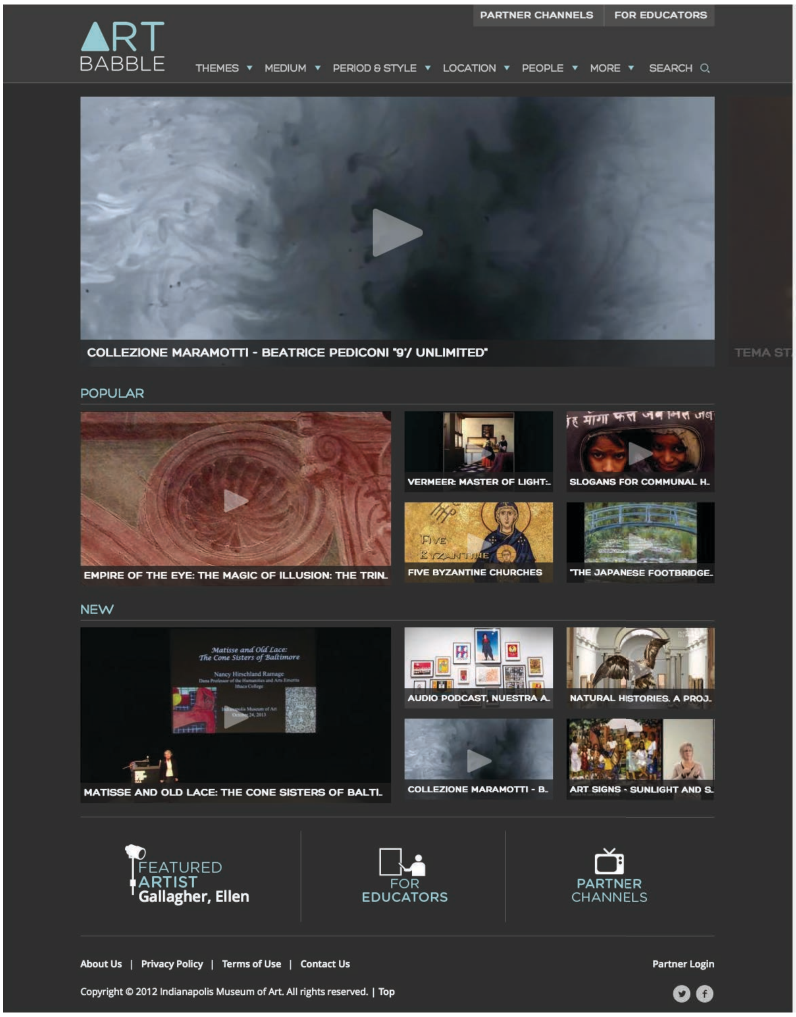

Figure 19: Screenshot of the ArtBabble Homepage from 05.12.2013

[253] http://www.artbabble.org

The platform offers a wide range of different formats[254]:

- **Documentaries**, telling a story about an artist, an artistic oeuvre, a specific artwork or a specific exhibition, covering a wide range of themes.
- **"Behind The Scenes"** reports, which show the work of museums or portray artistic production; a "making of" format.
- **Commentaries**, presenting a personal or expert point of view on art and art related topics; the interpretation of artworks also falls into this category.
- **Interviews** with artists.
- **Trailers,** an advertisement format, which offers a preview of exhibitions, events or art-related products, explaining what awaits the visitor.
- **Exhibition Highlights** put a specific exhibition into the focus, explain its concept as well as highlighting projects on display or activities.
- **Lectures and Talks**
- **Demonstrations** of artistic techniques or processes.
- **Tutorials**, which actually explain these artistic techniques, specific terms of current or past artistic practices or even offer complete how-to guides for viewers to emulate and get started on a creative task.
- **Audio**, which is basically a voiceover over still images or videos about sonic artworks
- **Time Lapse**, mostly documenting the process of installing an artwok at a show or the creation of a site-specific work
- **For Kids**, contains videos which are tailored to a young audience.

Thus it becomes apparent that the platform is dedicated to tell stories about art. "ArtBabble" covers a broad range of topics and through the range of sources also multiple points of view, but offers also depth through further annotation of the videos. "Throughout the films on ArtBabble, 'notes' appear on the right hand of the scene, attached to relevant points in the film. If another artist is referred to, a 'note' links to their Wikipedia entry, if a news event crops up, there's a link to the newspaper report" (Jamieson, 2009), as Ruth Jamieson writes in her article about the platform in the

[254] A list of the video formats can be found in the metadata of the videos and is listed under the „more"-section of the top-level menu from artbabble.org, which allows to filter the video material with regard to specific categories.

Guardian. Thus the linear video content is non-linearly enriched by using open resources. And also the attachment of own annotations to a specific frame as a way to personalize the engagement with the videos is possible.

However making the videos available on a common platform and with standardized meta-data and categorization is only one side of the platform. The community aspect of a video-sharing platform through features such as commenting on and communicating about the content as well as sharing it on social media platforms is central to the concept. This is already conceived in the name of the project which can be translated as "1. free flowing conversation, about art, for anyone; 2. a place where everyone is invited to join an open, ongoing discussion - no art degree required" (ArtBabble, 2012).

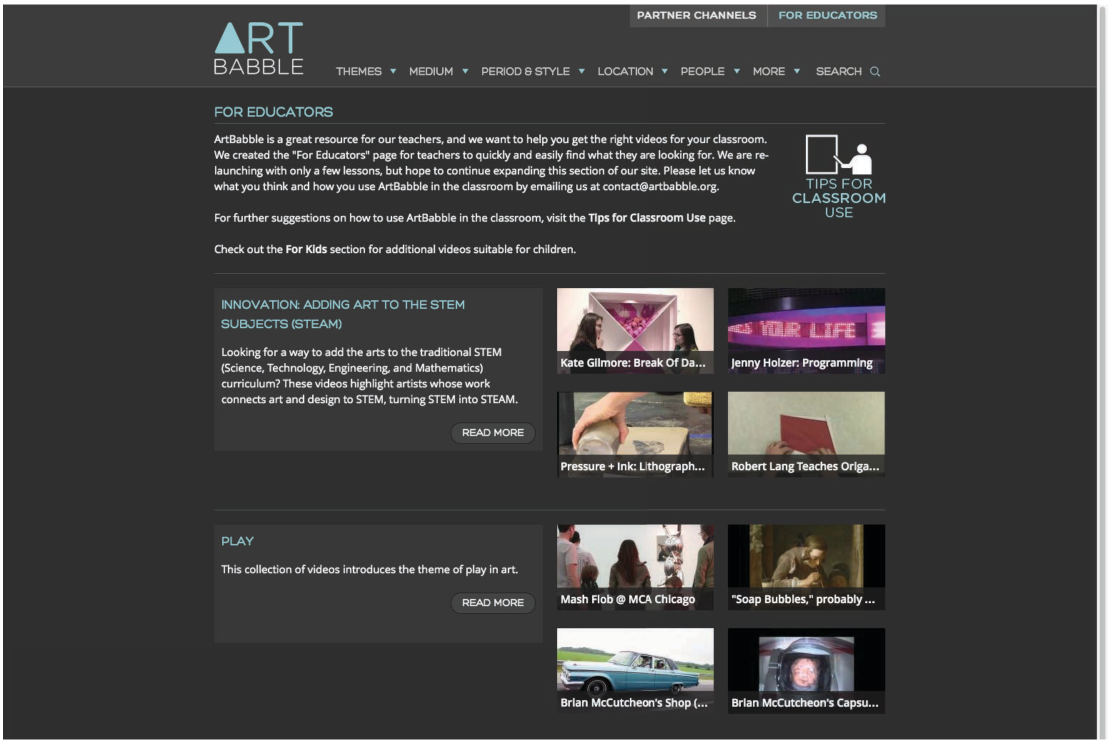

Figure 20: Screenshot of the "For Educators" section of ArtBabble from 05.12.2013.

For educators "ArtBabble" compiled playlists of videos for teachable topics tailored to specific grade levels and subject areas, for example "Innovation: Adding Art to the STEM Subjects (STEAM)", "Play" or "Role of Religion in Developing Society". And the platform also promotes ideas of how to employ its content as a resource for the classroom. According to ArtBabble this can include

- watching ArtBabble videos as preparation for a museum visit or as post visit activity.
- using ArtBabble as resource for research assignments for students, resulting in various possible multimodal outcomes such as podcasts or blog entries.
- using videos as hook or kickoff for a lesson on specific topics.
- using a scavenger hunt to guide groups of students to explore a selected video.
- building and expanding the vocabulary of students based on unfamiliar words used in videos.
- letting the students curate an own thematic set of videos (see ArtBabble, 2015).

All these proposed activities are re-using the available content in different kind of learning situations within a formal learning setting with different envisaged learning outcomes. This can be use-cases not only for this particular platform or content but also for other content providers of cultural content, as long as the content is accessible within a classroom setting.

1.6. Self Archiving

Another important resource besides institutional content is the self archiving done by artists and creatives themselves. This notion relates strongly to a notion of an archive brought forward by Sue Breakell, archivist at the Tate Archive, who defines an artist's archive as "a set of traces of actions, the records left by a life – drawing, writing, interacting with society on personal and formal levels. In an archive, […] [a single item, F.W.] would ideally be part of a larger body of papers including correspondence, diaries, photographs – all of which can shed light on each other […]" (Breakell, 2008). Thus such an archive can have two dimensions: on the one hand material documenting the creative processes and the artist's ideas or thought process for the public, such as sketchbooks, idea sketches, prototypes or the like; on the other hand a documentation of an artist's work or oeuvre, its exposure and exhibitions, press coverage, technical documentation (installation and preservation guidelines for cultural institutions) created by the artist him/herself. The material provides context as well as representation of artistic projects, naturally from the own perspective of the artist. They can range from objectivized descriptions brought together with media representations of the artistic projects to very subjective and poetic descriptions of the work, rather describing or expanding on possible experiences and atmospheres. Sometimes the artists even have written their own theoretical texts, providing their own reflections on their work as well as contextualization and theoretical grounding. This kind of public documentation is often found in an online-portfolio, artist's catalogues or the website of a creative. These outlets do not necessarily have an archival structure or all features of an archive in the classical sense (see Part V, Chapter 2.2.). However, oftentimes these outlets present works of an artist in a specific order, be it for example chronologically, categorized according to genres, keywords, topics, as part of a larger narrative or contextualized by theory in a catalogue format.

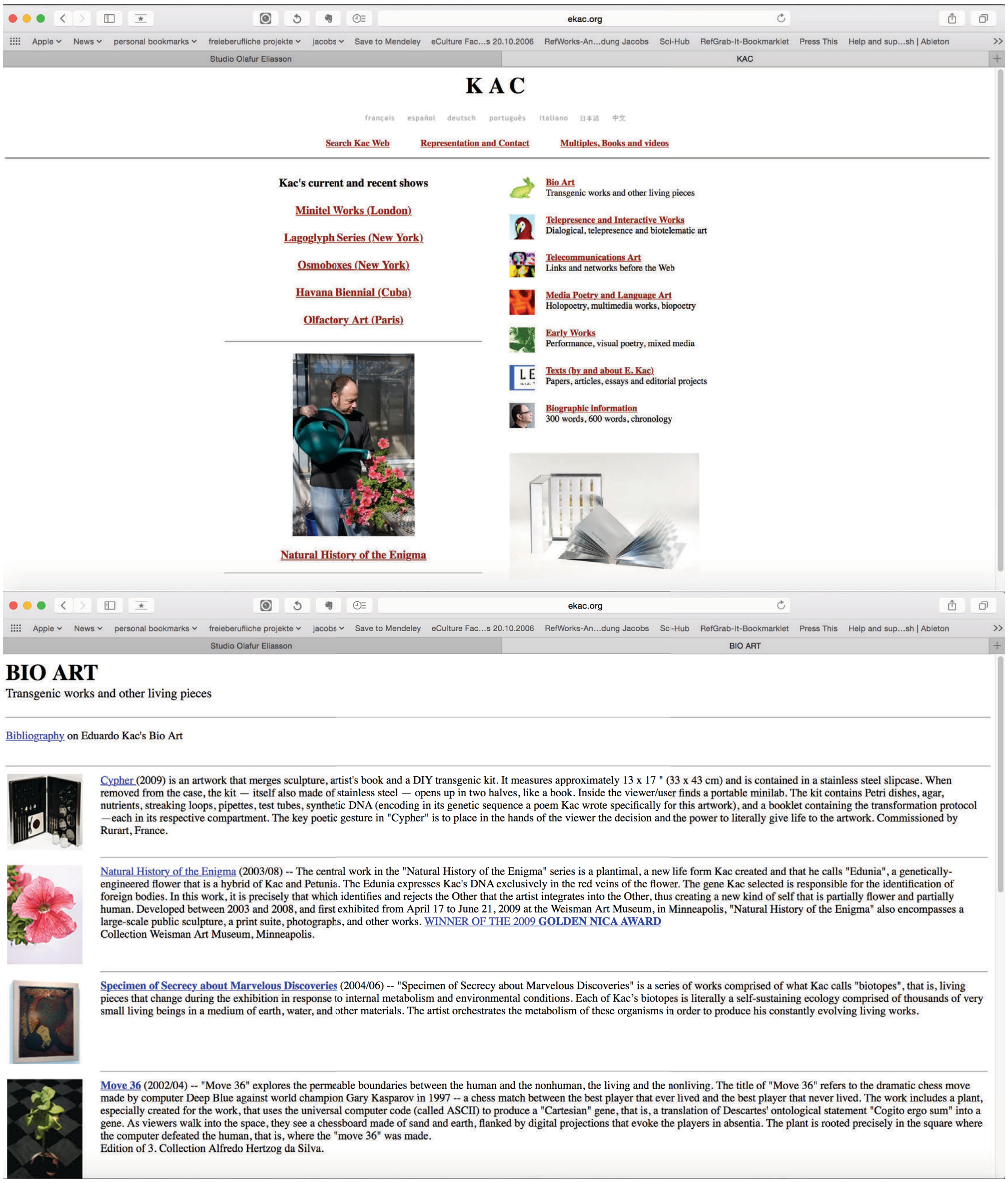

Figure 21: Screenshots of the homepage and one of Eduardo Kac's website (http://www.ekac.org) from 26.08.2016

An example for an artist-portfolio is the website of Eduardo Kac[255]. There he highlights several key works directly on the homepage, and provides direct links to websites of current and recent shows he is featured in, as well as a list of current exhibitions and events. Moveover he groups his work into several categories (Bio Art, Telepresence and Interactive Works, Telecommunications Art, Media Poetry and Language Art, Early Works, Text (by and about E. Kac), each featuring a chronological list of his works falling into the specific categories. The description of the artworks can contain longer theoretical articles about the projects as well as partially links to related works within the website. The "texts" section features more selected writings by the artist himself on his own works and on art-theory in general. In these writings Kac reflects his artistic practice and the practice of others. Eduardo Kac's editorial projects are considered part of his practice. In the same section selected articles and essays about Eduardo Kac's work provide contextualization for part of the works documented in his portfolio. Therewith this self-archive is a basic hypertext-catalogue.

The Studio Olafur Eliasson takes a more experimental and artistic approach with their self-archiving project "Your uncertain archive"[256]. In this project Eliasson deeply reflects what an online-archive can be, how the logic of an archive shapes the encounter of the user with the artwork, how it creates a world and determines what can be known (see Studio Olafur Eliasson, 2016). The studio carefully built the structure and authored the connections between the content – from artworks, projects, publications texts, sketches and interests of Olafur Eliasson and his studio. "Not merely a container for facts and dates, Your uncertain archive is organised around associations and experiences. It is a reality-producing machine, built to generate new content through proximity and contact. It is a living archive that expands continuously" (Studio Olafur Eliasson, 2016).

[255] http://www.ekac.org

[256] http://olafureliasson.net/uncertain; for a documentation of the project see Studio Olafur Eliasson (2016)

Figure 22: Browsing interface to "drift" through projects in "Your uncertain archive" of Studio Olafur Eliasson. Screenshot from 29.08.2016.

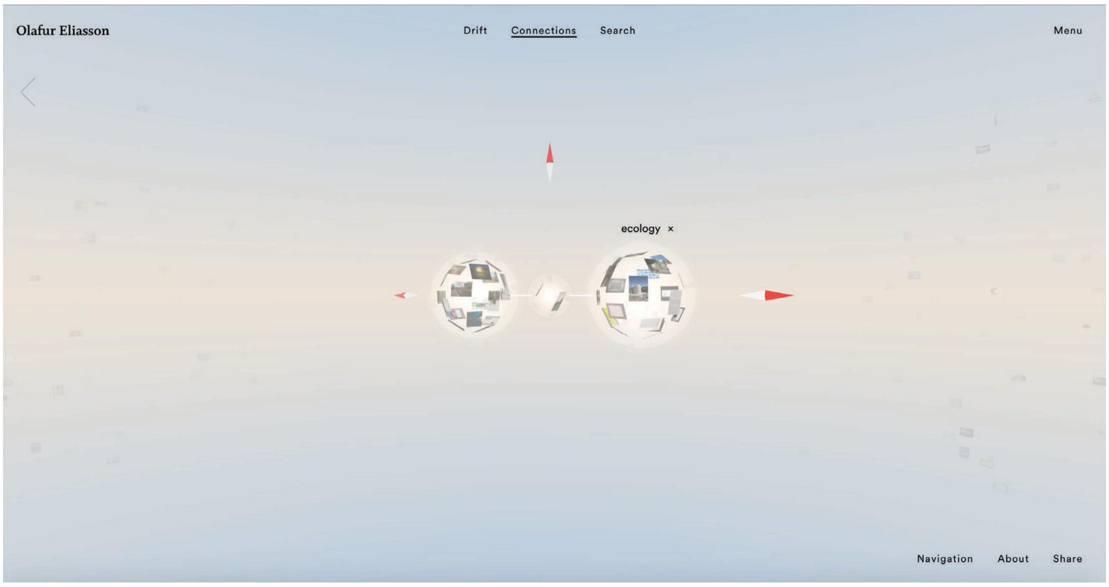

Figure 23: Browsing interface to explore "Connections" in "Your uncertain archive" of Studio Olafur Eliasson. Works tagged with a certain key-word are clustered in spheres. If the user selects several keywords the intersecting works having both keywords are again clustered together visually in the middle. Screenshot from 29.08.2016.

The focus of this particular archive is on creating an orchestrated interactive navigation experience for browsing the projects by Studio Olafur Eliasson. It is an artistic project in itself and concentrates on exposing the relations in the projects of the oeuvre of the studio from the point of view of the team. The main feature is therefore an experimental browsing interface (Figure 23) for drifting through a corpus of projects and getting to their documentation, as well as making the connections between the projects that were established by the studio team explorable through keywords. Using 3D-space, movement and fades in an experimental and visual browsing interface results in a more playful approach to navigating the archive, going away from the classical hierarchical navigation of a catalogue approach, which for example Eduardo Kac followed. The description and documentation of the projects is content-wise very basic in comparison with the theoretical reflections of Eduardo Kac, but with carefully crafted visuals of the exhibited pieces as well as sketches of the process the documentations convey a visual narrative of ideas and possible experiences of the works.

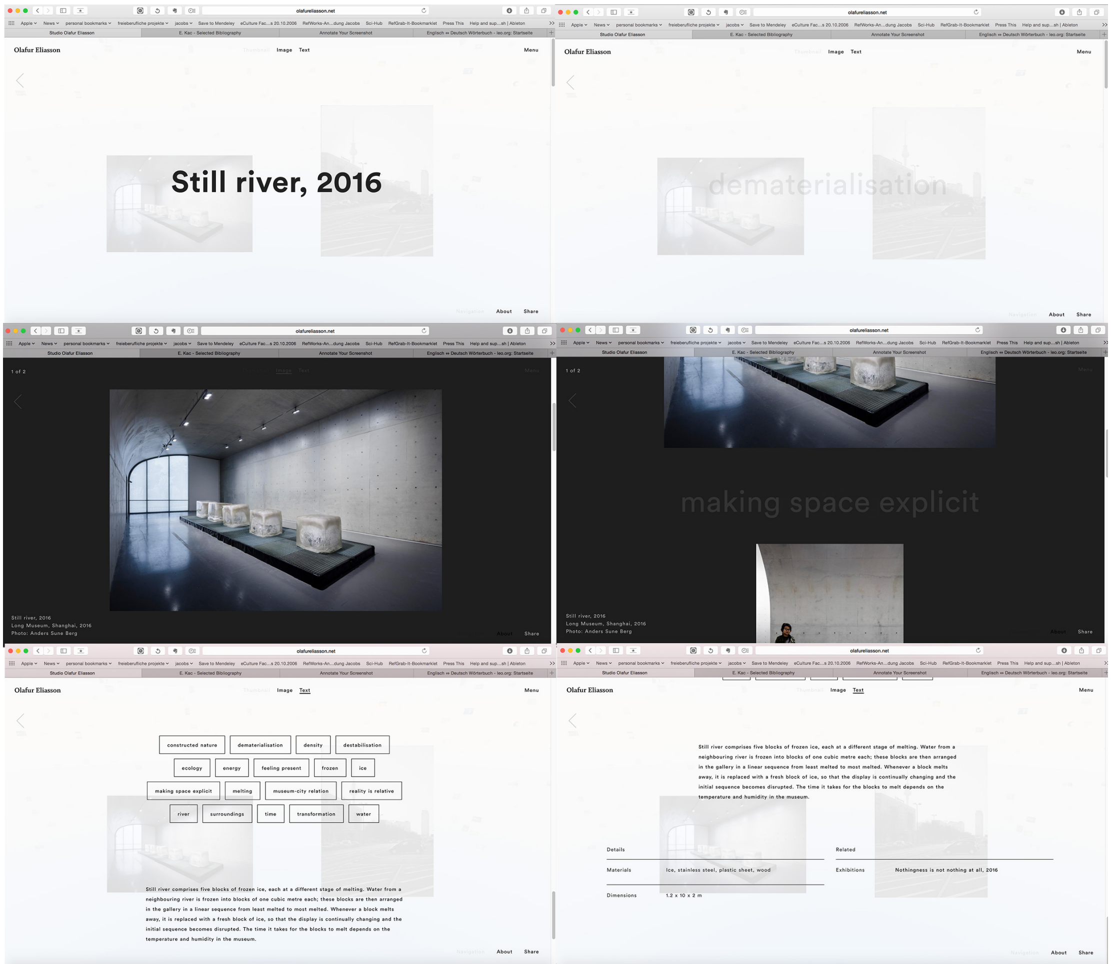

Figure 24: Different steps within the detail view of “Still river“ (2016) within “Your uncertain archive” of Studio Olafur Eliasson. The display works with Parallax-scrolling for the user to move through the different parts of the detail-view. Bold keywords are crossfading in the background in the image display showing visual documentation from sketches to documenting of the exhibited projects. Other parts of the detail-view include an interactive keyword list enabling to interactively explore relations to other projects, a short description of the project as well as general tombstone information. Screenshot from 29.08.2016.

Beyond its "marketing" function self-archiving can also serve as a primary source and contextual reference for cultural institutions and online repositories. To name one example: for festivals like the Ars Electronica the collected documentation about artistic projects of the Prix Ars Electronica competition comes from the original submission of the artist, which usually stems from their own documentation efforts. Thus the artist's documentation is directly reused in an online archive and therewith becomes institutional knowledge.

1.7. Art Discovery Platforms

Art Discovery Platforms usually do not have a collection on their own but rather curate works from and together with institutional collections following an educational mission in cultural learning. These platforms oftentimes are concentrating on thematic narratives or on providing frameworks for individual discovery and exploration. Thus they show the collection or archive data in curated contexts, use methods of digital storytelling or offer tools for connectivist learning through exploration and traversing a content-network as well as tools for users and institutions to communicate with each other. Two examples for this kind of platform are the Google Cultural Institute as well as Artsy.

Google Cultural Institute

The Google Cultural Institute is an example of the approach of a virtual meta-museum, a gateway for curated content of museums, collections and cultural heritage sites. As such it provides an outlet for museums, cultural institutions and archives to host, exhibit and contextualize selected and curated items of their collection or archive material[257]. The work of the institute focuses thereby on the development of interfaces for the presentation and exploration of content, on the application of cutting edge technologies for capturing cultural heritage and on standards for the aggregation of data. Google offers this platform as a service to partnering cultural institutions –

[257] The Google Cultural Institute launched „Google Open Gallery" (http://www.google.com/opengallery/) employing the interface technologies of the Cultural Institute website and enable artists, museums, archives and galleries to create collections, exhibitions and tours including images, video and audio files free of charge. These are not integrated into Cultural Institute's larger platforms but are rather standalone showcases or portfolios. Therewith Google opens up its display technology to virtually everybody – though right now in the test-phase it is on invitation only – and does not limit it to selected partner institutions.

selected by the company – whose work it is to curate, compile and deliver their collection data to be hosted on the platform in an agreed on exchange format. Where most institutions use their own web-presence as main outlet for their data, Google Cultural Institute is mostly an additional outlet for selected collection items, and therewith a showcase and contextualization for their collection. The Cultural Institute covers at the time of writing three subprojects, each with a distinct ways of making the assets accessible:

- The **Art Project**, which covers collection items from museums in over 40 different countries, showcasing mainly works on canvas, sculptures and furniture in high resolution images. The showcased items cover a time span of 250000 BC – the age of the Neanderthals – up until today. In the Art Project the single item is in the foreground, making it explorable in detail through high resolution images, which go up to gigapixel depictions, letting the user zoom in up to the level of a single brushstroke – much closer than the user would ever get in an museum environment. The front page shows featured assets in a fullscreen view, for which the user can directly go into the detail view. The platform offers institutional channels, containing all works of an institution, as well as a sorting of the assets by artist. Moreover it provides a filter and browsing interface on the granularity of single artworks.

  Besides the institutional channels the Art Project offers indoor streetview, to explore the gallery space of an institution (see Figure 57). Items featured on Google Cultural Institute are shown in an institutional exhibition context, in a real world exhibition space. Therewith physical space of an institution also becomes important in a digital environment. It is documented and explorable. Moreover through this project the gallery-interiors become directly available through the Street View feature in Google Maps. Thus Google Maps is becoming even more an coordinate system for information, where one cannot only find a museum on the map and get its opening hours, or go to its website, but also virtually explore its interior and part of their exhibitions from the comfort of your couch or desk. Therewith it strengthens the notion of Google Maps as “Google on maps”, which includes locality in search and also binds results back locally – such as artworks to the museums, where they are part of the collection.

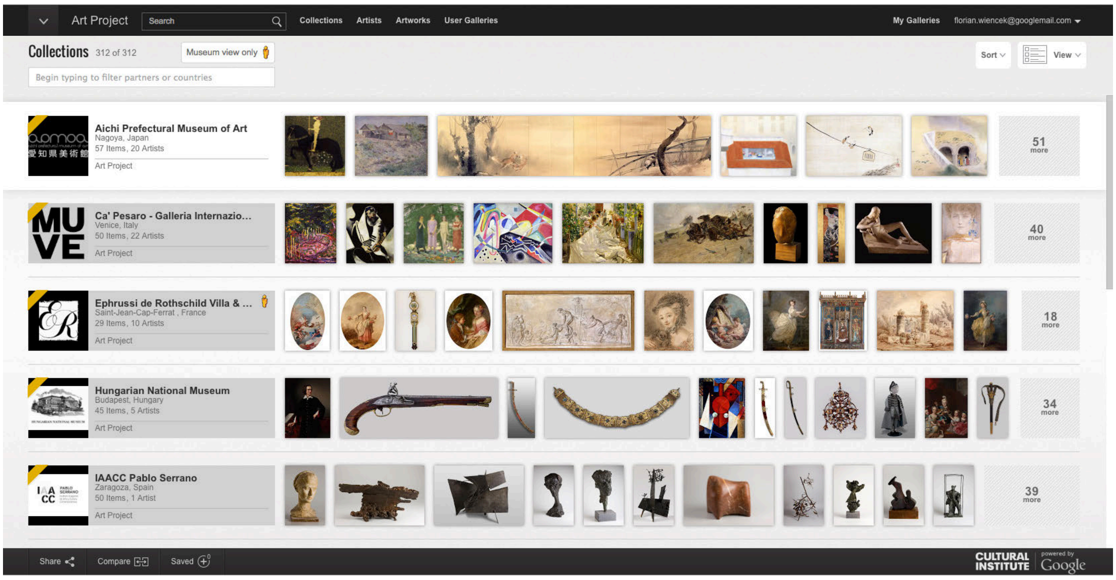

Figure 25: Screenshot of the Institutional Channels in the Google Art Project from 13.12.2013. From this page a user can launch the "Museum Views" as well.

- The **World Wonders Project** showcases modern and ancient world heritage sites, such as Stonehenge or the ruins of Pompeii. The places are geolocated on a map and presented in a mixture out of Street View images, which make the world heritage sites digitally explorable as an immersive mirrorworld. These are showing the site in the state of the day of capture in the 21st century, mostly in its use as tourist destination. Besides the photographic Street View images, which follow a documentary approach, the site is portrayed by artistic projects from diverse collections featured in the Google Cultural Institute. The artworks are showing a more personal view on the site, highlighting a personal impression or the atmosphere of the site. The detail information on the history and background of the world wonders is provided in collaboration with UNESCO World Heritage.

- The **Archive Exhibitions** are online exhibitions curated by partner institutions and curators in order to showcase archive material from photographs, videos to manuscripts or documents, which usually are rarely put on public display in cultural institutions. Some of the categories include “Historic Moments”, “Cultural Figures”, “Science & Technology” or “Fall of the Iron Curtain”. As discussed before, these exhibitions resemble with their horizontal display a physical gallery (see Figure 56)[258], where the visitor would stroll along the gallery walls and find label texts besides the displayed material, with the possibility to jump between "wall positions". Only in the digital version the user can oscillate between detail view, allowing interaction with and detailed inspection of the material, the gallery view, as well as other features like viewing the exhibition linearly as a slideshow.

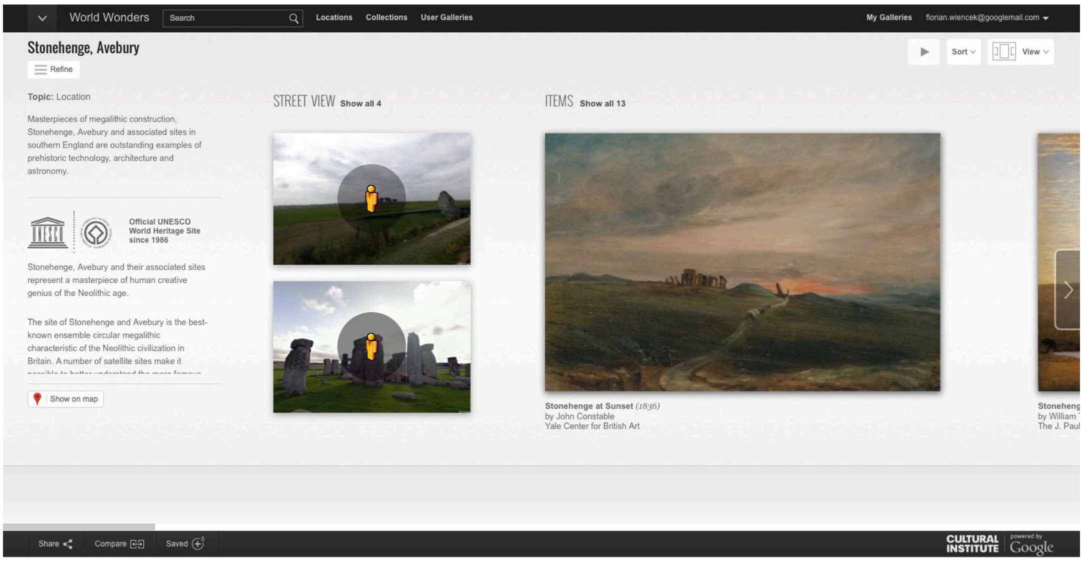

Figure 26: Screenshot of a detail page from Stonehenge, offering background information and different visual depictions of the world heritage site: from immersive Google Street Views to artworks depicting the site. Screenshot from 13.12.2013.

The possibilities of interaction with the artworks go beyond the exploration of collections, sites, museum galleries and the inspection of art work details in high resolution images – one of the key selling points of the platform besides the 360 degree gallery views and explorations of world heritage sites. Thus the highest content quality and immersion are key. Additionally Google Cultural Institute facilitates personalization through the curation of own galleries, which allow commenting on the artworks and can be made accessible for other users, a side by side comparison of two artistic projects on the platform or the possibility to share the artworks on the major social media platforms. All of these interactive possibilities can also be used for educational purposes. In the DIY-section of "Art Project Education" Google proposes several kinds of educational projects, which can be carried out with the help of the website: for example

[258] For a discussion of the online exhibition format see Part VI, chapter 2.3.2.

- **curation exercises** on a specific theme, connected by specific visual elements in the work (objects, colors) or resembling an exhibition as found in a specific in-gallery view of an institution.
- **remix exercises**, reusing material found in the Art Project.
- **photo expeditions**, where the students should find specific motifs or elements inside images – for example wild animals – prompting the students to closely examine artworks on the Google Art Projects, using the zoom feature and document their findings with screenshots.
- creating a **scavenger hunt** on a social network or in class for example using a short sentence summarizing a scene and let others search the image in the Google Art database (see Google Cultural Institute, 2013a).
- **looking exercises,** comparing subject matters, shapes or materiality over time; compare the depiction of clothing and folds; learn to identify the painter by his "signature stroke"; or look for hidden meanings in images.

Google additionally partners with content providers in order to provide educational content, such as introduction into the "language of art" (see Google Cultural Institute, 2013b) and provides teacher guides and educational packages for classroom use related to the World Wonder Project, to facilitate the use of these resources in K12 teaching. The company also organizes virtual lecture series using its own product "Google Hangout" and invites experts from partner institutions to talk about artworks and the work of cultural institutions.

Artsy.net

Similar to Google Cultural Institute the platform "Artsy"[259] is an extensive free repository and outlet of fine-art images and acts as an online art appreciation guide, which went online in October 2012. Besides being a repository without an own collection, and being funded in parts by sales commissions for artworks – which makes it comparable to commercial platforms such as Saatchi Online – the platform has an intrinsic educational approach. Artsy's mission is to "make all the world's art accessible to anyone with an Internet connection" (Artsy, 2013a) and aims to be a source for discovery, pleasure and education. "Using the latest advances in engineering and

[259] http://artsy.net

design, Artsy hopes to help educate and cultivate new generations of art lovers, museum visitors, collectors, and patrons" (Artsy, 2013a).

Like the Google Art project, this platform partners with galleries cultural institutions such as museums, foundations and private collections in compiling a section of artworks through art of all periods. Moreover the platform tries to cover major international art fairs and other art related events, in their effort of making the art world accessible to its global audience and not only looking into the past but staying up to date with contemporary developments. Artsy claims to have one of the largest art collections online[260]. But in contrast to the Google Cultural Institute, whose main efforts go into the technology development and production support for high resolution imagery and 360 degree imagery as well as making the content retrievable and browsable – the core business of a search engine – the core of Artsy lies in relating the artworks to each other by developing its meta-data. Thus they offer the partner institutions services for promoting their collection, exhibitions and programs in return for letting Artsy use their data. These services are for example including the artistic projects in the Artsy infrastructure, which relates them to other artworks in the database and makes them retrievable by relational search; the ability to post insights and announcements into the social layer of Artsy and thus offering a social media-like communication channel for institutions; and using Artsy's e-commerce platform to sell limited editions of artworks. For galleries Artsy offers marketing and sales tools "including unlimited artwork listings, a dedicated gallery profile page, promotion of current exhibitions and fair booths, client inquiries routed directly through the site, optional e-commerce functionality, and targeted email campaigns to users who 'Follow' the gallery's artists" (Artsy, 2013a).

Besides public facing marketing the platform offers a web-based Content Management System in order to control a partner's inventory on the platform, and which optimizes the inventory for search engines and sharing to other social networks like Facebook, Twitter, Tumblr or Pinterest. Thus in exchange for free content the partners get an opportunity to broadening their reach of their content and tools to directly address an

[260] In numbers on the day of writing this (November 12, 2013) they claim to have over 50000 works of art by over 11000 artists, contributed by over 500 galleries and over 140 cultural institutions– amongst them the Guggenheim Museum, SFMOMA and Smithsonian Cooper-Hewitt: National Design Museum; foundations like the The J. Paul Getty Trust or the Calder Foundation; providers of educational content such as Art21 or ArtTube.

audience interested in their content with their outreach activity and to be contacted by them as well.

To the user the platform presents itself – similar to Saatchi Online – as a platform for exploration of art. The homepage offers a selection of featured content: from exclusive coverage, over featured artworks for sale, to featured shows, artists or posts, which should offer an entry point in the different content entities of the platform. These entities are artworks, artists, institution / gallery, exhibition and posts. Posts are "stories, facts and reflections about artists and artworks created by the international Artsy community" (Artsy, 2013b). Thus they resemble social media content in the classical sense, which every subscribed member can publish, be it museums, foundations, auction houses, curators, artists, media outlets or other individual members. In the section posts the user can find all posts featured by Artsy as well as posts by the members or institutions he or she follows. But instead of being only presented in a timeline format, as it is common in most social networks, the posts can be associated to artworks or artists and are featured in the detail view of the particular artwork, bringing together multiple points of view on the project. Therewith a post gets the character of a comment and contributes to an ongoing discourse around an artist or artwork. Moreover institutions can feature content, which discusses for example one of their exhibitions or events. Besides member- or institution-generated content there are also editorials published by contracted writers. As already discussed for other platforms, Artsy offers a browsing interface, employing amongst others categories of subject matter (for example, political, landscape, fashion, etc.), medium/technique (for example, performance, film/video, painting, photography, design, etc.), style and movement (for example, Pop Art, Abstract Expressionism, Minimalism, Conceptual Art, etc.), price or popular categories. Besides these main entry points the user can use any meta-data about an artwork as entry point for browsing and in a second step for filtering the results, letting the user drill down to the detail information about an artwork and artist. Being a modeled as social media platform, Artsy lets the user create a profile, which enables the user not only to post but also to favorite and share artworks with friends, follow institutions and artists and get updates from them – for example news from the institutions or the information that a new artwork of a particular artist was added to the platform. Moreover it is possible to follow specific, so-called "genes", which are defined categories for artworks. The mechanism of "following" is modeled according to Christine Kuan, chief curator and director of strategic partnerships at

Artsy, after the blogging platform "Tumblr"[261] with the goal, to spur engagement of the users with the materials and with other members. Therefore a user can explore the public profiles of individual members and institutions and see their posts. However, even though the platform embodies traditional functionalities of social networks, its prime function is not in building personal networks and communication between the members, but it is fundamentally about artworks, artists and institutions as well as events around them. This gets evident for example in the fact that there are no features which allow direct conversations between members, nor is there a reply or comment function for the posts. But rather the user-contributions are directly related to the data about art itself. This differentiates Artsy clearly from other platforms, like for example Saatchi Online.

Two uses are central for the platform: collecting art as well as educational use and the use for art appreciation. For collectors the website offers an e-commerce platform, which can handle the sale of artworks from galleries. Therefore the detail view contains pricing information or at least the possibility to contact the gallery directly for the price of a particular artwork. Moreover it offers a feature to see the prices of similar pieces that were recently auctioned. The more interesting features for this investigation are the ones for art appreciation and education.

The core of the educational approach lies in learning by browsing the content on the platform, traversing the network of content and learning through the relations of the artworks. Thus a central point of the platform is the mechanism of building relations between the artworks, which enable a related art search and a recommendation system – like Pandora for art, as Melena Ryzik described the platform in her New York Times article (2012) shortly after the launch. And also Sebastian Chan from Smithsonian Cooper-Hewitt, one of the content partners, commented in an interview with the New York Times, the value of the platform is not so much as replacement of museums, galleries or books but rather as an interface for browsing art, which is different from a museum and tailored to the "Generation Twitter" (see Hargrave, 2013, p. 22), as well as art neophytes, who want to broaden their taste.

[261] https://www.tumblr.com

The basis for describing these relations is the “Art Genome Project”[262] spearheaded by Matthew Israel (see Part VI, chapter 2.1.2.) that is the basis for browsing and traversal of artistic projects across genres and time. For closer inspection Artsy offers zoomable high resolution images as well as the possibility to download[263] a part of the images to be reused for example for teaching and research: for example as examples and illustration for art historic discussions, art practice lessons or other subjects from literature to history. Additionally to the visual content the user gets insights into the discourse about artworks or artists on the one hand by formal descriptions of genes by the Artsy experts on the other hand through posts of members or institutions related to a specific artwork or a topic. The artist biographies, descriptions of the artworks or features about current art events give further background information for an art historical discussion. The “In the Studio” features enable to learn about artistic practices. Other suggested ways to use the available features of the platform are to use the “favorite” feature to create your own collection of artworks or curate an “exhibition” in class. The genes as defined vocabulary can moreover be used to develop exercises in describing existing artworks, which are not on the platform, or the own artworks of the students.

2. Meaning-Making in Cultural Online-Repositories and -Platforms

Following the definition of an archive in Part V, chapter 1.2. and the database as its digital counterpart in Part V chapter 2.1., this chapter looks at online repositories at large as software tools and how meaning is and can be generated with them – an important factor for their use for mediation practices. The goal is to establish and discuss an online-repository or –platform and its interfaces as a mediation tool in its own right and how the functionality encoded in the frontend as well as backend is working towards this goal.

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[262] The terminology is borrowed from biology and genetics, where the genome denominates the complete DNA sequence and therewith a complete set of hereditary information of an organism (see Binder, Hirokawa, & Windhorst, 2009a). The Human Genome project, where the project refers to in the name, has the aim to identify all the genes of the entire human genome, thus all the building blocks of the hereditary material of a human being (see Binder, Hirokawa, & Windhorst, 2009b).

[263] These images are usually public domain or were made available by the copyright holders.

As already stated, the archive itself is only "raw material". For mediation practices it has to be combined with tools, which enable and facilitate further engagement and processing as well as contextualization and linking of data. As Harald Krämer argues, the archive should lead to the right answer through the development of possible questions to tease out what cannot yet be known (Krämer, 2001, p. 171). Thus the meaning-making process activates the future potential, the not-yet knowable that an archive saves and preserves as well, using the database, their processing and interlinking as well as their interfaces as a stage to do so.

In general this thesis differentiates four dimensions of meaning generations in "digital archives", to be discussed in the following sub-chapters (see also Drucker, 2011 for a similar argument):

- categorization of the material and information architecture
- modes of retrieval
- modes of presentation and contextualization of the material
- interactive processes offered by the digital repository or platform as part of their software architecture

2.1. Categorization and Information Architecture

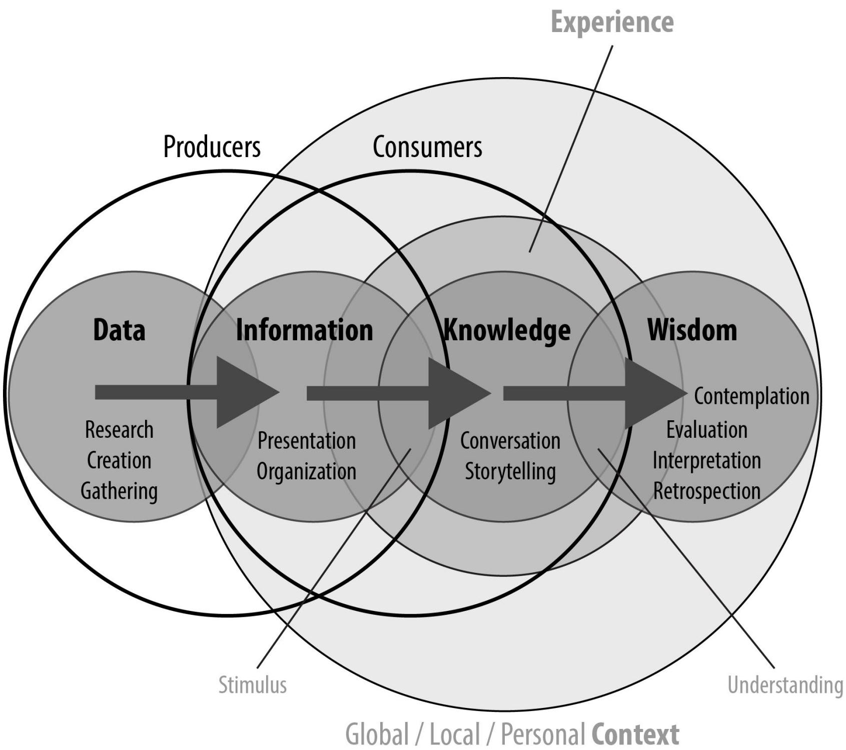

Figure 27: The continuum of understanding based on Shedroff (1994, p. 3).
Graphic: Florian Wiencek

In an attempt to explain meaning making and knowledge generation on the basis of data through information design – which enables users "to create valuable, compelling, and empowering information and experiences for others" (Shedroff, 1994, p. 1) – Nathan Shedroff described already 1994 what he calls "the continuum of understanding" (see Figure 27). This scheme outlines the transformation from data as a startingpoint to information, to knowledge and finally into what he calls wisdom. Where the whole scheme gets interesting especially for a concept this thesis refers to as "co-creative knowledge generation", (discussed in Part VI, chapter 2.4.2.), this section concentrates on the very first step in this scheme, which is the transformation from data to information through presentation and organization: a function a database and online-repository can fulfill perfectly.

As Shedroff writes "[d]ata is fairly worthless to most of us; it is the product of research or creation (such as writing), but it is not an adequate product for communicating. To have informational value, it must be organized, transformed, and presented in a way that gives it meaning" (Shedroff, 1994, p. 3). And he further explains: "Information makes data meaningful for audiences because it requires the creation of relationships and patterns between data. Transforming data into information is accomplished by organizing it into a meaningful form, presenting it in meaningful and appropriate ways, and communicating the context around it" (Shedroff, 1994, p. 4). Thus Shedroff mentions two criteria for the transformation from data to information: order and presentation.

2.1.1. Discrete Order

A specific order of a dataset is usually established by categorization, which is an act of grouping items together that are similar or related in some way. There are different ways to establish an order in digital repositories. To recall the orders discussed by Peter Haber (2006): he distinguishes pertinence (ordering by subject criteria) and provenance (ordering by origin), which do not have to be mutually exclusive in digital systems. Actually most database-organizations nowadays are nested, applying more than one criterion to establish an order – for example order alphabetically by name and then by year (see Shedroff, 1994). One of the easiest ways to provide an order of material is an alphabetic index, for example of names or terms, as often used in references such as dictionaries or encyclopedias. The location is another meta-data to sort material, for example by mapping it. But by far the most common one is the sorting into specific categories that are based on the field the material is from or that are inductively generated by engaging with the material itself.

There are two ways of generating these categories: the first is top down, which in its simplest form results in a non-hierarchical list of controlled vocabulary, or a hierarchical list called "taxonomy". Both are usually compiled by trained professionals and result in a pre-defined, often institutionally controlled logic of an archive and – depending on the consistency in its application – a certain degree of standardization and consistency in classification of the material throughout the archive (see e.g. Kwastek, Spörl, Helfert, & Kolar, 2007). This hierarchical or non-hierarchical list of standardized vocabulary is used – usually again by specialists – to assign metadata to archive- and database-records. This kind of classification can be found in many institutional archives or research archives, for example in the realm of media art in the "Archive of Digital Art"[264]. Beyond the efforts of individual archives to describe and classify their specific material there are efforts for more standardized vocabularies, so called thesauri – for example for artist names, geographic names or general subject related terms of a field.[265] For the field of art and culture the Getty Research Institute offers several influential thesauri[266]. "The Art & Architecture Thesaurus ® (AAT), the Getty Thesaurus of Geographic Names ® (TGN), the Union List of Artist Names ® (ULAN), and the Cultural Objects Name Authority ® (CONA) are structured vocabularies that can be used to improve access to information about art, architecture, and material culture" (J. Paul Getty Trust, 2013) and interoperability of repositories, which employ the thesauri as shared vocabularies. These thesauri can moreover be starting points or baseline for the development of field specific taxonomies as for example V2_ has done (see Fauconnier & Frommé, 2002).

[264] https://www.digitalartarchive.at

[265] Another result can be a so-called „authority files" containing normed terms that can be used for description in a documentation. These are known in the world of archives and libraries and usually based on ontologies. The „Gemeinsame Normdatei" of the German National Library or the Library of Congress Name Authorities Files (LCNAF) are examples of such files.

[266] see also http://www.getty.edu/research/tools/vocabularies/index.html

Very common in the participatory culture are bottom-up approaches for classification and ordering, which open up these practices from closed expert circles to wider user groups, reflect the need of the society at large but also allows every individual on a personal basis to stay on top of the massive amounts of data they produce on a daily basis. The starting point of this practice is the so-called "tagging". As Paul Anderson defines it, "[a] tag is a keyword that is added to a digital object (e.g. a website, picture or video clip) to describe it, but not as part of a formal classification system" (Anderson, 2007, p. 9). In first place tags are applied for personal use, but this practice has according to Paul Anderson two kind of outcomes, when it is applied in a larger scale: "[…]a folksonomy (a collection of tags created by an individual for their own personal use) and a collabulary (a collective vocabulary)" (Anderson, 2007, p. 9)[267]. As Anderson elaborates further: "Tagging does provide for the marking up of objects in environments where controlled indexing is not taking place, and as the tagging process is strongly 'user-centric', such tagging can reflect topicality and change very quickly" (Anderson, 2007, p. 34). Thus as Anat Ben David argues "the categories emerge […]according to what the actors [in a Latourian sense, F.W.] themselves say" (Digital Methods Initiative, 2010) in their own "issue language". A folksonomy arises when this free tagging by individuals is done in a social environment, usually shared and open to other users. Thus it is a conglomerate of people's individual uses of particular vocabulary and the user's individual meaning making of a digital object (see Vander Wal, 2007). Therefore it is a very valuable technique for the crowdsourcing of meaning making, but also in showing potential ambivalences in understanding of the same material. Another phenomenon is the collaborations between users and domain experts on a shared vocabulary with the help of classification experts, which leads to a compromise solution known as "collabulary" (see Anderson, 2007, p. 34). As Steven Downes observes there are two distinct ways of working:

> 1. people, working independently, just happen to use the same word to describe the same resource
> 2. people, working together, agree on a term that describes a given (type of) resource

[267] The initiative Forging the Future (http://forging-the-future.net/) is more specific with the distinction of different vocabularies. Folksonomy they define as vocabulary where anybody without restriction can contribute, then they define a „Creatoronomy", where the terms and classification come from the artists or creator in general. The taxonomy is created by catalogers or library students supervised by a cataloger (see VocabWiki, 2009).

(Downes, 2012, p. 407)

Where he describes the first way of working as a network and group behavior, which leads to a folksonomy, the second method resembles the more common methods of librarians and taxonomers (see Downes, 2012, p. 407)[268], which is opened up beyond an expert community. A prominent example where these techniques are at work for collaborative knowledge generation is Flickr Commons, where users are directly asked to make photographs more discoverable by tagging, commenting and therewith enriching the collection. Another interesting project in this regard is the "Forging the Future VocabWiki" (see VocabWiki, 2009), which served as a place to collectively define terms used especially to describe digital culture. Amongst others the platform Rhizome[269], which employs a mixture of taxonomy and folksonomy for their classification, contributed to this project.

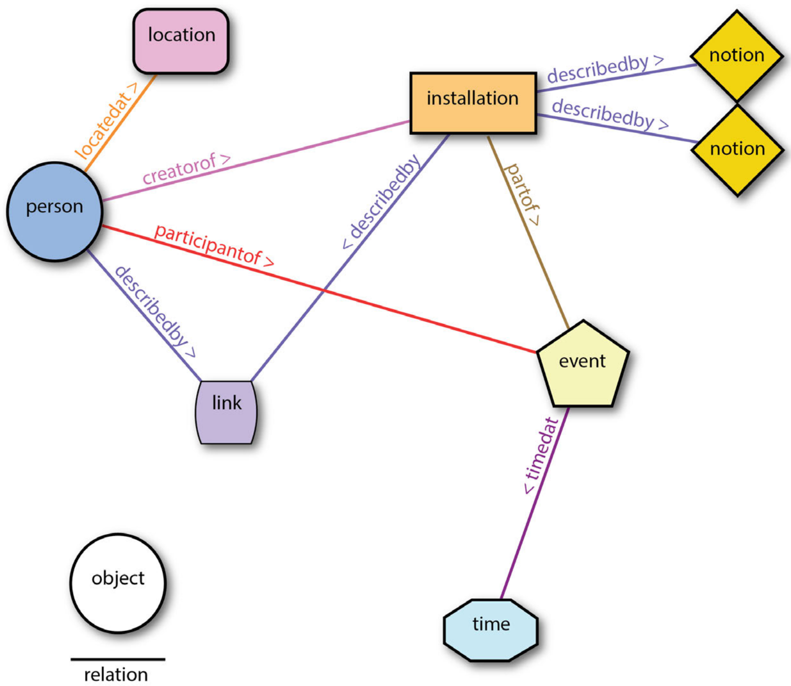

Figure 28: Schematic visualization of the object-relation metadata structure of the V2_archive adapted from Fauconnier & Frommé (2002, p. 2). Graphic: Florian Wiencek

[268] Even though Steven Downes (2012, p. 407/408) criticizes the word „collabulary" as being redundant as it is too close to a taxonomy from its method of production, and also not every folksonomy is a collabulary, as individuals who work independently on tagging do not really collaborate, which would require communication between the collaborators. If we really „need" this term – which Downes denies – or not, what it clearly shows in my opinion is a distinction between vocabulary developed in expert communities (taxonomies) and an opening up of this practice in the spirit of participatory culture in what Anderson (2007) calls „collabularies".

[269] http://rhizome.org/

Another way of order is the ontology, which in the domain of computer and information science is defined as consisting of objects (or classes) with specific attributes (or properties) and relations between classes. Usually the classes with their properties model real life objects and their behavior, and the relationships define how these objects relate to each other. For example in the ontological model of V2_s "Capturing Unstable Media Conceptual Model" (CMCM, see Figure 28; Fauconnier & Frommé, 2002) a person can be located at a location, can be the creator of an installation and participant of an event, while the person might have attributes such as a name, date of birth, or the like. This resembles a worldview of object oriented programming (see also Lev Manovich, 2001). "The definitions of the representational primitives [objects, classes, F.W.] include information about their meaning and constraints on their logically consistent application" (Gruber, 2009). Thus this object relation model represents on the one hand a model of a facet of our world, a domain of knowledge or a discourse (see Gruber, 2009). "In the context of database systems, ontology can be viewed as a level of abstraction of data models, analogous to hierarchical and relational models" (Gruber, 2009) but intended to model knowledge about complex systems, such as the production and reception of media art projects as it is modeled in the CMCM by V2_ (Fauconnier & Frommé, 2003). The similarity to systems based on relationships between data such as linked data becomes evident here.

2.1.2. Mixing Discrete and Continuous Description

The ways of order discussed until this point were all discrete in a mathematical sense as the categorization consists of distinct, well defined and separated values. In the age of computability of media and in awareness of computational methods of media analysis and classification, a mixed form between the established discrete, language-driven and well defined human description of cultural data and a continuous[270] description expanding the first one was developed with the Art Genome project by Matthew Israel, which is employed on the platform Artsy (see Israel, 2012b). Being still a completely human-created categorization, the Art Genome project develops and

[270] continous in the mathematical sense means the opposite of discrete, namely in the set of numbers (called real numbers) this branch of mathematics works, there always and infinitely another number between two numbers. Thus instead of clearly defined possibilities of mathematical objects or in case of cultural analytics categories there are infinite ones on a sliding scale.

expands an at best encompassing list of possible characteristics or terms assembled and defined by experts, which can be applied to art. Matthew Israel differentiates in an early blog post about the project the following areas, which are covered by genes, and gives examples for them in parentheses:

- Time Period (Pre-Impressionism, Modern, Contemporary)
- Medium (Painting, Sculpture, Installation, Video)
- Style or Movement (Pop Art, Abstract Expressionism, Young British Artists)
- Contemporary Tendencies (Tendencies occurring in contemporary art but that people might not yet be comfortable calling "movements," such as Contemporary Gothic or DIY)
- Concepts (Color Theory, Institutional Critique, Related to Film)
- Content (Portrait, Landscape, The Studio, Cityscape)
- Techniques (Monochrome Painting, Multiple Exposure, Sfumato)
- Geographical Regions (Where an artist has lived and worked)
- Appearance Genes (The look and feel of an object)
- Labs (Genes in development; not public)

(Israel, 2012b)

As it gets evident, the "Art Genome", which denominates a complete list of characteristics or genes for an artistic project and shows as well as generates relations of artistic projects inside the database, consists of a mix of objective and subjective labels. The definition of these so called "genes" are based on art-historical scholarships, discussions around contemporary art in various media, communication between the Artsy experts as well as communication with the partner-institutions, whose works are featured on the platform (see Israel, 2012b). But the purpose of the genes is not only to categorize the data featured in the platform Artsy. Rather "[t]he Art Genome is another way of creating serendipitous connections" (Sebastian Chan, quoted in Ryzik, 2012). Or as Matthew Israel wrote in a blogpost, Artsy is mapping serendipity (see Israel, 2012a). He argued in his presentation at the Museum and the Web Conference 2013 that genes do not summarize artworks or artist's oeuvres, but rather serve as bases, as starting points for exploration. And this serendipitous exploration through "related art search" – you can call it browsing or traversing the relations between artworks – is what Artsy conceives as their main educational approach.

> "This type of search can be understood as a new tool for learning about art and art history. It provides an educational experience quite different from other art-historical resources like books and journals, lectures or films. Related search is an active, exploratory, and self-motivated experience that opens up seemingly infinite pathways" (Israel, 2012a).

On the basis of the corpus this function allows a user of Artsy to trace the development of specific movements or genres like collage or documentary photography over time through the function to sort the items related to a gene chronologically. A user can do the same for subject matters like landscape or portrait and how they were dealt with differently over time, in different artistic movements, in different genres. He or she is able to juxtapose different artists within a movement such as surrealism or dada. Moreover through the differentiation between genes for an artist and for individual artworks of an artist allows to compare, how a single project differs from his or her whole oeuvre as well as how individual works differ from each other (see Israel, 2012b). Therefore the genes are a "jumping-off point for a discussion on the variety within certain styles, movements or techniques—both contemporary and historical" (Israel, 2012a) as well as an artist's oeuvre.

The aspect of discussion in the development and application of the genes strengthens the role of human actors. The Art-Genome definitions are on purpose human-generated and not stemming from automated analysis. As Melena Ryzik puts it: "Software can help filter images for basic visual qualities like color, but the soul of the judgment is human" (Ryzik, 2012). And Ryzik quotes the Artsy engineer Daniel Doubrovkine: "We learned that the data matters much more than the math […]. How are you going to pick something that shows 'warmth' with a machine? We're not." (Ryzik, 2012). Both, the definition as well as the application of genes is said to be a group effort of the genome team at Artsy in communication with the content partners. This inductive method bears the critique that the quality of the genome is depending on corpus, its size and the quality in terms of breadth of available material – voiced for example in Ryzik's New York Times article. The article criticizes that its outcome is true for the corpus itself but not necessarily generalizable – a critique one can apply to any inductive and corpus based method. Thus creating a genome for the complete art history is a lofty goal, but needs a corpus, which represents a complete range. This is currently not the case for Artsy, at least not yet. Neither is it the case for any museum. However through bringing a wide range of sources and therewith artworks together on the platform, there is the potential to widen the scope of the "Art Genome Project" and the relevance of the classification for a broader field of artistic projects.

Even though the "Art Genome Project" has similarities and relations to previous established ways of classification, it also differs from all of them. On the one hand the genes applied to artworks and artists look like tags, but they go beyond that use on Artsy. Where tags are binary – either a work has a specific keyword or not – genes can be applied in a gradual strength between 0 and 100 (see Israel, 2012b). This takes up the continuous nature of variables within the computer and allows a more nuanced connection between the artistic projects. Secondly the "Art Genome Project" differs from a classical taxonomy, because it is build up polyhierarchical, which means that not all characteristics are related to each other and can be merged into a single hierarchy or tree structure. As discussed, multiple and nested orders are one characteristic and possibility in an digital evironment. Additionally the project has similarities to a thesaurus, as it only includes generic terms. But it is not focused on grouping by and retrieving similarity of terms, as a thesaurus would be, but on the connections between artworks through the defined traits (see Israel & Backus, 2012). And these can include capturing "individual art-historical and artist influences, such as the fact that Jackson Pollock was influenced by (among other things) Mexican Muralism or Thomas Hart Benton" (Israel, 2012b).

It becomes apparent that the Art Genome Project applies the discrete logic of an explicitly human-defined categorization system and takes up the continuous characteristic of a computational analysis in its application. The former was and still is the standard in the humanities since the categories and order is rooted in language, which describes things in a clearly defined way (based on a specific definition of what a keyword or term means). Martin Warnke even talks about a dominance of language for ordering over other traits (see also Warnke, 2003). Classically there is the tendency of assigning language-based metadata – thus data describing data – to digital objects. This makes the data retrievable by a computer, allows to add machine readable and "understandable" semantics to it, and to build relationships between the data. Moreover it is a way to inscribe individual or institutional points of view and meaning attribution.

However, with the processability of the data new possible orders beyond established categories, new points of view from the perspective of a computer onto all kinds of cultural data beyond text emerge by the virtue of automatic data analysis. Thus rather than discrete categorization through vocabularies the computer uses a continuous, mathematical categorization based on the statistics of the visual analysis results, such as the color values in RGB, variables like the degree of smile or a specific emotion of a depicted person, detached from human association and interpretation[271]. This establishes a novel continuous form of categorization and order using computational analysis as a starting point. The computed order of data based on these properties is necessarily also a continuous one, as Lev Manovich explains. And instead of using a relatively small number of categories to describe a cultural object, computational analysis can extract according to Manovich hundreds to thousands of features from the object that can be used and combined for different continuous orders of a corpus of cultural data (see Lev Manovich, 2015, slide 38). This leads to the move from a rigid and discrete categorization towards what Lev Manovich calls “thinking without categories”, a research paradigm he brings forward in his concept “Cultural Analytics” (see e.g. Lev Manovich, 2008, 2009a, 2009b, 2013c)[272].

2.1.3. Computational Analysis as Way of Ordering Data

Cultural Analytics aims to study cultural processes on the basis of the computational analysis of massive cultural datasets and flows of digitized cultural artifacts as well as natively digital cultural objects, including their visualization. The ability to possibly use all kinds of available digitized and natively digital data of human history – and through computation not being limited to a small subset of them – carries the hope to “create more comprehensive and inclusive understanding of human cultural evolution and dynamics” (Lev Manovich, 2013c). According to Lev Manovich this also challenges the common notions of culture and how to analyze it. The goal of Cultural Analytics is to let the utopia of an “all-inclusive cultural mapping” (Lev Manovich, 2013c) lead to new

[271] For Cultural Analytics the change from discrete to continuous hast wo implications: a) Mathematically it is the change from discrete and clearly defined values and logic to an infinite numberspace, that is usually the form of result the visual analytic algorithms deliver, but also how analogue media work before they are digitized. b) the possible infinity of the granularity of order adds to the complexity of understanding media data and might allow a more fine-grained order and relation than fixed categories.

[272] The concept was developed by Lev Manovich in 2005, the term was coined in 2007 (see Lev Manovich, 2013c).

questions to ask, new angles to look at, which are inspired by the analytic results that computational low level analysis of cultural data can deliver.

Low-level analysis aims at the algorithmic pattern detection on the basis of raw data, for example all the pixels in an image. It operates on low-level features of an image file, such as file size, resolution, color or texture (see Khan & Jaafar, 2011, p. 1). Examples for the image analysis refer to basic algorithmic analysis of computer vision, for example the entropy of all pixels in an image, or the standard deviation of all pixel values, as used as one of the comparative graphics in the one million mangas project by Lev Manovich and Jeremy Douglass (see Douglass, Huber, & Manovich, 2011, p. 34). The outcome of varied computational analysis of the cultural data is then an entry point for further human qualitative analysis of the dataset, enabling to give an overview and the possibility of a targeted dive into massive datasets. The algorithmic analysis offers a computational point of view onto the data, allowing the detection and exploration of patterns in massive collections of cultural data, but also ideally researching processes of interactive media and experiences, such as the evolution of web design or playing a video game (see Lev Manovich, 2013c). The method is an attempt to give insight into massive datasets, which are too large for humans to make sense of them without the help of technology – a contemporary challenge which digital humanities oftentimes summarizes under "big data" (see e.g. Burdick et al., 2012; Marcus, 2013). The results of the computational analysis can be the basis of different orders within the collections of data, not based on human perception or meaning attribution but rather on traits within the digital data itself.

Another branch of research goes beyond low-level analysis towards a high-level or semantic analysis of the data, for the interpretation of which one would usually need human intelligence. The low-level analysis and patterns resulting from the computational analysis serves as a starting point to derive and computationally attribute or suggest semantic meaning of the data – depending if it is an automatic or a semiautomatic system. These suggestions are expressed for example in keywords, description, classification or ontologies, representing the "semantic ideas" that constitute the cultural object for a human being. As already discussed, this interpretation is dependent on the background of the human. But what becomes obvious is that there is a gap between the information a computer can derive from data and the interpretation by a human in a specific situation (see e.g. Khan & Jaafar, 2011;

Smeulders, Member, Worring, & Santini, 2000). The goal of this research, as for example conducted in the research project "Visual-Film-Discourse" (see Bateman et al., 2009) at Jacobs University Bremen and University of Bremen and in a wider context at the Research Center "Visual Communication and Expertise", is to bridge this semantic gap and create software frameworks that are able to derive semantics of visual data that can aid and resemble human interpretation. The outcome can possibly lead to the automatic or semiautomatic attribution of semantic relations within media data based on specific criteria, which is already possible and practiced in text-based corpora right now.

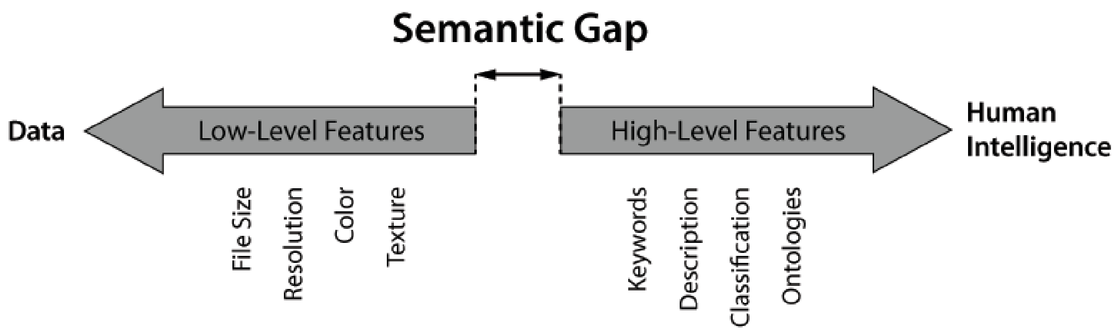

Figure 29: Semantic Gap, adapted from Khan & Jaafar (2011, p. 1). Graphic by Florian Wiencek

An example for a semiautomatic function based on high-level analysis that is popular in social networks such as Google + or Facebook or image databases such as Apple's iPhoto, is the face detection in images and the automated suggestion of who is visible on a particular photo. And especially under the auspices of commercial companies such as Google or Yahoo but also in the academic environment the detection of high level image features such as specific objects or even as detailed as attributes within a facial expression is already possible, as proven for example in the tool Orbeus Rekognition[273]. Examples are determining if a person smiles, wears glasses, has the mouth and the eyes open or closed, as well as detecting the gender and classifying the pose as well as the ethnicity of the person. Where these features are relatively straightforward to describe and reuse, the results become difficult to classify when it comes to determining the age of the depicted person, his or her confidence, or rating the beauty of a person. Because the algorithm is closed source and the tool does not actually reveal what it measures to get to the results on the basis of an image or what are references, these features are difficult to use and apply as basis for meaningful

[273] http://rekognition.com

assertion. Same goes for emotions, without knowing what traits are used for them. But the image recognition feature shows that even though more complex recognition of specific motifs might still be difficult, an object recognition could already automatically offer descriptive metadata about the image content in the range of objects and concepts it can detect. Where these tools have their limitations be it technologically or in terms of applicability, they show the rapid development and potential in the field of visual analytics and the hope is that through further research this could be broadened to the automatic detection of other semantic features.[274]

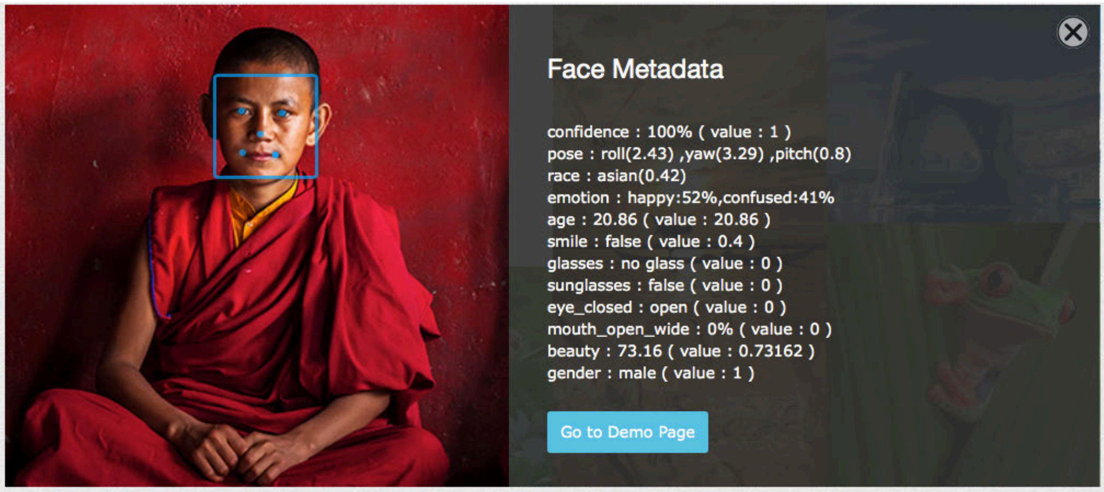

Figure 30: Example for facial metadata recognized by Rekognition Source: Screenshot of rekognition.com from 01.10.2015.

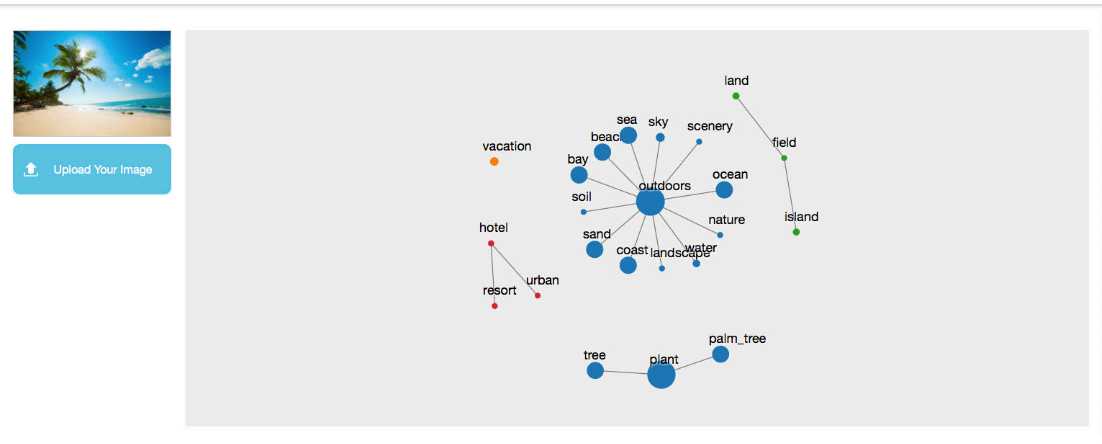

Figure 31: Example for object recognition on Rekognition, showing networks of object-groups detected on an example image. Source: Screenshot of rekognition.com from 01.10.2015.

[274] In the project "Visual-Film-Discourse" the research group the author of this thesis was involved in experimented for example with visual motifs such as "handshake" or "Pieta", derived from the research database on political iconography called "Political Iconographical Archive of Vision" (PIAV) by Prof. Marion G. Müller, with varying results in automatic retrievability[274].

A lot of computational data analysis not only of the data itself, but also on how users actually interact with the data is already happening in the background of (database-) applications and is combined to recommendation systems, affecting the user's perceived order of the database. This is part of what Tim O'Reilly called "Web Squared" (see O'Reilly & Battelle, 2009). Computational data analysis also plays a role for search engines such as Google, which index all the data they collect and take into account other factors such as the "value" of the data – for example through the page-rank algorithm by Google and other ranking algorithms employed in different search engines and archive projects. These tools also determine the personal relevance of the data for each user – leading to personalized search results based on the user's interests[275] as well as his location[276] – or diverse ways of influencing the information flow on news walls of social networks (see e.g. Wiese, 2013b; Yeung, 2013). All these orders of presentation and temporary or personalized orders of information are based on computational analysis and potentially have influence on the perception of information and the meaning attribution and interpretation of data.

The value of these technologies is ambivalent: where on the one hand they help to discover details that users maybe would not have looked for in first place alongside of what they are actually searching (serendipity), the tools also might hide something potentially interesting in the data that the system does not reveal. And as the user has little to no influence on the computational behavior in the background, he cannot clearly specify or retrospectively change his interests from his own point of view, but has to rely on the computational assumptions made for him. This all goes back to Foucault's assumption of the archive as a tool that determines what one can know or say about a specific field (see Foucault, 1973). But now this determination goes beyond storage and human made order as it is driven by a non-human agent as another factor ordering and revealing the content, which in turn has potentially its own "archive-political" agenda in form of what is pre-programmed by the institution, individual or company that created the tool.

[275] The interest can be determined for example by tracking previous searches, purchases, clicks and other user behavior online as well as offline.

[276] The location can be determined by the IP address of the user's device or GPS data on his smart device (see exemplary Gordon & de Souza e Silva, 2011; Rogers, 2008, 2013).

In turn all of these mechanisms can be very valuable for mediation processes. They allow a multitude of potential archive-driven narratives by revealing or basing them on different kinds of relationships of the material; they allow adaptive systems to react to the individual needs of a visitor, to personalize experiences, to drive exploration and individual perception of cultural objects; and methods like Cultural Analytics allow to think differently about a set of data, allow different insights.

While computational analysis might not be 100% accurate and error free, nor always revealing its mechanism of measuring or attributing of meaning – in terms of very subjective metadata attributed by closed source algorithms – they can still be used for the creation of pathsways for the exploration of a dataset. An example is the use of partly ambivalent facial recognition metadata gained through the service Rekognition in the "Selfiexploratory" of the project Selfiecity conducted by Lev Manovich and his colleagues. The project analyzes the style of self-portraits (selfies) comparatively in five different cities, aiming to use these images as a way to find something out about the people who take selfies and the society and culture they are taken in. In the interface the facial and image attributes derived by the Rekognition-algorithm and image metadata (head position, facial features as well as four main moods) together with demographic attributes such as place and gender as well as age derived through human tagging by Mechanical Turk workers can be used to filter selfie-images in a very fine-grained manner. The filter mechanism is operated either by clicking on a city or gender, or drawing a range with a brush tool to select within the other continuous variables. The technique used in this interface by visualization specialist Moritz Stefaner builds up on "facet browsing", which makes "different aspects of the underlying data accessible in parallel. Selecting one of the metadata values, and thus filtering the result set, restricts the available metadata values only to those occurring in the results. Consequently, the user is visually guided through an iterative process of query refinement and expansion, never encountering situations with zero results"(Stefaner, 2015). Thus this kind of filter-mechanism narrows down the images to explore and the interface allows to experiment with the data and image features and ask questions based on the dataset and the filterable visual features: such as "Do angry people tilt their heads more strongly? And what is a characteristic mood for people in Moscow?" (DigitalThoughtFacility, 2014).

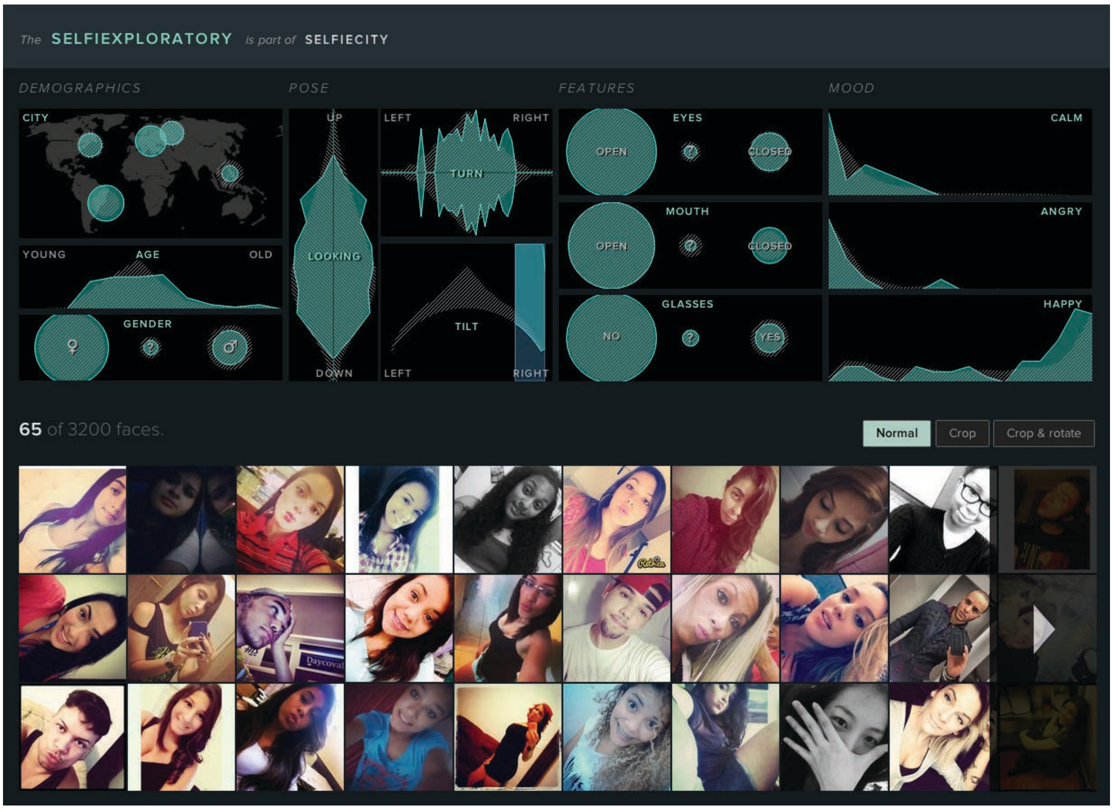

Figure 32: Screenshot of the interface "Selfiexploratory" from 09.10.2015 – http://selfiecity.net/selfiexploratory/.

When using the analysis results as computational point of view and entrypoint for further analysis one runs into the challenge of the semantic gap in reverse in comparison to regular visual analytics. The question in that case is not so much how the computer can bridge the semantic gap to understand an image, but rather what do the emerging patterns within a set of continuous variables actually mean. What can they tell a researcher about a corpus of data? What interpretations do they allow? Thus the result of using continuous variables and resulting patterns as basis for human interpretation and knowledge generation is an oscillation between concrete ideas and continuous variables. Patterns within the dataset are translated into concrete ideas to make the continuous data interpretable for humans. And it might also entail an oscillation between analyzing patterns in large quantities of cultural data and doing a close analysis of a single cultural object or small amount of cultural objects – a movement that is supported by the media visualizations by Lev Manovich's Cultural Analytics.

An example for this movement can be found again in the Selfiecity project. The graphs in Figure 33 and 34 show the distribution of mood in different cities (with the highlight of the example of Berlin), as well as the differences of gender within one city. The assortment of graphs from different cities shows the distributions within these cities next to each other. Each city has the same sample size of images and therewith the results are comparable. This overview of multiple graphs allows to answer for example the question in which city people seem to smile the most and in which city they might have the most reserved looks. The possibility to zoom onto the single images in the graphs allows to then go from an overview of the distribution of different moods within the photos to looking at individual selfies and talking about image characteristics or detecting visual patterns based on human analysis within a subset of images. A very basic example that got apparent to the research team was that in Bangkok selfies show a lot of smiles. The next step then would be to investigate what that says about the city, its people or the culture and would allow an investigation into social aspects or the society, „using social media as a lens into society" (Lev Manovich, 2015, slide 43) and contemporary social media data and visual data as a source. The starting point, however, to make sense of the dataset from the distance up to individual images is an order based on continuous variables as result of computational analysis and tagging.

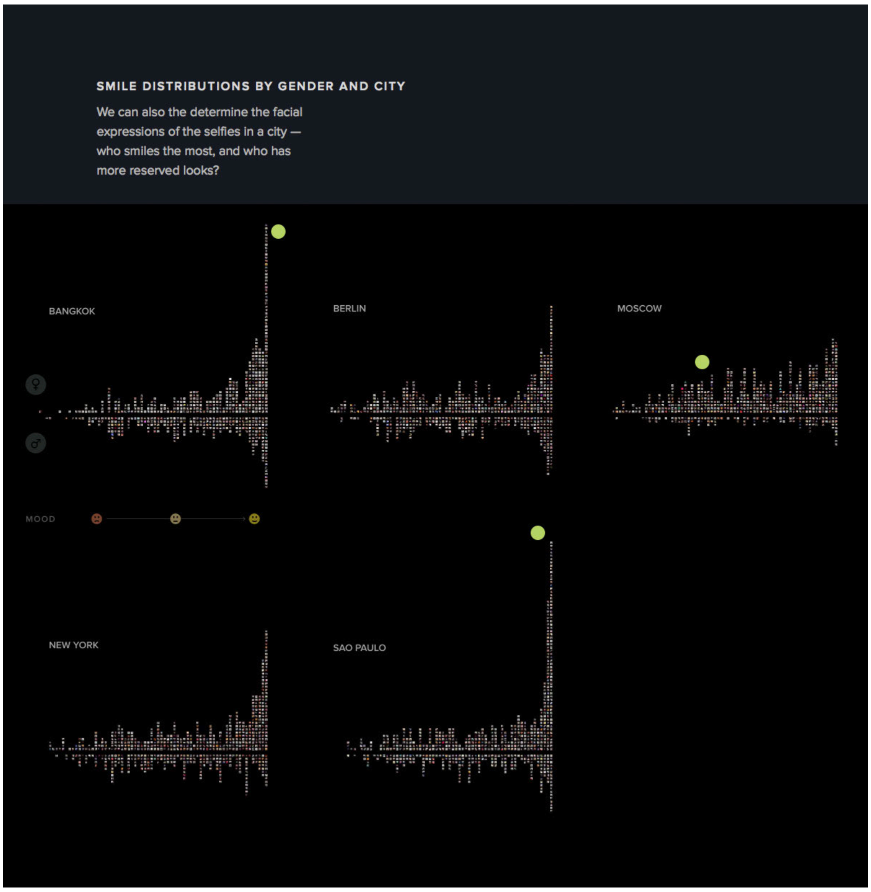

Figure 33: Smile distribution by gender and cities from the project Selfiecity. This overview allows a comparison between different cities and highlights findings. Source: Screenshot of http://selfiecity.net taken on 09.10.2015.

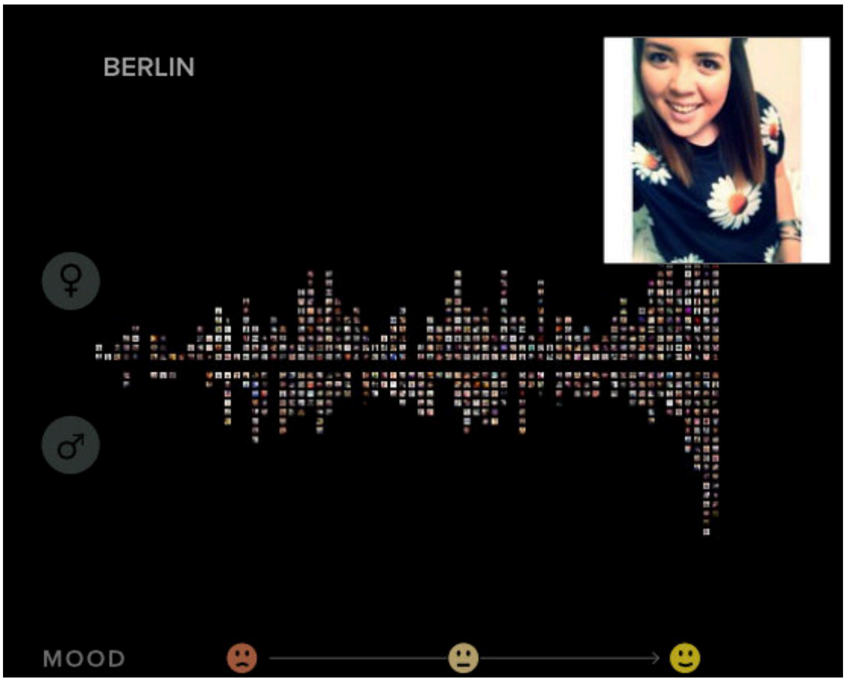

Figure 34: Graph of the project Selfiecity shows the distribution of mood in the example of Berlin, as well as the differences of gender within the city. Source: : Screenshot of http://selfiecity.net taken on 09.10.2015.

These different systems of order describe and structure the data and are therewith already a form of archival contextualization. More importantly the classification really comes into play as entry point for browsing paired with a graphical representation or interface, as well as for searching for specific data. But when dealing with web applications, another very important structural element is the information architecture, which is the logical foundation of a website determining the navigation, ordering the content elements, defining where in the structure certain functionalities are located and how users are able to move through layers of information. If one would compare it with a physical archive or a library, this would be the floorplan. It is the classification of an application's or website's content[277], thus a level above the data. Or to formulate it more general: a structural mechanism for the display. On a more technical level it becomes evident that protocols and the structure of the communication network in case of online applications, as well as the constraints, affordances and characteristics of digital media – as they were discussed in Part III – are determining, what a user can know and what questions he can ask based on the available data, or how he can

[277] For a discussion of different classification schemes for information architecture see Donna Spencer (2010).

interact with the information through a software interface. Art Historian and Education scholar Michael Scheibel (2004) summarizes the structures of media technology that create the conditions for storing and mediating knowledge today with the term "Datatektur"[278], which structures the knowledge space outside of the physical realm. And also interface designer Philipp Heidkamp strengthens the importance of information structures with regard to the growing complexity of information systems, as these systems do not only have influence on findability, but also on the added value for meaning attribution and contextualization that can be brought to the data by a hypermedia organization of pre-formed as well as dynamically linked or further enhanced information structures and their presentation and interaction with them through diverse interfaces (see Heidkamp, 1999).

2.2. Contextualization through Retrieval

Findability of specific data in an overflow of information is according to Lev Manovich (2001) the biggest challenge for an information driven society and also key for activating the cultural data as well as keeping it in the cultural and shared memory of the users instead of being forgotten in "deep storage" or the invisible Web. This challenge is addressed by retrieval that is a specific kind of action and interaction with the database, which adds to the meaning making process beyond the interface on the data level the database provides. Search results can be seen as temporary contexts for the data they feature, which are always in flux. The varying temporary contexts also change the meaning the user can attribute to a dataset in context. Search is based on a trigger – for example a query or a question – on the data structures of the database and algorithms that – based on this input – pull, order and arrange the relevant data.

As Peter Morville and Jeffrey Callender (2010) point out, the first and foremost goal of search is findability and re-findability. "We search to find objects and answers" (Morville & Callender, 2010, p. 6). They describe the archetype of search as process, which leads from the query to a result and from there to the found object. At a later point they elaborate, "[a] query is simply a question without the ornament of natural language" (Morville & Callender, 2010, p. 7). But besides finding something within a dataset, search can also serve as means for navigation (see Morville & Callender,

[278] „Datatektur" is a mixture out of the terms data and architecture.

2010). Moreover the two authors also point out other strategies for retrieval besides the prototypical search, such as *filtering*, where the users rely on people, algorithms or tools to filter and therewith narrow down a massive amount of information for example of news feeds towards our interests; *browsing*, where one does not search something specific but rather tries to get a sense of the available material and see what invites a user to take a closer look, where he stumbles upon – thus enabling and inviting serendipity; and *asking*, where one asks a question in natural language for example to a specific community or on a social network in order to get a response from humans. And of course in reality these strategies are oftentimes mixed in order to get the result and information one wants.

As Moreville and Callender describe it, "[…] search at its best is a conversation" (Morville & Callender, 2010, p. 9), in case of computer-mediated search a conversation with a non-human agent either in a formalized language such as SQL or mediated by interfaces. And even more, users can learn through retrieval processes, as Moreville and Callender argue. Search is

> "an iterative, interactive process where we find we learn. The answer changes the question. The process moves the goal. Search has the power to suggest, define, refine, cross-sell, upsell, relate, and educate. In fact, search is already among the most influential ways we learn. […] Search is the world's most popular teacher" (Morville & Callender, 2010, p. 9).

Thus the user learns through recursive patterns of searching, reviewing the search results and individual items, going back and forth between these and refine searches or start new searches on the basis of what he found out. In other words, search helps a user to get a deeper understanding of a topic on the basis of the available data and to understand the search results by additional searches or refining searches. This process builds a mental map. The authors also describe collaborative ways of searching.

> "We search on behalf of other people. We search with other people. We crowdsearch with Twitter and Mechanical Turk, distributing our queries (as whispers or shouts) to a networked community of searchers and solvers. Search can be a social experience in which we share goals, queries, and results" (Morville & Callender, 2010, p. 10).

Thus search becomes even more a conversation with the help of social networks, where one can ask other people with different personal background for their input, their individual interpretation of items or results, to formulate queries for a specific topic differently and thus obtaining different insights. Therefore the user gets insights beyond machine generated results from a specific search provider based on relations of data stored in its database, but rather multiple individual or collective interpretations of these relations. Thus the search is a trigger for conversations and exchange. A good example for this kind of contextualization is the GAMA-Wiki[279], where users can act as curators to create guided tours or playlists based on the archive and searches thereof, directly embed and contextualize results and potentially discuss or collectively edit them within the framework of a wiki-platform. And last but not least search can lead to action, interaction with or manipulation and respectively reuse of the material users find – oftentimes directly from within the search results, if adequate tools allow them to do so. Or the insights might lead over to action in the real world, which gets even more important with the upcome of mobile media, where search is oftentimes also tied to location. As Morville and Callender summarize: "Search is not just about findability. We search to learn, understand, share and act" (Morville & Callender, 2010, p. 11). Thus search itself is a form of mediation and can be used as a tool for electronically mediated cultural learning on the basis of the existing and emerging datasets. The goal of search might be different for each user and the situation he or she is in. The challenge to design tools that employ search as a method is to also design a scenario around the process with goals of cultural learning in mind, as well as to anticipate the needs of the users in that specific situation. Moreover search is also a way of activating cultural data, as it is a form of recall, bringing the data back into the functional memory of the system but also of the user who searches. It contextualizes the data and promotes its reuse be it in conversations, stories, cultural expressions or the like.

Thus it becomes evident that with retrieval one aim is to find something within the data based on a question one formulates in a query (see Morville & Callender, 2010). The way to go about this task and interact with a cultural repository is determined by its interfaces. Looking at a variety of digital repositories one can isolate design patterns for the database "front-end" in which the "database aesthetics" (Paul, 2007b) are

[279] see further discussion in Part VI, Chapter 2.3.2.) – Curated Contexts. The overlap of examples also shows, that the dimensions of meaning-making within online databases and platforms for cultural data are intertwined.

expressed. A design pattern is according to Erin Malone "an optimal solution to a common problem within a specific context" (Malone, 2010). Christiane Paul's definition of a database reveals design challenges, which the patterns need to address when it comes to the experience from a user perspective: retrieval, display of results, detailed representation of the cultural object along with its metadata, contextualization and interaction with the data, which build a pathway of retrieval (see Figure 43). These elements form an abstract interface to the database that allows the user to query it without having to engage with its specific data structure. Moreover the different, previously described strategies of retrieval are encoded and enabled with the common interface elements for retrieval used on platforms and databases for cultural data.

a) Entrypoints for Retrieval and Data Exploration

The most common entrypoint for a query is the search box, which in its format ranges from Google-like one click search fields as for example offered by Europeana on its homepage to advanced search functionality at for example GAMA (see Figure 36), a subject gateway specific for media art. In its simplest form it is comprised of a text field to enter the query that in itself does not tell the user what he can search for or something about its language or scope. This text field is paired with a button to call the function in the backend that initiates the search process. Europeana offers on top of that a drop down menu to choose to search over all data fields or one specific of the available ones (see Figure 35). In contrast GAMA offers a more complex interface that allows the user to be very precise in the formulation of the query without having to work with logical statements to refine it (see Figure 36). There the user is not only able to specify over which specific field he would like to search but rather can combine different search parameters: for example search for artworks of a specific artist, which were produced in a range of years or have a specific keyword in the metadata set that can amongst others denomiate a specific technology used for the production of the work. And as GAMA is a subject gateway bridging several repositories, one can search either across all or in one or more specified databases. Moreover users are able to filter the search results according to specified criteria, for example if the entry includes a video or not.

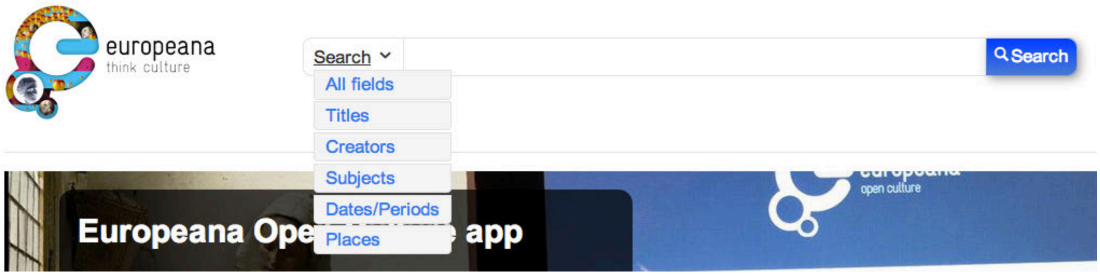

Figure 35: Screenshot of the simple search mask from Europeana.eu from 29.08.2013, including the option to specify over which data fields in the database you would like to search.

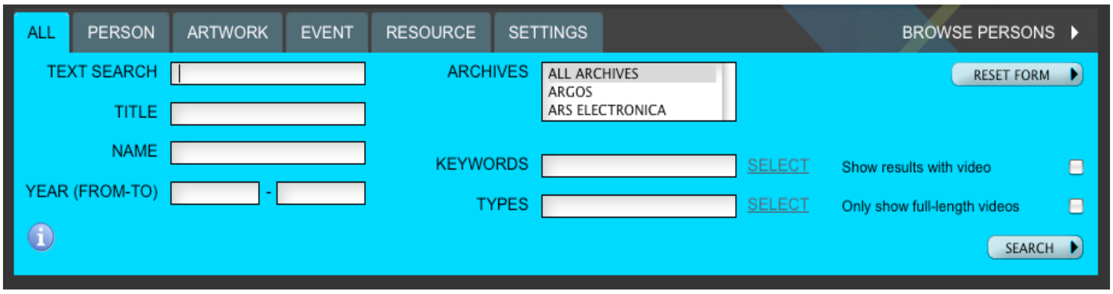

Figure 36: Screenshot of the advanced search masked offered at GAMA (gama-gateway.eu) from 31.08.2013.

Another entry point besides query forms are alphabetic lists and indexes, which give the user an overview over for example persons, artworks, categories or keywords. Such an interface can be found in Medien Kunst Netz[280] (see Figure 37). netzspannung.org and the Ars Electronica Archive[281] employ filter mechanisms that allow to filter the data shown in the results or overview according to pre-defined criteria (see Figure 38). These mechanisms represent a less open ended form of "search" that give insights into what users are able to find on the site and limits their choice from the very beginning to the available data instead of allowing an open ended search that could also lead to no results. The interfaces serve as starting point for narrowing down or exploring the complete dataset based on a user's interest.

280 www.medienkunstnetz.de

281 http://archive.aec.at/

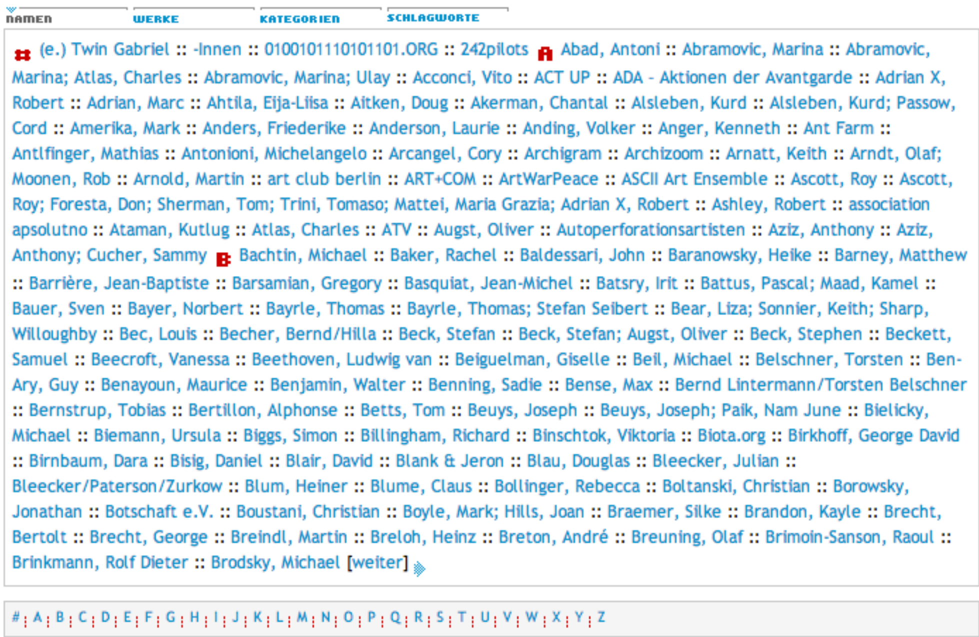

Figure 37: Alphabetical index of artist-names on Medien Kunst Netz (medienkunstnetz.de). Screenshot from 30.08.2013.

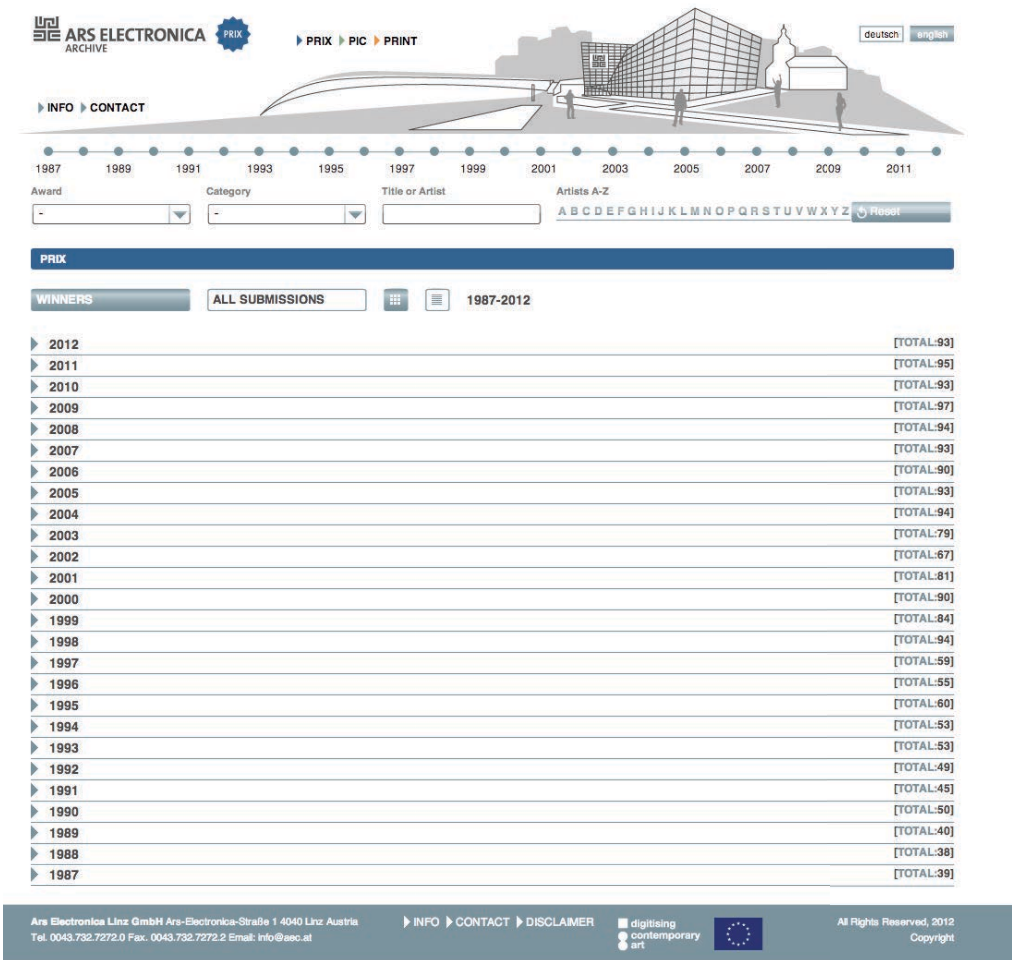

Figure 38: Sophisticated filter-interface of the Ars Electronica Archive, which combines several filter criteria including year, award at the Prix Ars Electronica and Letter and an alphabetical filter for artists with a simple search for title or artist of a work within the filtered data. Screenshot from 29.08.2013.

A third, even more open ended way of exploring the data are interfaces, which allow "browsing" through the data. As Gabriele Blome and Jochen Denzinger write, the main difference between retrieval and browsing is that at retrieval the user usually know what he or she is looking for and is able to formulate the interest in some way. The user is able to shape, specify and maybe even broaden a search through the search process, by reiterating the search process and using tools offered by many online-archives such as sorting, filtering search results or related searches (see Figure 43)(see Blome & Denzinger, 2004). Thus even though search is according to Whitelaw currently "the dominant tool in the display and navigation of digital archival record" (Whitelaw, 2009, p. 2), he describes the nature of search as having limitations what the user can achieve, depending on the interest of the user:

> "While search is a very effective technique for delivering records in response to a specific query, it has significant limitations. As an access tool, search assumes that a user is able to provide a query; but a user who is unfamiliar with the collection's scope, contents, or structure, may not be in a position to query it effectively. Personal experience suggests that such users (who are certainly in the majority) take a trial-and-error approach to search, using successive queries as a way to develop some sense of scope and context" (Whitelaw, 2009, p. 2).

Pure browsing interfaces are the opposite to search. They make offers to the user to explore and be lead and inspired by the content. One approach are interfaces that show data in no particular order as an entrypoint to the database, and therewith open up for serendipity where the act of traversing is the goal (see Blome & Denzinger, 2004). Usually the user is presented with a random fraction or some curated highlights of the full breadth of data. Philipp Heidkamp describes this in German as "flanieren", which translates in English into "strolling". With this term he summarizes the phenomenon of getting lost in the open hyperlink-structures of the Web, browsing through pages traversing the link-structure and finding information without actively looking for them (Heidkamp, 1999, p. 428). But he also compares it to the way visitors typically move through a museum. An example for such a browsing interface is the exploration interface from Daniel Langlois Foundation (see Figure 40). It takes the form of an image / wordcloud – inspired by tag-cloud visualizations – which lets the user explore artworks, themes, artist-names and publications. A click on either the title or the image opens up an overlay showing a larger image and thumbnail information and gives the user the opportunity to go directly to a page with more in-depth information about the artwork. But also the already mentioned index lists are a form of browsing.

The 2013-prototype of the "Smithsonian Cooper-Hewitt, National Design Museum" experimented with different entry points for browsing the data, which stem from the meta-data and algorithmic analysis of their collection objects, such as: colors, concordances, countries, departments, exhibitions, people, periods, roles and types. In doing so they go beyond the common filter-mechanisms, which result in a subset of collection items to explore that relate to the selected meta-data. Such a filter-mechanism oftentimes does not explain itself, so that a non-expert user not necessarily knows, what he or she is selecting. To remedy this circumstance Cooper-Hewitt, and therewith especially Sebastian Chan and Aaron Straup Cope, build in informational layers, which give deeper insights into the collection or the process of filtering and searching. This adds to the transparency of the collection search, opening up the algorithmic black-box at least a little bit.

To give some examples: If one selects "concordances" as an entrypoint into the collection, the following page will give the user the information what concordances mean in an easily understandable, somewhat funny way: "Ways that we think our stuff is the same as someone else's stuff" (Smithsonian Cooper-Hewitt National Design Museum, 2013a). Moreover the database makes transparent in natural language, what the filter-criteria are and is very straightforward with what information is available and where the results might not be complete. This opens up the possibility for the user to delve into details of which data and relations are known, to work with a complete dataset of the museum that drives the relations and to contribute own knowledge about possible relations.[282]

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[282] This becomes apparent when one goes to the next step of the concordances example and chooses "people" – another metadata subject. The interface will prompt the user with the following: "Concordances, by person[., F.W.] Ways that we think our people are the same as someone else's people" (Smithsonian Cooper-Hewitt National Design Museum, 2013b). And by choosing a particular institution of the resulting list, for example the Design Museum (London), one will get the result: "People we know about from the Design Museum (London)[., F.W.] We don't know who every person in our collection is at the Design Museum (London) but we know who 21 of them are" (Smithsonian Cooper-Hewitt National Design Museum, 2013c). In this explanation the website also links to a list of all persons from the database of Design Museum (London) that the algorithms were able to find, and the number of people were are not matching in the dataset or could not be clearly identified. Corresponding to that the collection offer users the possibility to share their knowledge, if they know about concordances between the Cooper-

Last but not least the color filter interface gives an insight, where the color definitions, used for search come from[283] and how the color the user chose is named in "robot-speak", meaning the technical Hexadecimal-code that is commonly used on the Web and in CSS to denominate color. Therewith the interface gives a glimpse into the computer-view on the objects, necessary to search for the colors and the proximity-method used to find color-matches (see Figure 39). Thus browsing the Cooper-Hewitt collection does not only allow the user to explore the objects inside the collection, but through its transparency it also gives insight of how the search processes behind the scenes work.

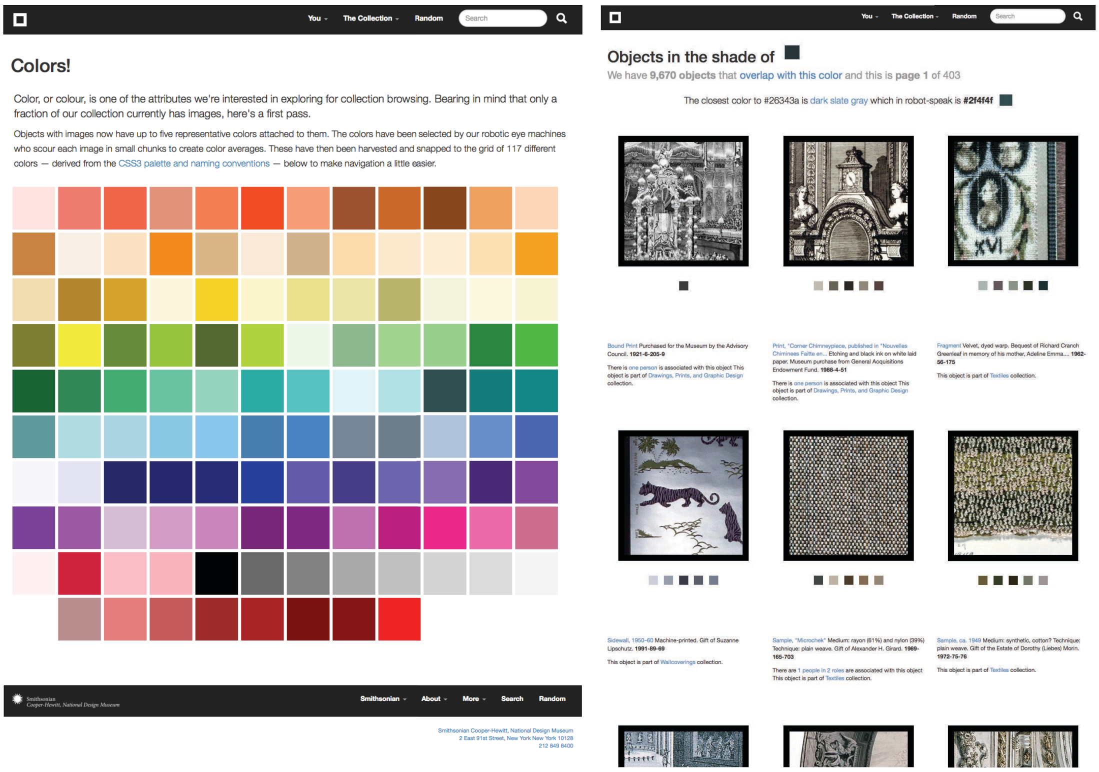

Figure 39: Browsing by color in the online collection of the Smithsonian Cooper-Hewitt, National Design Museum (http://collection.cooperhewitt.org/objects/colors/). Screenshots from 23.11.2013.

It got evident that databases often offer search and browsing or indexes as two different entry points to their data and use the filter mechanisms within the search results, to

Hewitt database and the one of Design Museum (London). The museum even offers a CSV-file of all the people in the Cooper-Hewitt collection as direct download. Therewith the museum crowdsources the finding of concordances and opens up the process of contextualizing its data.

283 In this specific case the CSS3 palette and naming conventions are used.

further refine them. And also hybrid forms of searching and browsing, which give the user both possibilities in one interface, maybe even combined with filtering – as in the interface of Prix Ars Electronica Archive (Figure 38) – are common.

Figure 40: Exploration interface on the homepage of the Daniel Langlois Foundation (http://www.fondation-langlois.org/html/e/). Screenshot from 02.03.2010.

b) Search-Results

The next step on the search path coming from the query is the result-page. “A search engine results page (SERP) is a custom map that’s built in response to a query” (Morville & Callender, 2010, p. 10). It represents what the search engine – thus the algorithms behind the retrieval mechanisms – has found through the search. It can be compared with an individualized table of content, but it is also a collection of data-objects, which are in one way or another related within the specific repository or within a collection of repositories. Therewith the result page can serve as a simple starting point to explore the relations within an archive and makes them visible. It gives an overview of the temporary context of data within an archive determined through the search query, with a varying amount of details shown about the individual item. This overview should enable the user to judge if the result contains what he was looking for with the query and if the user wants to get further information about a particular item. A standard format is a paginated, hierarchical list, like GAMA employs (Figure 41). Some archives offer possibilities to change the order of the result list by choosing to order it to a criterion of the user’s choice.

Depending on the usage context of the archive a result list can go beyond simple mapping or listing the results through offering additional functionality and leading to direct action of the user in interacting with the items and data as well as their context.

The GAMA result list, for example, goes beyond the standard functionality by offering the possibility to filter the results with regard to several criteria, in order to narrow the list down. Moreover it enables the user to directly perform actions on the resulting items, such as playing a video item without going into the detail view or directly navigating to the database from which a result in this subject gateway stems. Also a direct link to the search result is displayed in order to link to or to embed and therewith to reuse the query-results in other contexts.

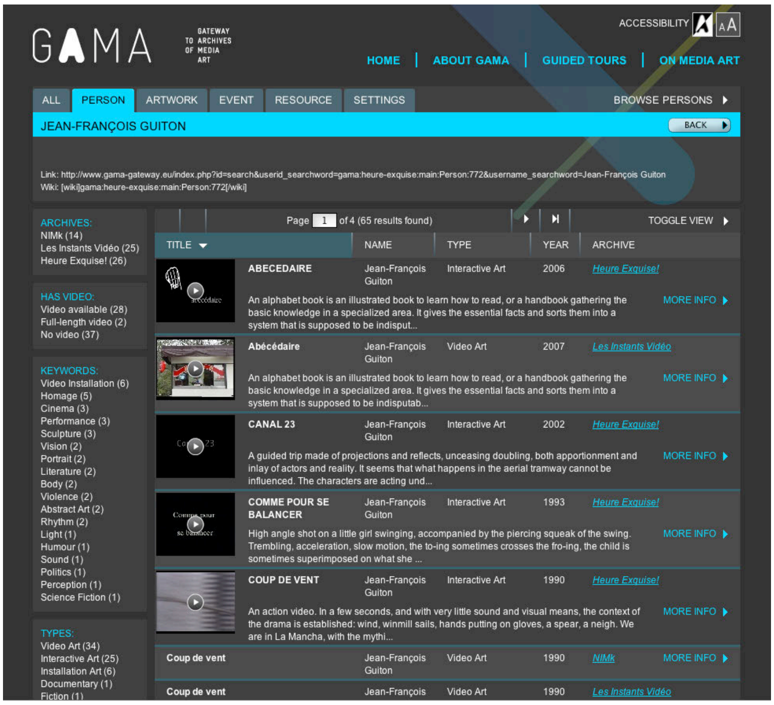

Figure 41: Result list of GAMA (gama-gateway.eu). Screenshot from 31.08.2013.

c) Item-Details

The results page usually leads to a detail view of a specific cultural object (see Figure 42), which lets the user see further details about the cultural item and – if available – gives him an opportunity to explore a representation of it. The metadata are ranging from tombstone information such as person or artist, date of the object, type of object, over additional media material and a description, to further object- or archive / collection specific information such as ascension number at a museum, as well as rights and license information. In short it is a display for different information layers of metadata, which tells the user about the cultural object and displays a digital reproduction or documentation material about the item. This view can also be a springboard for actions – be it interacting with media or participative actions such as sharing or citing – and further contextualization.

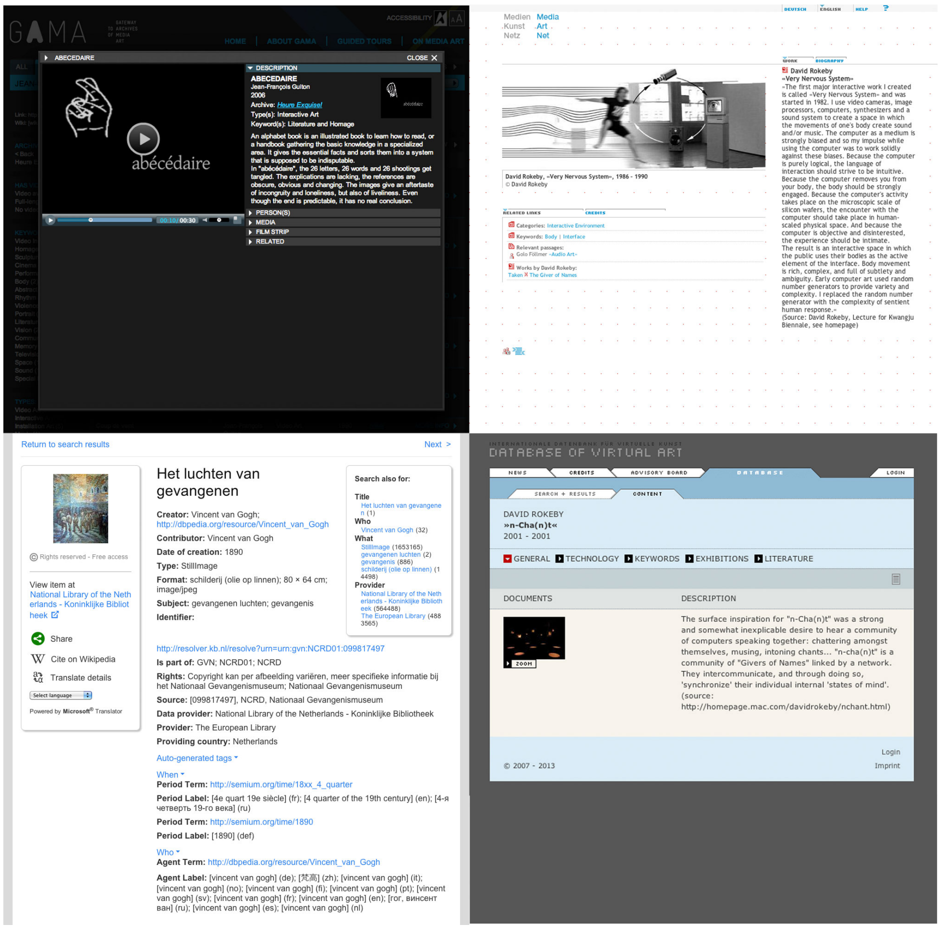

Figure 42: Collage of detail views. Top left: GAMA (gama-gateway.eu); top right: Medien Kunst Netz (medienkunstnetz.de); bottom right: Europeana (europeana.eu); bottom left: Database of Virtual Art (virtualart.at). Graphic by Florian Wiencek, created on 31.08.2013.

One example for an interactive method of algorithmic contextualization that is oftentimes offered in the detail view of a cultural object within a repository is "Related search" (see Figure 43 & 44). GAMA and Europeana are two examples offering this function at the detail view of their cultural objects. Related search triggers a new search over the database using specific traits of a cultural object as trigger. In text-based search these traits come from the metadata and can trigger searches for objects with the same keywords, the same type of object, related through the same person or culture, or in a subject gateway objects being of the same provider mostly solved by hyperlinking these terms within the detail page. But GAMA goes beyond relations manifested through the meta-data and offers a section called "film-strip" in the detail view, which not only gives the user an overview over moving image objects on a shot-level but also allows him/her to search for works that contain visually similar material by clicking on a specific shot. Also the Cooper-Hewitt, National Design Museum[284] uses a similar mechanism by interlinking different names or terms, such as the designer, type of work, materials used, country, years or period, which each trigger searches over the database showing related works on basis of the clicked term. Searching on the basis of a color palette as related search enables the user to find objects in the database that employ the same or very similar color to the object currently on display.

The related search leads to an exploratory oscillation between different detail views and result lists, following edges of relations within the network of the database, where every user pursues an individual path or trajectory through the database based on his or her decisions and interests. This puts the items into a temporary order. In short the user is traversing the database.

[284] http://www.cooperhewitt.org/

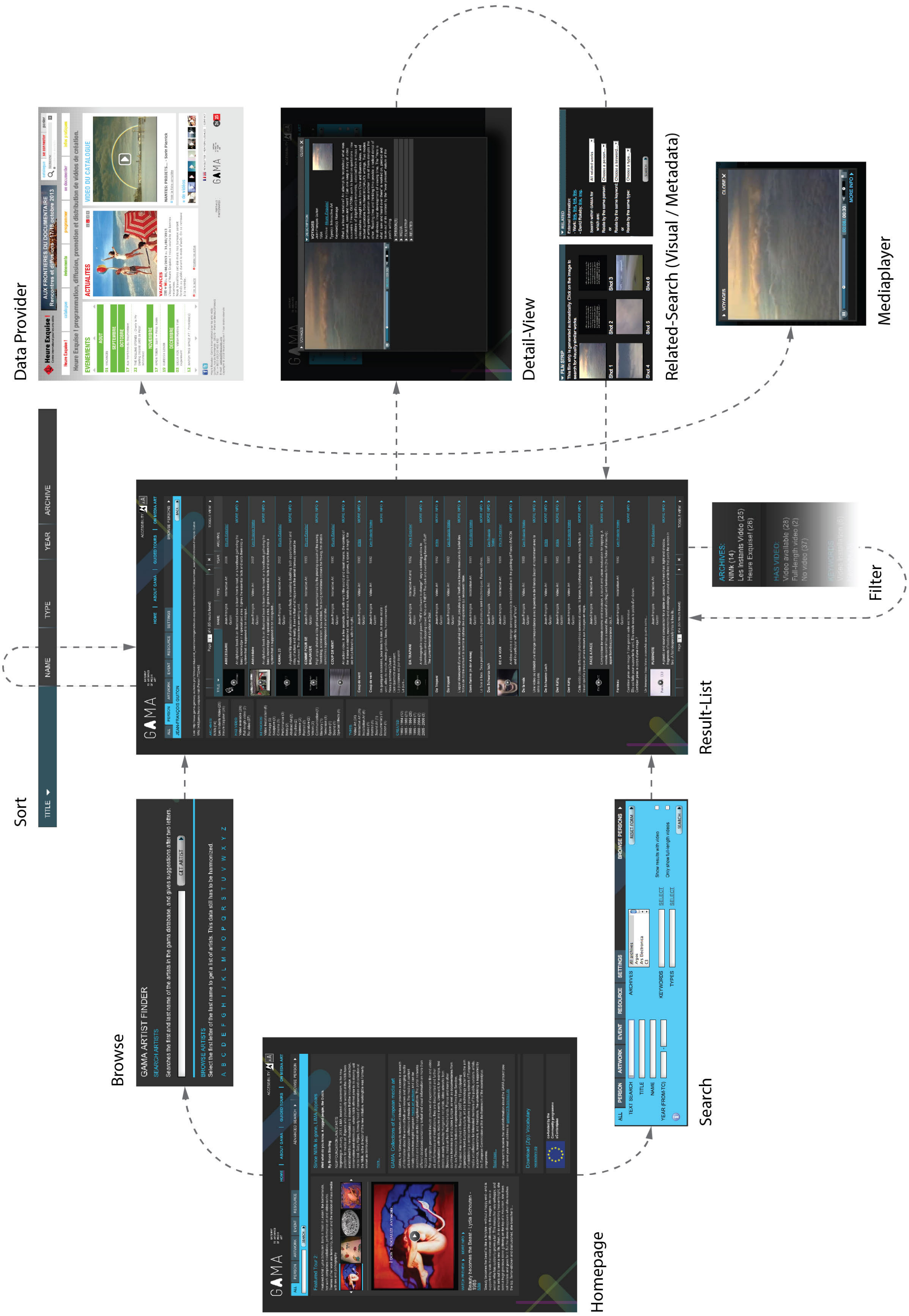

Figure 43: Schema showing the previously described pathways of retrieval from homepage to detail view using the example of by now offline project GAMA (gama-gateway.eu). Graphic by Florian Wiencek. Screenshots used date back to 31.08.2013.

As the examples of search interfaces make evident, classically not only the logic but – resulting out of this circumstance – also the retrieval is mostly language driven, no matter if one looks for text driven information, media or cultural objects. In order to retrieve a cultural object, most of the time a user employs keywords about this object that he expects to be used in its meta-information. One asks questions, be it in natural or formal language, but it is not only about asking "a" question but the "right" question, or the question in the right way to obtain the desired results. This depends on prior knowledge and an understanding of the "language of query" as well as of the "issue" the user is looking into. "The way we define a problem or frame a question shapes how we and our colleagues understand, answer, and act" (Morville & Callender, 2010, p. 3). As Anat Ben David describes it, words become keywords for a query (see Digital Methods Initiative, 2010) through the right query design. This entails amongst others identifying and familiarizing yourself with the "issue language" of the actors – in that case the cataloguers – that can vary from archive to archive, from discipline to discipline. One needs to choose one's terms carefully so that they are "exact, yet inclusive" (Digital Methods Initiative, 2010). Last but not least through refining search and keywords by using logic as well as using a recursive method of repeating and changing the queries based on the results one gets (see Digital Methods Initiative, 2010) the user can potentially get the optimal dataset for his needs as a result and moreover reach new insights throughout the process [285].

With search in cultural repositories one therewith follows relations of cultural artifacts manifested in the use of a pre-defined or collectively accumulated terminology, which is interpreted by algorithms. The search result and its matching with the potential expectation of the user depend not only on the familiarity of the searcher with the terminology applied for classification and metadata of the archive, but also on the coherence of the application of the vocabulary as well as the configuration of the search engine: variables can be precision and recall, which range from finding *only* the relevant results at high precision or *all* the relevant results with high recall (see Morville & Callender, 2010, p. 26/27); the amount of anticipation of user's needs[286]; and the

[285] see learning by searching in Part VI, chapter 2.2.

[286] Does he/she want to look something up or does he/she want to learn through query? How good is the user's domain expertise as well as the search expertise? What is the regular context of usage for the database? (see Morville & Callender, 2010)

error tolerance, for instance with regard to spelling mistakes or different ways of spelling for example a name.

But as the retrieval based contextualization tools in GAMA show (see Figure 44), there are ways to go beyond text-driven search by using methods of cultural and visual analytics to actually be able to base retrieval or recommendations on media specific traits. Therewith semantic similarities that can be translated or expressed by text are complemented through media specific expressions. The specific recommendation system implemented in GAMA analyzes videos inside the subject gateway on a shot level, employing the already discussed automated image analysis, and presents the user with a library of different shots of a video in the detail view. By clicking on one of the shots GAMA searches for other videos inside the gateway that have a similarity to this specific shot. Therewith the user can find works also based on visual similarity, a function also implemented in commercial tools such as TinEye or Google Image Search.

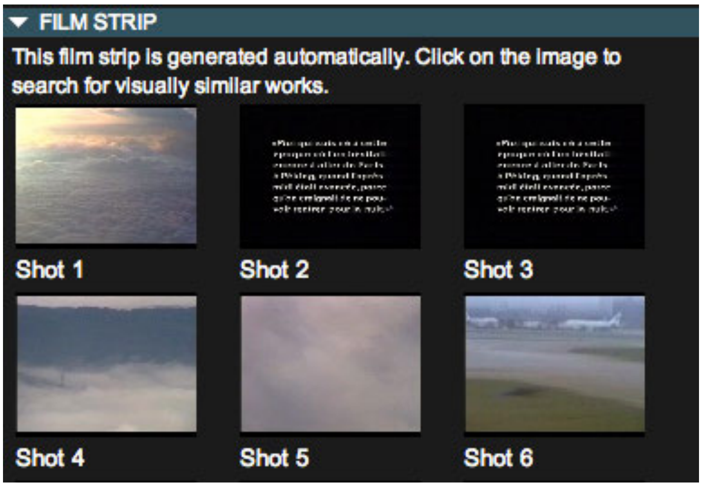

Figure 44: Film-Strip View in the item details of GAMA. Screenshot from 31.08.2018.

2.3. Modes of Presentation and Contextualization & Interactive Processes

Another step on the way from data to information besides the order is according to Nathan Shedroff (1994) the presentation. And the necessity of an adequate presentation also gets evident with the concept of Cultural Analytics, which besides the already discussed data analysis works with visualization tools to represent the data in a way that humans can understand it and interact with it. The latter is moreover determined in conjunction with the software architecture behind it. The graphical user interfaces (GUIs) of the digital media artifacts, digital repositories, databases or web-platforms as software products are in that case displays for cultural data as well as art and culture in their own right. The interface forms the in-between between the user and the digital or digitized cultural object. On the one hand it acts as a medium of presentation, as an exhibition display. On the other hand it determines how the user can interact with the cultural object (see also Lev Manovich, 2013b) and therewith influences its manipulation value (de Mul, 2009).

The database as a cultural form (Lev Manovich, 2001) and as system (Paul, 2007b) has according to Lev Manovich its own language of expression, or as Christiane Paul as well as Victoria Vesna would call it, its own aesthetic (Paul, 2007b; Vesna, 2000, 2007). As Christiane Paul writes:

> "The data container itself is not by nature beautiful, but rather seems to be characterized by non- or anti-aesthetics: it consists of tables and structures that house discrete units that in themselves carry limited meaning but have the potential for multiple relational connections. Databases, however, do not consist of only the data container. A database essentially is a system that comprises the hardware that stores the data, the software that allows for housing the data in its respective container and for retrieving, filtering, and changing it, as well as the users who add a further level in understanding the data as information" (Paul, 2007b, p. 96).

And she explains further: "The digital medium is not by nature visual but always consists of a "backend" of algorithms and data sets that remain hidden and a visible 'front end' that is experienced by the viewer/user […]" (Paul, 2007b, p. 97)[287]. The frontend is therewith a visual translation of the backend, makes its functionality accessible and abstract data experienceable for the user. This is what Frieder Nake distinguishes with regard to algorithmic art as surface and subface (see Nake, 2012). And also Philipp Heidkamp (1999) argues that the interface of a database as software decides if users find something, if they get lost, or are able to explore. But it also defines the possible interaction within a database, which is the to uncover and understand the structure and patterns within the data. In 1999 Heidkamp already distinguished selection, manipulation, navigation and simulation as different categories

[287] For a similar argument see also Steve Dietz (2007).

of interaction with a database and also hints towards human-to-human-communication as another form of interaction possible within a database interface. The latter got much more important in the participatory culture with regard to common social media functionalities such as liking, sharing or commenting but also contributing either core data or metadata. And one could even add contextualization as a way of working with the content, for example by transferring data into new contexts through embedding or mashups. But Heidkamp addresses another important task for an interface, besides enabling presentation of and interaction with data: an interface should also draw the user into the data and make him/her curious about it. Thus the interface needs to be intellectually stimulating and foster active (mental) engagement. The user discovers information and develops insights about the data through engaging and interacting with it, by traversing a database. Thus Heidkamp argues that the applications should not eliminate human erring, or trial and error, but rather integrate it into the concept, plan for it, allow serendipity and react and adapt to the user's interaction (see Heidkamp, 1999).

Even though this thesis argued that the retrieval-process itself is a form of meaning making and even a form of learning as well as temporary contextualization of the data, contextualization as a factor for meaning making goes beyond retrieval alone and therefore needs to be explored more in depth. In a digital repository data can be contextualized through presentation, for example by making the archival context of the data evident, which can happen through showing the relations of data within the database amongst others through related search interfaces (see Part VI, chapter 2.2.) and by placing the data in different contexts within and outside of the database[288]. The contextualization through collection interfaces is usually combined and realized through possibilities of interacting with the cultural data and especially its metadata.

[288] As already discussed, Cooper-Hewitt's collection database is an example that contextualizes its dataset with external content – such as Wikipedia entries – and it devises mechanisms to be able to reference photographs or 3D models of an object stored on platforms such as Flickr, Instagram (http://instagram.com/), the Trimble 3D Warehouse (http://sketchup.google.com/3dwarehouse/) or Thingiverse (http://www.thingiverse.com/) by so called "machine tags", which can then be queried via the APIs of the services and therewith bind back the information to the collection (see Straup Cope, 2007). The museum also encourages to cite all their objects within Wikipedia articles, and makes it easy for the user to do so by providing a template to copy and paste the code for a citation, as does Europeana. Thus the institution actively embraces not only internal but also external contexts, be it mingling with its content in the collection database or be it referencing objects of the Cooper Hewitt Collection outside on other platforms.

Here different modes of interactive presentations of the data and its relations come into play, such as forms of visualization.

2.3.1. Visualization Interfaces

Where related search can make relations of individual datasets traceable it is difficult to get an overview of the larger context and relationships of data within a dataset. A basic question to answer is therefore how to best display and present a rich set of data. One possible answer is to use visual representations of data. As Mitchell Whitelaw writes, "[w]e deal with visual representations of data on a daily basis; every web site and computer interface, not to mention spreadsheet chart or graph, is essentially data in visible form" (Whitelaw, 2009, p. 1). Visualizations in general have a long history especially in science, spanning from cartography over diagrams to graphs or charts, that are all visual displays of mostly quantitative information. Traditionally these were static displays of information. As data nowadays is computable, this allows to generate multiple different familiar and unfamiliar forms to represent the data. Through developments in interactive computing these visual representations can be moreover directly manipulated. The field of data visualization aims to solve the question of how to best represent a given set of data. And with its methods one can develop solutions also for cultural collections, to gain an understanding of a collection and the relations of data within the collection as a whole as well as its individual items – describing different levels of granularity of a collection (see Whitelaw, 2009, p. 1). Whitelaw refers to an argument by Joanna Sassoon (2006) that the digitization of collections and therewith a focus on its information value or content could lead to a decontextualized and superficial impression of a cultural item. A key hypothesis of Whitelaw's work is that visualization can actively work against this tendency and make the context of a digital collection visible. And it can go beyond the limitations of search that were discussed in Part VI, chapter 2.2.

For Whitelaw visualizations open up the possibility to present an overview over a large volume of data and to reveal patterns, communicate context but also let the user dive into the details of individual items of a collection. Therefore a number of databases are using visualization interfaces in order to make their data explorable in addition to search as an entrypoint into the data. Examples include Semantic Maps, timeline interfaces or maps. These can also be categorized as interfaces for browsing as

Gabriele Blome and Jochen Denzinger (2004) do. But additionally to allowing an exploratory behavior they also make evident relations between data graphically. In their 2004 article Blome and Denzinger name these interfaces “Knowledge Discovery Tools” that are dynamic interfaces visualizing archive data and therewith allow to intuitively and visually chart the data of a specific repository. They mostly offer interactive tools to manipulate the display of the data and adapt it to the user’s specific needs and therewith enable a visual exploration of and active engagement with the data and potential knowledge within them (see Blome & Denzinger, 2004).

a) Generous vs. Ambiguous Interfaces

With regard to browsing interfaces the literature distinguishes roughly between ambiguous and generous interfaces. **Generous interfaces** aim to show and reveal rich information about cultural collections allowing the user to get an overview of an existing dataset and also lead a way into exploring it (see e.g. Whitelaw, 2009). A good example is the “Series Browser” (see Figure 45, upper image) from the project “The Visible Archive” by Mitchell Whitelaw. It is based on the premise “show everything” from the visualization studio Stamen Design, and aims on the one hand to give an overview over all 57000 series in this particular collection of the National Archives of Australia. On the other hand it wants to enable insight into relations between the series and some meta-information about them. After going through several design iterations, Whitelaw established a display where each series occupies a square-space on a 2D canvas. The series are displayed in chronological order by year starting from top left going to bottom right and are sized according to the size of a series in the physical world – on the one hand the number of registered items (inner square) and shelf-space the series occupies (outer band). The color or more specifically hue of the squares represents the year span of the documents in a series, where red indicates short span series and purple long-span series. This display, where the series’s size and historical distribution becomes clear immediately, can reveal structures within the collection also through visual patterns. It shows for example that the majority of series in the collection contain only few items. Or it reveals that some series contain many items but only occupy very little shelf-space, allowing the conclusion that the items must be comparatively small, such as photographs or index cards (see Whitelaw, 2009, pp. 6–7). Adding interaction allows to add further layers of context to the display. A simple interaction enabled by the display is to focus on one specific series by selecting it, which not only reveals a caption with attributes about the series, but also relationships to other series (see Figure 45, bottom image). These relations are based on the Commonwealth Records System as categorization system that records different relation types (amongst others related series, preceding or successive series), which are again color-coded in the interface. Following and browsing the links established in the interface gives the user a sense of the relationships within the collection. And a colored outline of the squares indicates a specific agency as origin of the material, which can be hightlighted in the interface and allows to the user to see all other series by a specific agency (see Figure 45, bottom image).

This display is an example of a very complex and rich visualization, which was tailored towards a specific collection and its visualization needs. It gives the user an impression and overview of the whole series visually, and through visual patterns and interaction the user is able to gain further insights into metadata of specific series as well as their context established through relations within the collection and common traits of the series. Thus meaning making works through pattern detection within the whole collection and exploration of relations between data.

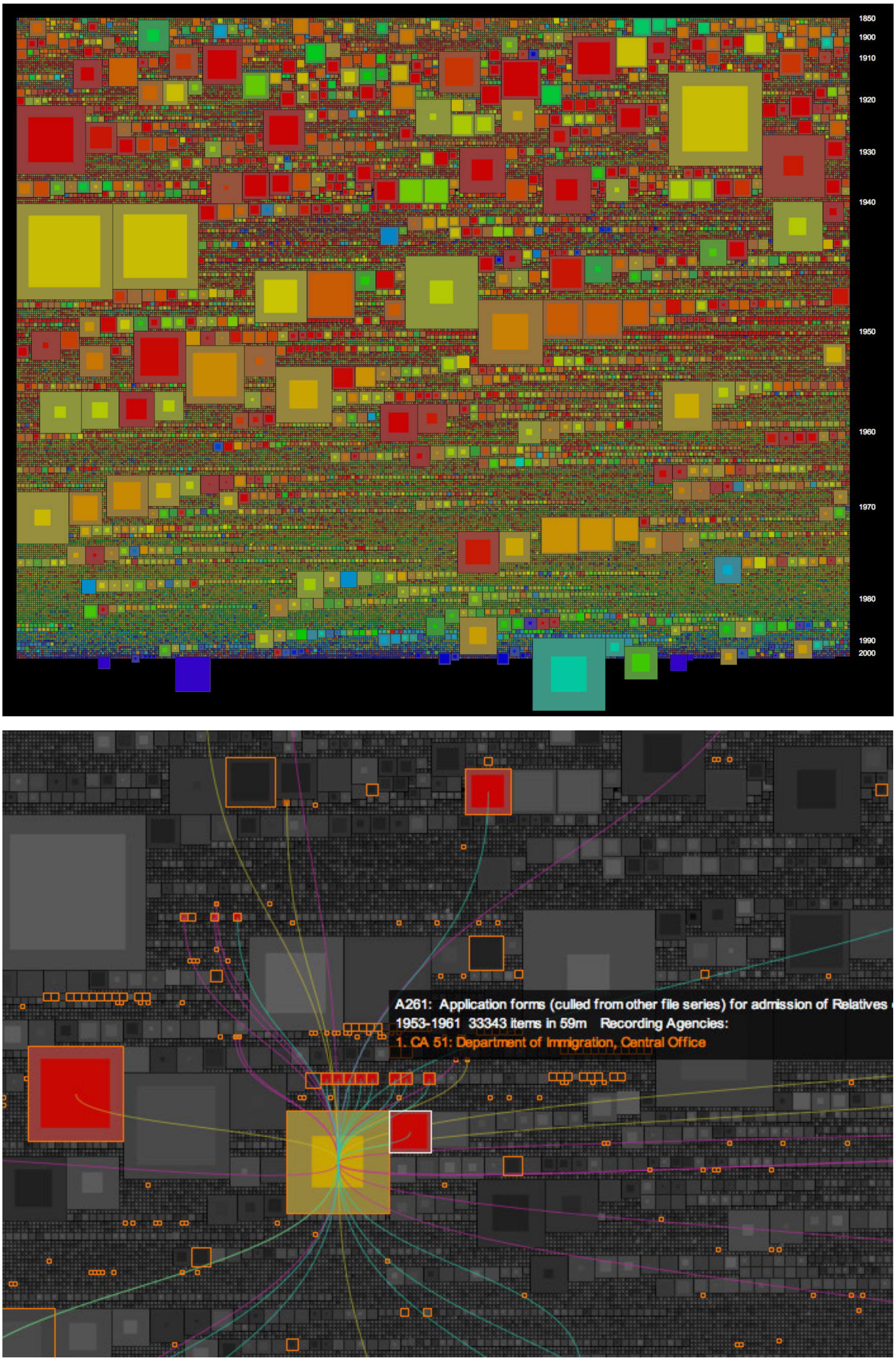

Figure 45: Screenshots from "The Visible Archive" project by Mitchell Whitelaw, 2009. The „Series Browser" is visualising all 65 000 archival series in a dataset of the National Archives of Australia and is an example of a generous interface. Source: Whitelaw (2009, pp. 7 & 8)

The opposite approach are **ambiguous interfaces**. Tom Schofield, a digital media scholar, uses this term in his ongoing research to denominate interfaces, which work specifically against the principles of data journalism such as clarity, brevity and creativity that are usually employed in order to tell great data stories. He understands ambiguity as a lack of clarity, and argues that this lack of clarity can foster engagement with the data: for example through leaving gaps to foster the user to mentally fill these gaps with imagination; through spurring the user's curiosity and interest and getting him to spend time with the material in order to discover interesting aspects; as well as through creating an experience with data (see Schofield, 2014). Thus the mental involvement and individual engagement with and exploration of the data and its potential meaning is key in Schofield's approach. And instead of focusing on the big picture of a complete collection this approach focuses rather on smaller units of a collection up to the granularity of parts of individual collection items.

Schofield experiments with speculative ways to intervene and engage an audience in archiving and cataloging as ongoing process of knowledge production. One of his experimental "un-generous" interfaces is called "Archive Windows – An alternative view on the Bloodaxe Manuscripts", which is a manuscript viewer that allows the user to only see a fraction of the manuscript clearly and to explore the manuscript fraction by fraction (see Figure 46). The position of this clear window is controlled by the position of the cursor on the screen, and therewith enables the user to move it through the manuscript. According to Schofield the user would respond to the scarcity of information by wanting more information. This kind of experimental interface therewith can serve as a stimulus to draw the user into the content, to foster exploration but also to foster interpretation through imagining and filling in the blanks of missing or obscured information. But it also fosters close looking, the concentration on isolated details.

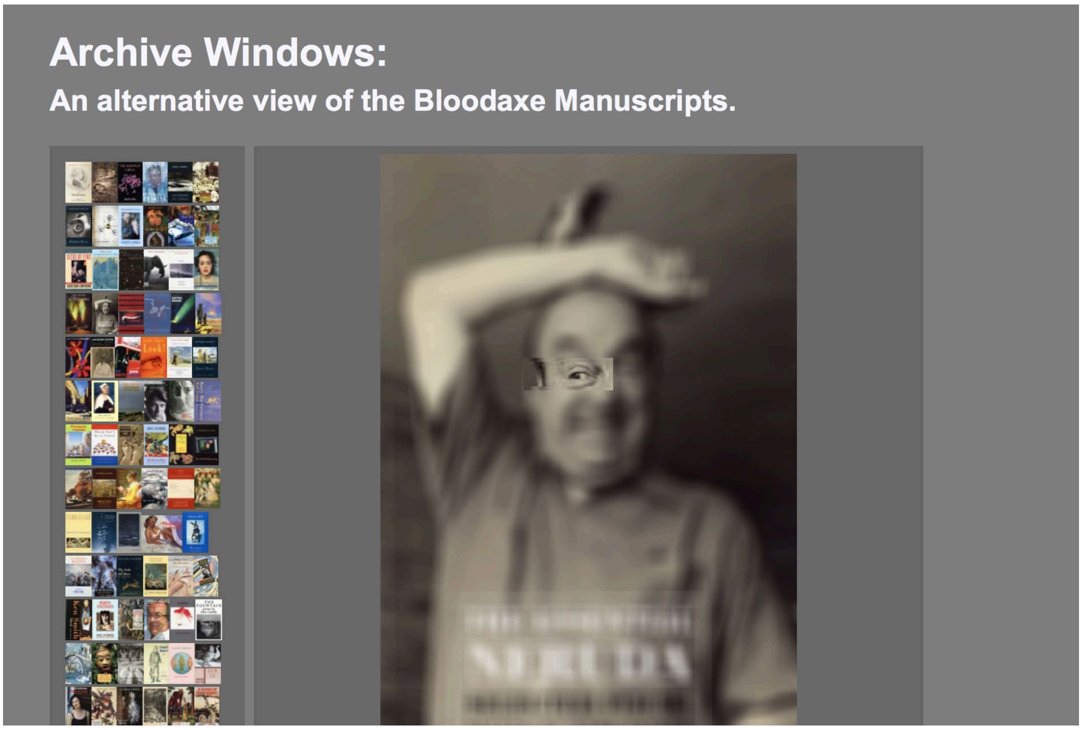

Figure 46: "Archive Windows" by Tom Schofield (2014). This version uses book-covers as stand-ins for manuscripts, as these were not available yet at this stage of the production. Source: Image courtesy of Tom Schofield.

b) Semantic Map

Besides tailor-made visualizations for specific collections there are several more general interface-types, that can be often found as visualizations that serve as entry point to the data of cultural repositories – semantic maps, timeline interfaces or maps, as mentioned already above. Fiona Cameron (2003) defines semantic mapping as “a strategy used to graphically represent concepts and multiple relationships between items” (Cameron, 2003). An example of a semantic map can be found at netzspannung.org (see Figure 47). Blome and Denzinger (2004) describe it as a map of the database that enables the navigation of semantic relations between the items, which in this specific example of netzspannung.org stem from statistical text analysis over the description texts using the Kohonen Map procedure (see Novak et al., 2002; Strauss, Fleischmann, Denzinger, Wolf, & Li, 2004). This algorithm groups similar items on a 2D grid, which results in clusters, where the nearness of the items refers to their degree of correlation. For the user this results in four different views: a zoomable map which, if zoomed out completely, shows an overview over the complete map and the clusters, to give a general impression of the data pool. Keywords describe the semantic space of each cluster. The further the user zooms into the map the more detailed the representation of the projects and their relations gets. Projects are initially represented as squares in the overview mode, which are clustered around keywords. In the second zoom step more details are added and projects are displayed as boxes with a representative image and basic information mapped onto a grid. In the most detailed view of the semantic map by netzspannung.org the relations between the data objects and therewith the semantic context of a selected object within a preset semantic distance become visible (see Figure 48). A separate region of the window provides the user with the full project information of a selected project within the semantic map of netzspannung.org. Moreover the interface offers the possibility to search and filter the content based on keywords, project-titles, authors and abstract texts.

Beyond this direct archival usage of the semantic map, Jasminko Novak, Michael Wurst, Monika Fleischmann and Wolfgang Strauss (2003) propose a more general system based on a form of semantic maps. The researchers envision what they call “personalized learning knowledge maps” as an approach to capture and visualize implicit knowledge and hidden assumptions within a group of users, and therewith make this tacit knowledge explicit and usable, based on the users’ interaction with the information. Having access to tacit knowledge is according to them key for communication and knowledge sharing (see Novak et al., 2003). Bringing their thesis together with Nathan Shedroff’s “Continuum of Understanding” (1994), who defines knowledge as shared experience, it becomes evident that transforming implicit, personalized information and experience structures into perceivable explicit experiences, and therewith allowing a group of people to share them, is tantamount for knowledge generation as well. In fact the user interface therefore is central for forming and enabling an experience or meta-experience (see Wiencek, 2014) of cultural items or lived experiences and memories of groups or individuals associated with them.

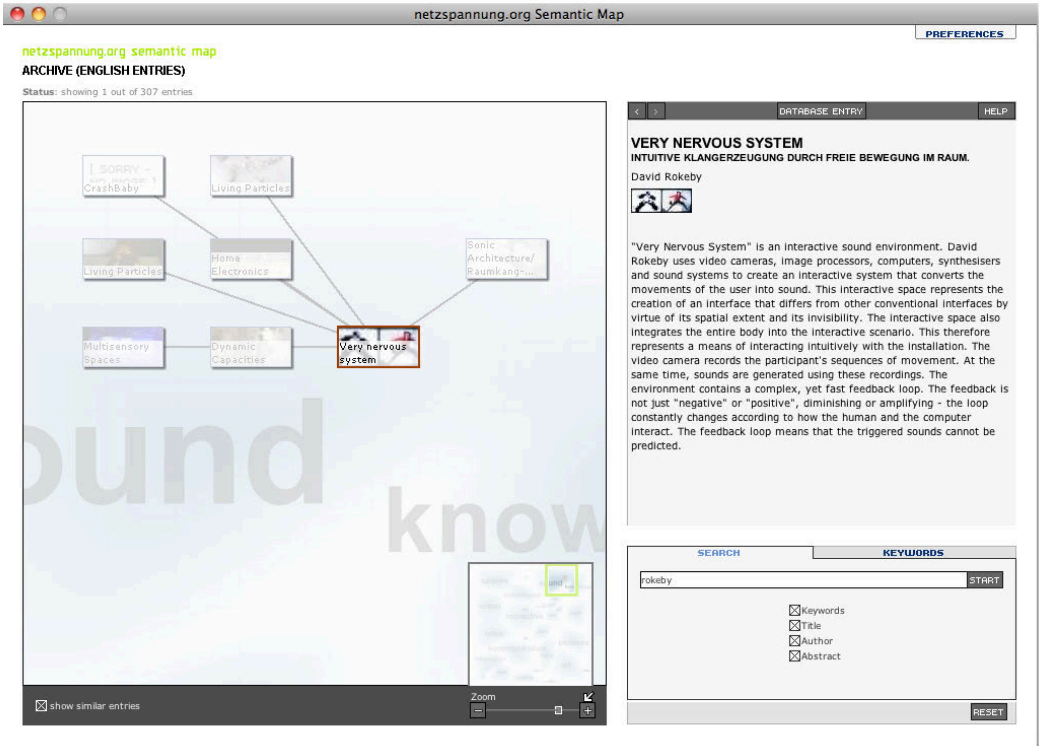

Figure 47: Screenshot of the Semantic Maps Browser on netzspannung.org

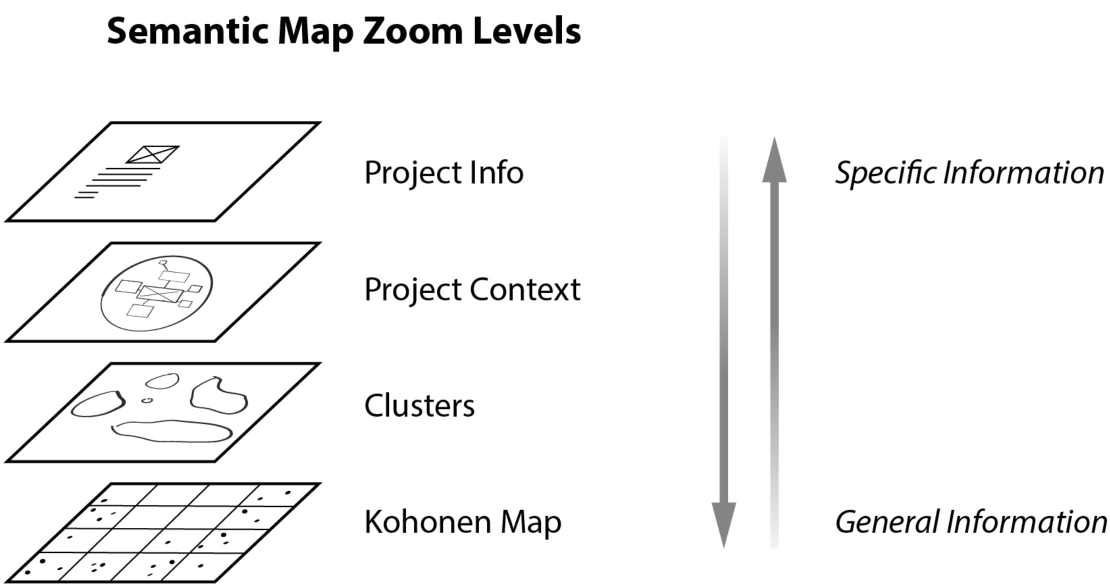

Figure 48: Information layers of the Semantic Maps browser on netzspannung.org. Graphic by Florian Wiencek, based on Novak et al. (2002, p. 89).

c) Timeline- and Mapping Interfaces

Two other dimensions suited for visualization are time and space, which can be transformed into timeline and mapping interfaces. As it became evident in Part V, chapter 2.2. and also argued amongst others by Florian Kräutli, time might have become a main organization mode of digital data – last but not least with Social Networks such as Facebook or Twitter, that follow a chronological order in displaying their news-feeds and giving latest news more relevance. But Kräutli (2016, p. 73) also traces historically the rise of a time-centric model of structuring data in line with the increasing amount of data in an information centric society, that people are unable to meaningfully file into a classical folder-structure without it becoming too complex and therewith difficult to overlook and navigate (see Kräutli, 2016, p. 73). Therewith it was frequently used for information management and retrieval (see Kräutli, 2016, p. 73), last but not least in form of so called "streams" such as the "Lifestream" proposed by Freeman and Fertig (1995) or more current photo-streams or file-streams in major cloud storage or media sharing platforms (see Kräutli, 2016, p. 73). And last but not least for history-writing time is the central dimension, hence it is for an archive, if one see it as a collection of historic records.

Timelines usually project the data onto a time axis, which can also display multiple trajectories of development synchronoptically as the examples of netzspannung.org and the timeline of audiovisual culture in Figure 49 show. Florian Kräutli (2016, p. 24) defines timelines in his PhD thesis on the very topic of timeline visualizations of cultural data as an organization of data through the model of time – from calendrical dates over sequences, cycles or a different temporal structure. It is therefore a "time-centric visualization" (Kräutli, 2016, p. 24) with which the user is able to explore for example parallel historic developments and get a sense of the historic and time scale of a subject matter, use time as a filter or comparison mode as well as an entrypoint for navigating a dataset. The timeline interfaces in Figure 49 have dominantly stacked several layers of parallel timelines on top of each other representing multiple histories and facets of historic developments within archive data, and therewith a particular field of information, side by side. These interfaces can be used for browsing archive data as well as creating semantic connections as visible in the timeline-example of netzspannung.org. But, as the latter platform claims as well, digital timeline-interfaces can go beyond the parallelism of for example printed timelines in allowing different levels of information. A description of the netzspannung.org interface makes this evident: "[…]to begin with, the Timeline interface shows a database entry only as an icon consisting of a title and cropped image. Rolling over the icon calls up the subtitle and author. If the icon is clicked, further information appears. By virtue of the connection to the database and the structuring of the information, the Timeline interface allows very large volumes of data to be visualized" (netzspannung.org, 2009d). Thus through interaction with the timeline such as rollover or click the user is able to get from a temporal overview to more and more fine-grained detail about a project. And through combining this kind of temporal interface with mechanisms such as search and filtering for meta-data – for example keywords, specific time-frames, concepts, or the like – the tool allows to ask more complex questions towards the dataset such as: what is the predominant technology, concept, motif or topic used in a certain timeframe? Is there a peak of a topic in a specific timeframe and does it correlate with time-historic events? The more different historical layers are stacked in parallel in the timeline and the richer the meta-data of the items in a database is, the more complex questions can be answered using such a knowledge discovery tool.

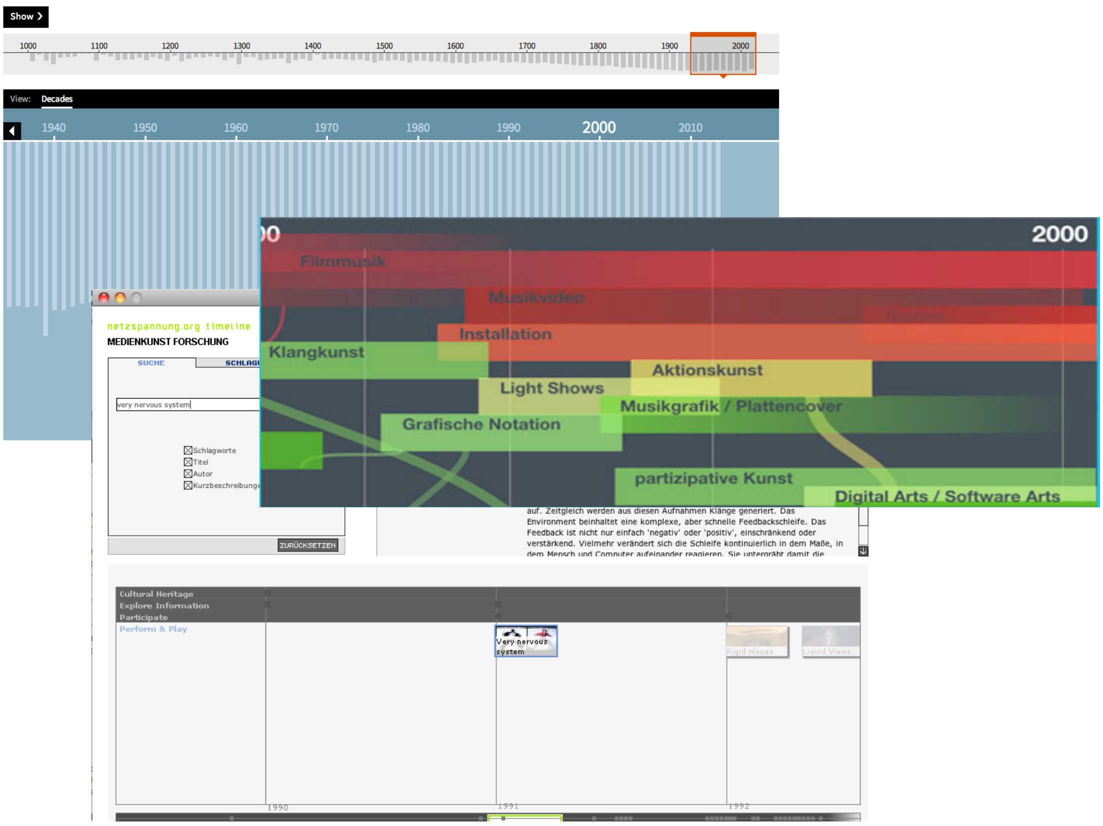

Figure 49: Collage of timeline interfaces. Top: timeline of Digital Public Library of America (http://dp.la/timeline#/; 01.09.2013); middle: timeline of Audiovisual Culture by Ludwig Boltzmann Institute Media.Art.Research (http://vis.mediaartresearch.at/webarchive/public/view/mid:40; 17.11.2009); bottom: timeline of netzspannung.org, 01.10.2010.

Where a timeline can be used as a "knowledge discovery tool" (Strauss et al., 2004) when designed for research, it can be also used as an interface for communicating research outcomes. As Florian Kräutli differentiates these two, the purpose of the latter "[…] is not to discover new knowledge in the field of history, but to communicate insights from the field to the public" (Kräutli, 2016, p. 94). Thus their primary goal is not to process data but to convey information or tell a story that is pre-processed and based on scientific insights. The timeline on Audiovisual Culture by Ludwig Boltzmann Institute (Figure 49, middle) is a good example for this form of timeline, as it was mainly employed in a physical and online exhibition setting as an interactive way to navigate and contextualize the history of this particular field covered in the object based-narrative of the exhibit as well.

The possible interactions with the interface as display or as research tool also determine the information and knowledge to be derived from this kind of visualization. Kräutli differentiates four stages of interaction within timeline interfaces, that are to be seen as fluid: static, dynamic, exploratory and open (Kräutli, 2016, p. 96). In my view these categories can be transferred to any visualization tool. Where a static timeline has literally no interactive possibility other than looking at it and works on screen the same as it would printed on paper or fixed to a wall in a museum, dynamic timelines offer basic interactive possibilities. This can go from switching between different views which are pre-configured and scripted– similar to a slideshow or scrolling through a longer webpage – to making visible more details about a project included in the timeline. Details or changes in the display might be highlighted visually and there might be multiple parts within the display interface that can be navigated separately, such as in the DPLA timeline in Figure 49. Exploratory timeline interfaces allow interactions on a deeper level such as directly manipulating the visual representation beyond pre-scripted screens or drill deeper into the data of individual records through functions such as filter or search mechanisms. This enables to actually ask research questions using the interface. An example for this category is the netzspannung.org timeline. An open display would even intensify the manipulation possibilities by making it possible to freely manipulate any aspects of the interface through a UI or through scripting. It is also not limited to one fixed dataset but allows the import of custom datasets. Therewith the visualization becomes an open analysis tool for any kind of dataset through being able to customize the tool to work with the data that "may be reproduced and reused by others, […] a main requirement of tools for scholarly analysis" (Kräutli, 2016, p. 96).

Mapping interfaces in their simplest form locate data geographically and ideally let the user interactively explore the data. Google Maps and Google Earth offer easy to use platforms for geolocating content. But besides simply geolocating data objects and therewith for example giving an overview of the geographic distribution of a dataset or clustering the data by origin of the cultural objects, these interfaces can – depending on the type of data one is working with – go far beyond this. Examples include tracing the movement of a cultural object over time or the provenance of material to manufacture it and the way it traveled to the manufacturer. One can add a timeline component to the mapping interface, as does the project HyperCities[289], which enables the user to select specific timeframes to filter mapped historic content and thus conflates the dimension time and space. The Google mapping products, which are the geodata-basis with which HyperCities operates, also allow placing a variety of media data such as 3D models or overlays of historic maps onto current satellite images or maps, just to name a few examples. Therewith the maps georeference the material but also – in case of historic material – allow the user to explore historic layers of specific geographic places. Eric Gordon and Adriana de Souza e Silva (2011) argue referring to a presentation of Google product manager for GeoSearch, Lior Ron, at the Where 2.0 conference in May 2008: "most information is located or locatable; the map, according to Ron, could become the universal interface from which to access that information" (Gordon & de Souza e Silva, 2011, p. 19), or, to use a different term, the coordinate system for a wide range of information. In the past years, with the upcome of diverse mapping applications such as Google Maps or Bing Maps, and their inclusion of various information layers into the maps, they are transformed from a wayfinding tool to a search interface. Ron frames it in a way that one should think of Google Maps as "Google on maps" (Gordon & de Souza e Silva, 2011, p. 19). And especially when one pairs the mapping of data with the geolocation capabilities of mobile devices and brings these information rich maps into the world, this goes beyond a map as tool for visualization but affords "a different way of knowing and experiencing space" (Gordon & de Souza e Silva, 2011, p. 21). A phenomenon Gordon and de Souza e Silva describe in the term "Net Locality". "Now that we are immersed in data, the map is the

[289] http://www.hypercities.com

most logical framework through which to make sense of it" (Gordon & de Souza e Silva, 2011, p. 21).

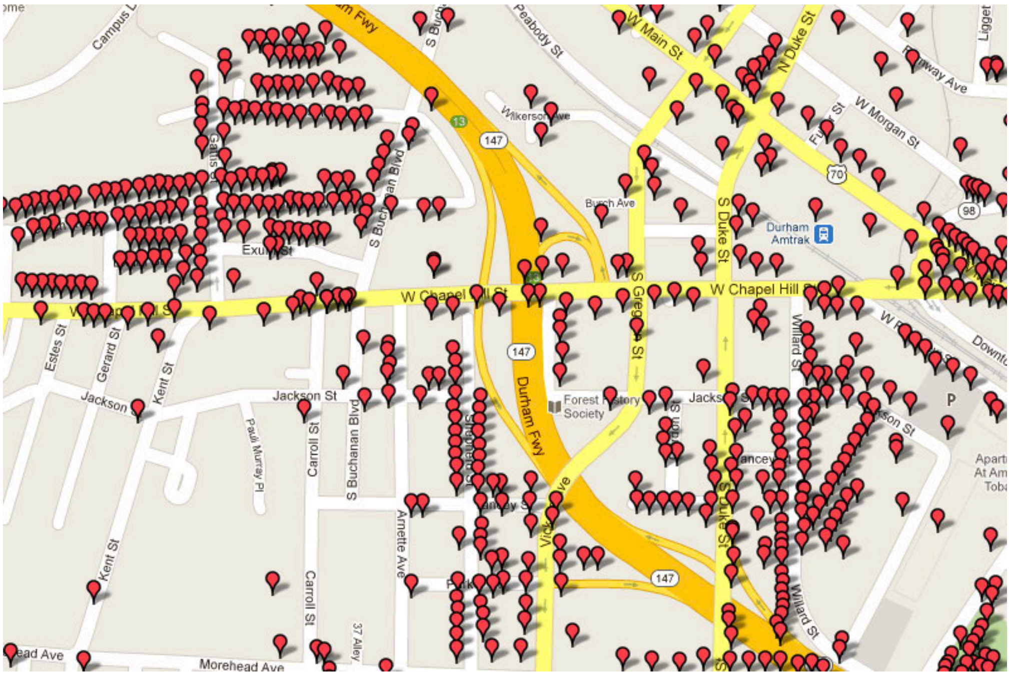

Figure 50: Screenshot of a map as coordinate system to navigate and locate information about historic buildings in Durham NC. The map is developed by opendurham.org and is based on Google Maps. Screenshot from 19.02.2013.

All these mentioned interfaces or visualizations provide a specific contextualization of all or a part of the data in a database, usually by pairing traits of the data, such as semantics or metadata information like time or location with a suited coordinate system. And these are only a few of many potential realizations which are possible especially through opening up datasources for re-use by offering an API and by combining different cultural heritage source(s) with other reference datasets such as geo-location data for mapping. This cross pollination of datasets produces additional value and new insights and questions also with the help of visualizations, exploratory interfaces and applications enabling a cross-contextualization of these datasets.

Several examples can be found in the app-section of DPLA[290] or hackaton-results on Europeana[291] or Coding da Vinci[292], which usually showcase prototypes produced in a limited amount of time of how the available data can be effectively reused in

[290] http://dp.la/apps

[291] http://pro.europeana.eu/web/guest/hackathon-prototypes

[292] http://codingdavinci.de

applications. The goal is usually to showcase the social and business value of open cultural data. One example is the application "Serendip-o-matic"[293], which examines the user's research interests by extracting keyterms of text pasted into a text box on the front page – be it of one's own research or any text one finds interesting – or by importing a bibliographic collection from the citation manager Zotero[294]. On the basis of the extracted keyterms related content is identified in sources such as the Digital Public Library of America, Europeana or Flickr Commons, resulting in a grid view of items in the featured databases, which could be interesting for the user, based on the material he entered. A click on the item leads to the detail view directly on the website of the source and therewith connects the original source directly with the context, without obscuring its identity. The tool is designed first and foremost as inspiration tool with search results that are meant to be suggestive, not exhaustive. But it is intended to help to point the user to material that he might not have discovered otherwise.

2.3.2. Curated Contexts

The previously described generated contexts, where non-human software-agents are generating or extracting (semantic) relations within the data by automated analysis of the data or metadata. These analysis results are used to (pre-)order or even select or suggest the data for a dynamic display and the interfaces react to human intervention for example in form of filtering or searching. However in the online realm there are also human curated or authored displays similar to what one would find in a physical museum. Here human agents decide on specific items to display as subset of a larger collection[295], put them into a particular order and maybe even author the selected collection items into one specific narrative or refer to them within a greater narrative. These approaches vary in the degree of linearity and dynamism of the display – in short the additional influence of a software agent.

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[293] http://serendipomatic.org/

[294] http://www.zotero.org/

[295] This digital collection is of course always based on archive and digitization politics, and therefore on human decisions to begin with.

a) Virtual Museums

Database-driven displays for art and culture, especially the ones from cultural institutions, are often summarized under the term "virtual museum" (e.g. Huhtamo, 2010) or "online exhibition" (e.g. Mundy & Burton, 2013). Media archaeologist Erkki Huhtamo traced the origins of the term "virtual museum". He states that the category "virtual museum" is very vague and overused, held together by the general common denominator as "referring to almost any kind of collection of material (supposedly of 'historical' or at least 'cultural' value) put on general display on the Internet" (Huhtamo, 2010, p. 121). As predecessors Huhtamo names projects using the telephone networks as exhibition medium, such as the project "Museum inside the Telephone Network" (InterCommunication Center, Japan, 1991), where home users could access exhibitions via telephone, fax or computer networks – but not yet the Internet. Also CD-Rom-based virtual museums were popular in the beginning of the 1990s and throughout the decade (see Huhtamo, 2010, p. 122). Even though there were – according to Huhtamo – some attempts to use 3D-navigable spaces for simulating physical gallery spaces[296], the dominating form in the early days of technological displays for art and culture was the one of hypertext and hypermedia. "Numerous commercial CD-ROM products [...] were conceived as virtual visits to existing art museums such as Le Louvre or Hermitage" (see Huhtamo, 2010, p. 122). Even though there were many experiments with virtual exhibition spaces, not many commercial products attempted to imitate the physical museum space[297] but rather presented documentation material of the building and presented the viewer some highlights from the collection in form of an interactive catalogue. This catalogue included background information and interpretative information about the works, as well as different modes of interacting with the image material and accessing the context. An example[298] mentioned by Erkki Huhtamo is a CD-Rom-Collection from the Hermitage in St. Petersburg published in the 1990s.

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[296] An early example is Apple's "Virtual Museum" presented at Siggraph 1992 employing Apple's Quicktime VR technology. A more recent application of this paradigm is the use of Google Indoor Streetview within the Google Cultural Institute (see Figure 60).

[297] Erkki Huhtamo noted as one exception the CD-Rom of Musée d'Orsay, Paris.

[298] 20 years after the production of the CD-Roms it is hard to come by the original media products and find the appropriate hard- and software environments to run them. Therefore descriptions of these products stemming from the 1990s are the only sources the author was able to fall back on for getting an insight about these CD-Roms.

Figure 51: Screenshot from an online demo of the 1995 Hermitage CD-Rom retrospectively created in Flash. Source: Montoure 2015, http://www.webmutant.com/portfolio/hermitage/

The CD-Rom-Collection from Hermitage – as reviewed by Alexander Boguslawski (1995) mediates the museum collection and the museum itself in a collection of three disks. The first CD-Rom gives an overview over the painting collection of the Hermitage, grouping images in regional and temporal groups as well as a section on the halls of the Hermitage that houses the paintings. The second disk focuses on the history and architecture of the Hermitage, each section highlighting different parts of the building. Alexander Boguslawski highlights the comparison of old inside- and outside views of the Winter Palace through Watercolors with modern photographs of the rebuilt Hermitage. The third disc then focuses on jewelry, decorations and household articles and gives insights contextual topics such as jewelry styles, jewelers of St. Petersburg as well as the tsars and emperors who once owned these objects. A glossary of jewelers materials and terminology, places, people events and objects discussed in the texts rounds up that disk. The disks offer different viewing modes or menus to access the content:

a) "Book Mode" which is a list of images
b) "Map Mode" allowing the user to move directly to any highlighted room in the Hermitage on a plan of the building and therewith to navigate the physical structure of the museum and have a virtual walkthrough through a 3D reconstruction of the gallery rooms.
c) "Topic Mode" that lists all sections of each disk
d) "Slide Show Mode" that automatically cycles through the images on a disk in a slide-show format.

As it gets clear already in this mode, the main access to the content happens through images of the artworks or the architecture. The main screen layout in the detail view of a work splits the screen into a large image and a vertical button bar on the right side, that allows on the one hand to display descriptive information with hyperlinked access to further contextual image material and on the other hand offers different magnification modes for inspecting the main image. These include the

a) "Lens Mode" that allows to point to any fragment of the image and to see it slightly larger in a separate section of the screen.
b) "Zoom Mode" divides the screen into two parts, which displays the full image and a twice magnified, scrollable view next to each other.
c) And the "Special Zoom Mode" (Panoramic View) enlarges the magnified main image to the full screen and places it in a frame of directional arrows, making the zoomed image navigable in the other direction.

The way of access resembles an annotated, digital diathek, which was at the time still the most common way, reproductions of collections were archived. Thus the CD-Roms remediate a known point of access to reproductions of artworks in a museum collection and extend it with additional interactive possibilities to inspect the images as well as additional contextual information about them. Therewith the virtual museum includes the layers of "the gallery as navigable non-linear database, the convergence of several different media and the visitor's/user's interactive and haptic relationship with the exhibits" (Huhtamo, 2010, p. 128). The use of the diathek-metaphor is strengthened by the reviewer referring to the pages with images as "slides" instead of hypermedia documents. And comparing interface design patterns used within the CD-Rom with contemporary database interfaces it becomes evident that patterns such as alphabetical lists, the composition of detail views or zoomable images were already established and used in these early products and are still common today.

These products were conceptualized for the use outside of the museum and are thus part of the museum experience outside its walls. Thus, as Erkki Huhtamo argues, "[f]or many users such CD-ROMs were supplements rather than substitutes for the physical museum. They were sold as souvenirs in the museum shops as part of their promotional machinery" (see Huhtamo, 2010, p. 122). And according to Huhtamo many museum collections continue this tradition of bringing assets from their collection, which are usually on view or in storage in the physical space of the institution, into the private environment of the user. Erkki Huhtamo calls this the "domestic pinacoteca" (Huhtamo, 2010, p. 128).

As the World Wide Web became more popular and widespread and the bandwidth as well as the storage capacity increased, these exhibition formats increasingly were moved online instead of using CDs or later DVDs as storage media and therewith also changed scope from a static collection to a web-platform. The developments went into two directions with different scopes: online exhibitions and online collections.

b) Online Exhibitions

In recent years "online exhibitions" developed into two main directions, which Jennifer Mundy and Jane Burton (2013) call "rich media catalogue" as well as "capturing the gallery". Online exhibitions therewith can amongst others act as mediated versions of physical exhibitions currently or formerly installed in a physical galleryspace and thus fulfill a documentary function. The first approach "still foregrounds images of the artworks in a two dimensional design scheme, akin to a printed catalogue, but increasingly it offers rich media assets to support the images" (Mundy & Burton, 2013, p. 200). An example for this approach is MoMA's microsite for its Cindy Sherman exhibition shown in the gallery in 2012 (http://www.moma.org/interactives/exhibitions/2012/cindysherman/). The website was built up as a visual "room-by-room guide to works in the exhibition, focusing on Sherman's photographs first and foremost, but with additional videos and commentaries" (Mundy & Burton, 2013, p. 200). It offers an entrypoint to the exhibited works sorted by gallery (Figure 53) with additional audio narration and introductory texts explaining the concept of each gallery and the overall exhibition and offering the possibility to explore the stills shown in a horizontal scrollable display with images only. Additionally a chronological order as entrypoint is offered as well as a series of videos where other artists talk about their favorite work in the exhibition. Thus the site is a hybrid of digital catalogue allowing the user to traverse through different layers of information and degrees of detail, and additionally to explore the works of the exhibition in the thematic and physical order of the exhibit or with time as coordinate system. Moreover users can see some highlights through the eyes of other artists as contextualization in a separate section.

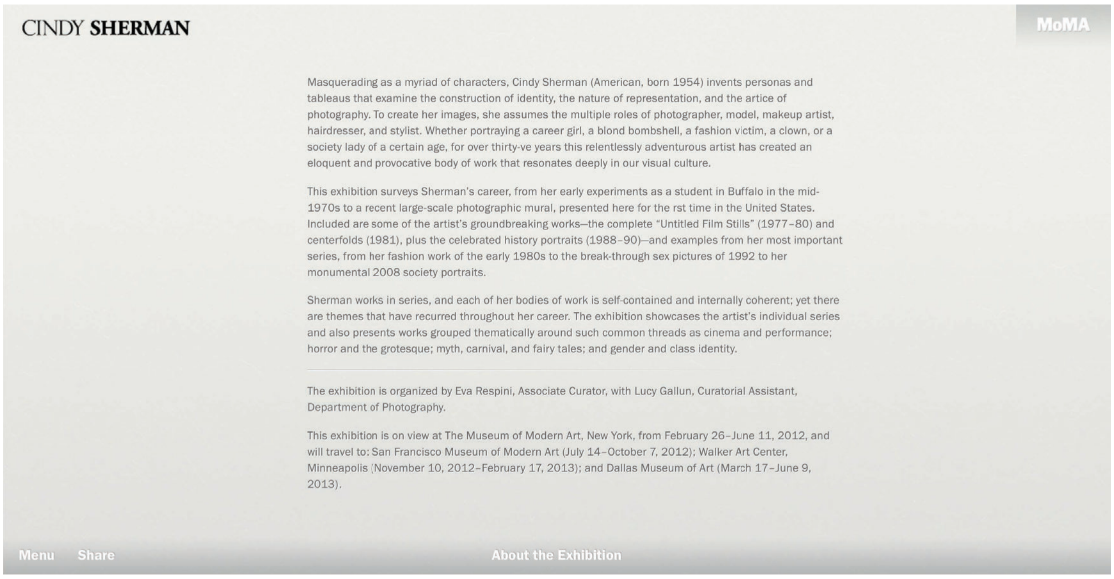

Figure 52: Infotext layout in MoMA's Cindy Sherman exhibition microsite from 2012 (http://mo.ma/1fwjdiY). Screenshot from 15.09.2016.

Figure 53: Works by gallery in MoMA's Cindy Sherman exhibition microsite from 2012 (http://mo.ma/1fwjdiY). Screenshot from 15.09.2016.

Figure 54: Detailview of one gallery with horizontally scrollable display one work at the time and the audio description running. Details about the work beyond thumbnail information are not displayed. Screenshot of MoMA's Cindy Sherman exhibition microsite from 2012 (http://mo.ma/1fwjdiY) from 15.09.2016.

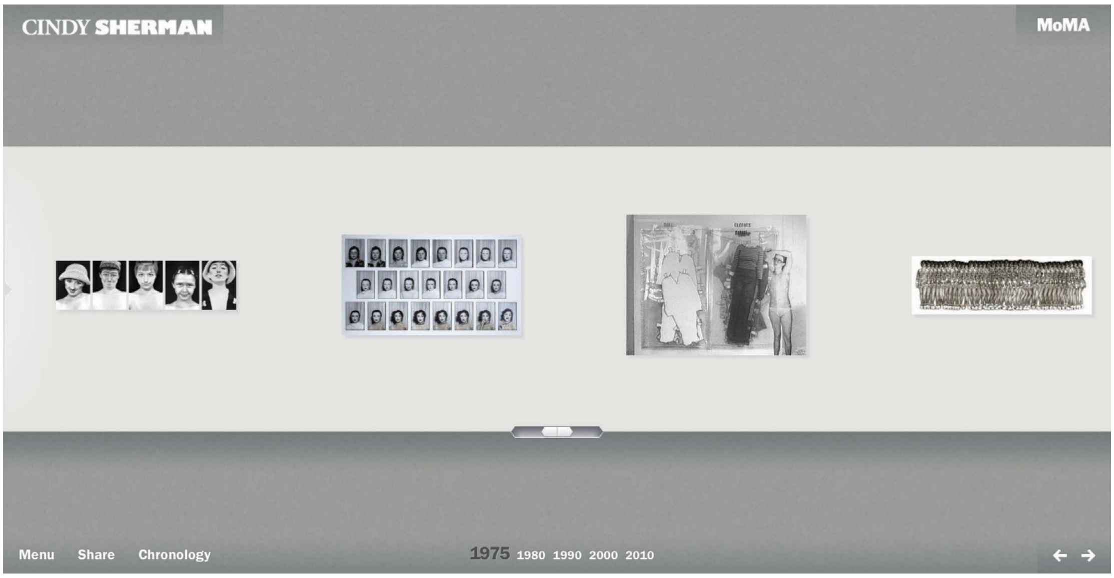

Figure 55: Chronological order of the exhibited Cindy Sherman works in MoMA's Cindy Sherman exhibition microsite from 2012 (http://mo.ma/1fwjdiY). This is another example for a timeline interface. Screenshot from 15.09.2016.

Another example for a similar approach to curated contexts are the “Archive exhibitions” of the virtual meta-museum **Google Cultural Institute** (see Figure 56), which also offers a horizontally scrollable display resembling a classical gallery hanging. The horizontal movement through the display reminds of strolling along a long gallery wall. The movement happens either by clicking on arrows on the left and right like in a conventional horizontal navigation through a series of images, or by moving a box indicating the visible section within an overview of the whole display on the bottom of it, a metaphor used for example in image editors. In contrast to the Cindy Sherman microsite the displays are a mixture of images and textboxes placed in a grid structure, which resemble even more closely objects and labels in a conventional exhibition. Besides a general introduction label for the exhibition as well as credits, the labels contain object descriptions of an object in the direct vicinity of the label within the grid. The images lead on click to the "detail view" of the object in form of a zoomable high resolution image with the possibility of getting access to the same object details again. "Users can compare and contrast famous artworks from different institutions and zoom in on paintings for a view that goes well beyond what can be seen by the naked eye, demonstrating the power of digital technology to deliver an experience that would be impossible in galleries" (Mundy & Burton, 2013, p. 200). Moreover the exhibition can be viewed linearly as a slideshow including the detail view of the object as well as the labels as separate text-slides. Therewith this display resembles a museum setting as "storytelling with objects", where cultural objects out of a larger collection are curated with regard to a specific topic and juxtaposed in a display in a linear fashion. The narrative is hinted at by implicit relations through the juxtaposition and selection of objects within the display setting – an implicit argument to be discovered by the user.

But the Google Cultural Institute moves even a step further to the "capturing the gallery" approach in not only resembling a museum display but making the physical museum displays explorable online (see Figures 57 & 58). The indoor street view technology allows a virtual walkthrough through the physical gallery space employing a 360 degree navigable "Museum View". This moves the "virtual museum" walkthroughs from early CD-Rom projects to a new level of realism. For this Google employs the concept of a mirrorworld (see Smart, Cascio, & Paffendorf, 2007), a virtual space which reflects or models the physical space and serves as interface or coordinate system for data and information. Thus it is an informationally enhanced virtual model of the physical world. As Smart et al describe, "[t]heir construction involves sophisticated virtual mapping, modeling, and annotation tools, geospatial and other sensors, and location-aware and other lifelogging (history recording) technologies" (Smart et al., 2007, p. 9).

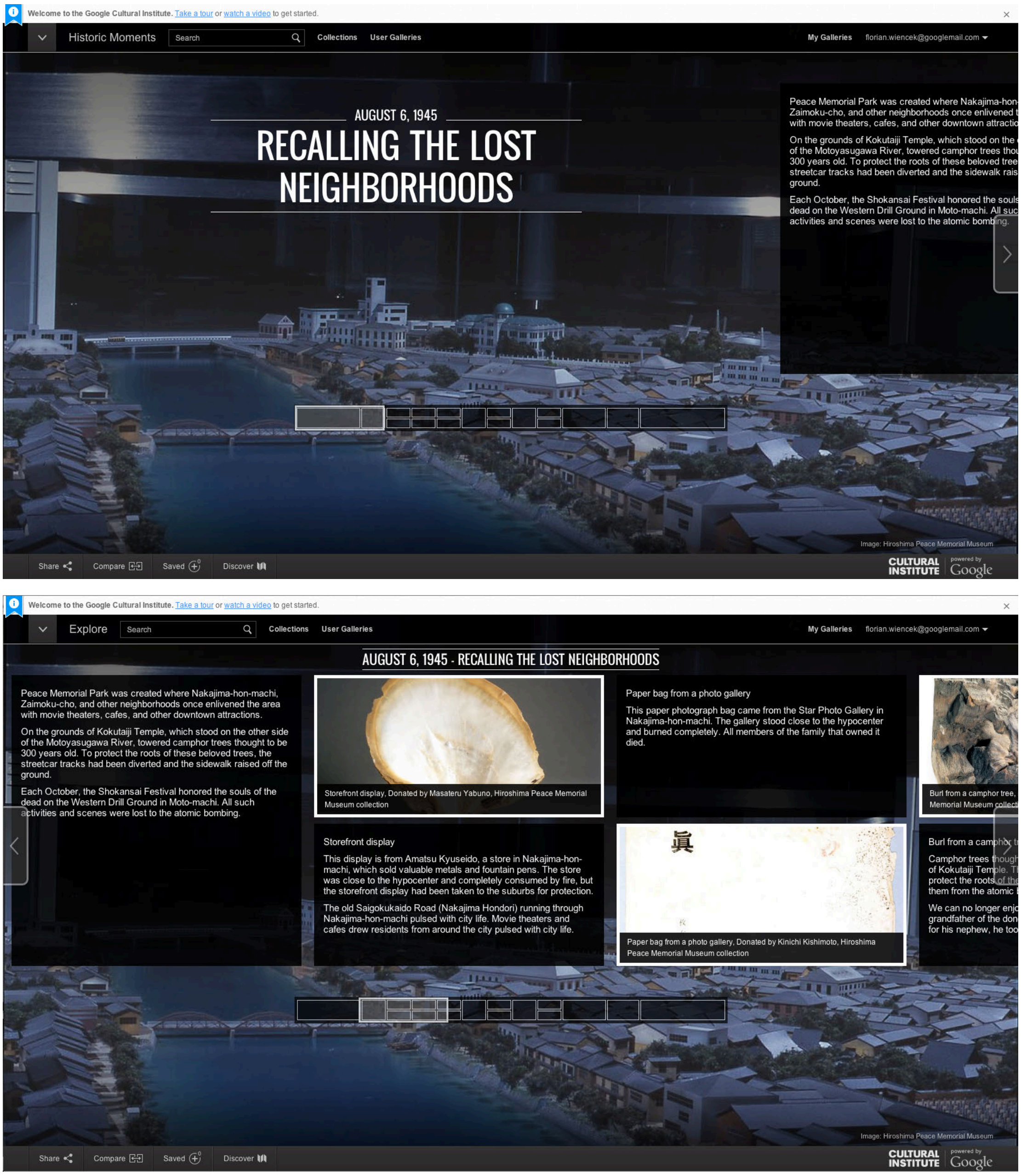

Figure 56: Screenshots of the exhibition „Recalling the Lost Neighborhoods“ on "Google Cultural Institute" (http://www.google.com/culturalinstitute/exhibit/recalling-the-lost-neighborhoods/ARVNCcZi?projectId=historic-moments) from 02.09.2013. Top: start screen of an exhibition with the title on top of the full screen background image. Bottom: grid view consisting of text labels and media material.

An example is Google Earth[299], including the function of Google Streetview, which lets the user virtually wander and explore the streets of a city. These applications mimic aspects of the physical world while using it as coordinate system for networked information. They enable the exploration as well as collaborative annotation and

[299] http://www.google.com/earth/index.html

enhancement of the digitally enhanced representation of the physical world without actually physically moving around in it. And this technology is exactly employed in the virtual gallery view.

For this specific project Google Cultural Institute, or more specifically the Google Art Project as part of the larger organizational setting, works with "Google Indoor Streetview" technology to capture the exhibition setting in the museum's galleries resulting in an explorable photographic representation of an indoor space. The interface allows moving through the space as if one would walk through the aisles of the real galleries, by using the mouse and clicking at specific hyperlinked points in space to move to the selected location. From there one can look around the virtual point of view, zoom into details of the space. The interface also enables the user to get additional information and orientation by using floor plans of the museum[300], and indicating where on the floor plan the user is standing and in which direction he or she is looking. Moreover a horizontal menu on the bottom of the display gives a scrollable overview, which of the works of the specific exhibition the user is currently exploring are also documented in the database. From this navigation the user can jump directly to the detail views of the works. But the virtual visitor can also use the mirrorworld-gallery space as navigation system and click on the hyperlinked work represented in virtualized space to get to further information about it. Therewith this comes close to navigating the real gallery space and going up to a work one is interested in, reading the label as well inspecting the work up close. The digital can oftentimes come closer to a work than in a physical museum with its conventions to keep distance from an artwork as well as to not touch it, sometimes even closer than human senses would afford without technological mediation. Therefore this type of "online exhibition space" takes the conventional "virtual museum" a step further, by introducing the mirrorworld-functionality and representation of one specific state of an existing physical exhibition paired with extended technical representations of the exhibited cultural objects. Where this is one Web 2.0 form of online gallery-space employing many technologies introduced with the shift to this virtual 3D-spatial paradigm, the question remains, if representing the physical gallery space in an online environment might be in the end falling short of what the medium can actually can do beyond the physical gallery space

[300] this navigational element was already used in early CD-Roms as discussed in the section on Virtual Museums and thus follows a common design pattern.

in terms of mediating the artworks through active engagement and interaction with the information space.

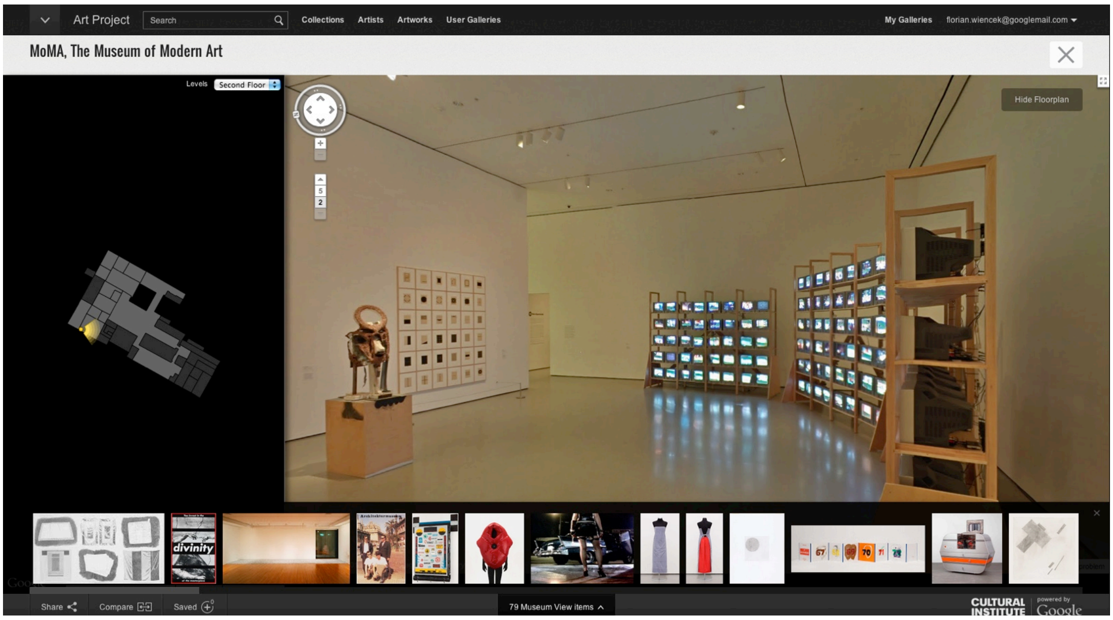

Figure 57: Screenshot of the „Indoor Street View“ making the gallery space of MOMA explorable within the „Google Art Project“. This specific scene shows an installed video installation in its exhibition context at the time of exposure. Screenshot from 14.12.2013

Figure 58: Screenshot of a "behind the scenes" video, showing the production of the "museum view", using a specially designes Street View-trolley, which takes 360 degree images or the gallery interior while pushed through the gallery aisles. Source: Google Art Project (2012).

The **Archive of Digital Art** offers a different non-spatial approach to documenting past exhibitions. The ADA Lightbox was originally designed as a tool for comparative research, where the canvas of the interface serves as „desktop“ for researchers to place virtual index-cards with data about previously selected or digitally collected digital artistic projects from the ADA archive on the plain – from images over videos to descriptive or informational texts – and therewith have the data side by side as entrypoint to perform a qualitative, comparative analysis. But this plain canvas can also act as empty wall for exhibiting information about artworks with the description text from the archive in a sidebar on the left side of the screen. Through interlinking several of such walls with works that were all featured in historic exhibitions on digital art, paired with a curatorial statement of the exhibition and brought together with a text collection in PDF format, this approach remediates an exhibition that was already on display before in the sense of remediation by Bolter and Grusin (1999) by translating it into the format of a networked online publication. The first exhibitions documented in this way were the digital exhibitions CODeDOC and CODeDOC II, curated by ADA community member Christiane Paul. The first edition was commissioned by the Whitney Museum of American Art in 2002, the second edition by the Ars Electronica in 2003. The original exhibition was shown on the „Artport“ Website, which in itself was and still is a digital exhibition for net-art. Where the original exhibition focused on American artists and invited them to complete an assignment – „connect and move three points in space" (Paul, 2016) – in a programming language of their choice, the second edition focused on European artists and showed the software-exhibition during the Ars Electronica Festival with the theme „Code – The Language of Our Time“. The main idea behind the exhibition was to expose and „explore the relationship between the underlying code of software art and the results it produces“ (Paul, 2016) by first letting the viewer scroll through the code that lies underneath the surface oft the project and then lead further to the resulting aesthetic outcome and interface. The „original exhibition – taking the first CODeDOC as example – is in itself a website with a brief conceptual text linking to the full assignment for the artists and links to detail pages about the individual artworks in the series. The detailpage gives a brief intro about the artist, links to the netart-piece itself that is hosted on the museumserver and offers a navigation to the other artworks in the exhibition. Therewith the exhibition is in itself a hypertext publication showing netart pieces where they should be seen: on the computerscreen of the users. Thus the original exhibition does not differ that much from archive interfaces or other networked publications. Moreover these exhibitions did also have a comment area where other artists could discuss with the creator of the work. This discourse was also part of the original exhibit.

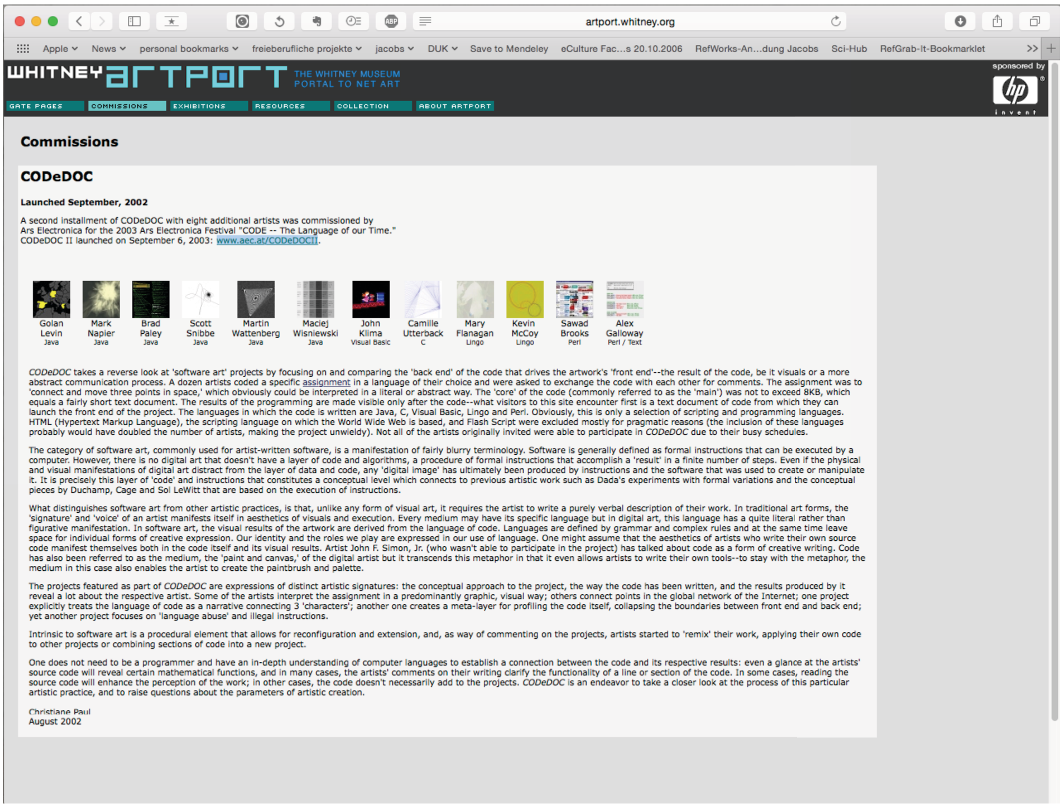

Figure 59: Landingpage of the original CODeDOC exhibition on Whitney Artport. Screenshot from 03.10.2016.

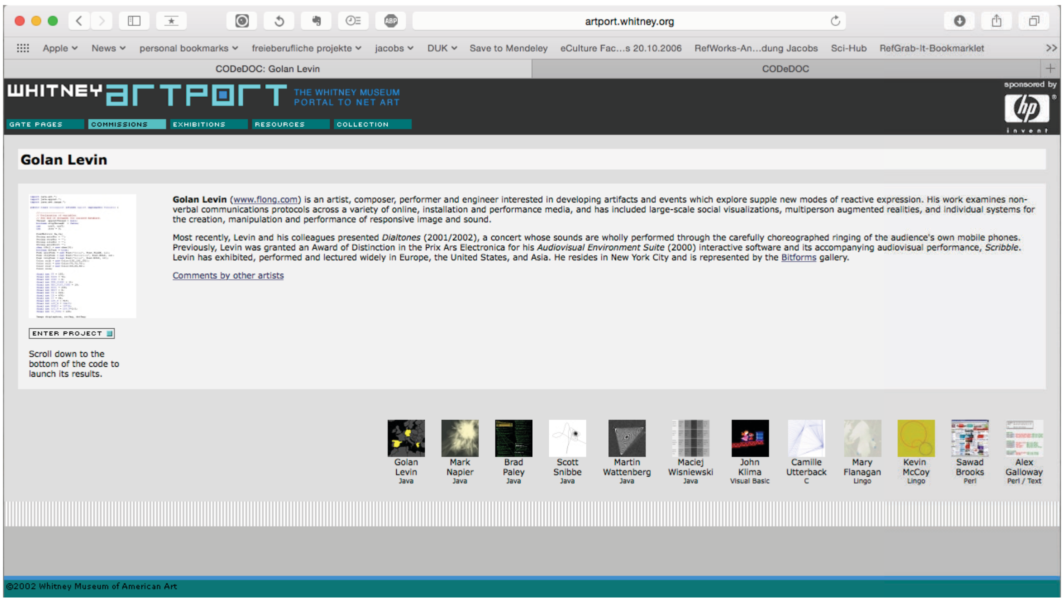

Figure 60: Detail-page on Whitney Artport of Golan Levin's netart-work „Axis Applet" (2002) with artist-bio, thumbnail view, link tot he artwork on the Artport, comments and a discussion about the work and a navigation to other artworks in the online exhibition. Screenshot from 03.10.2016.

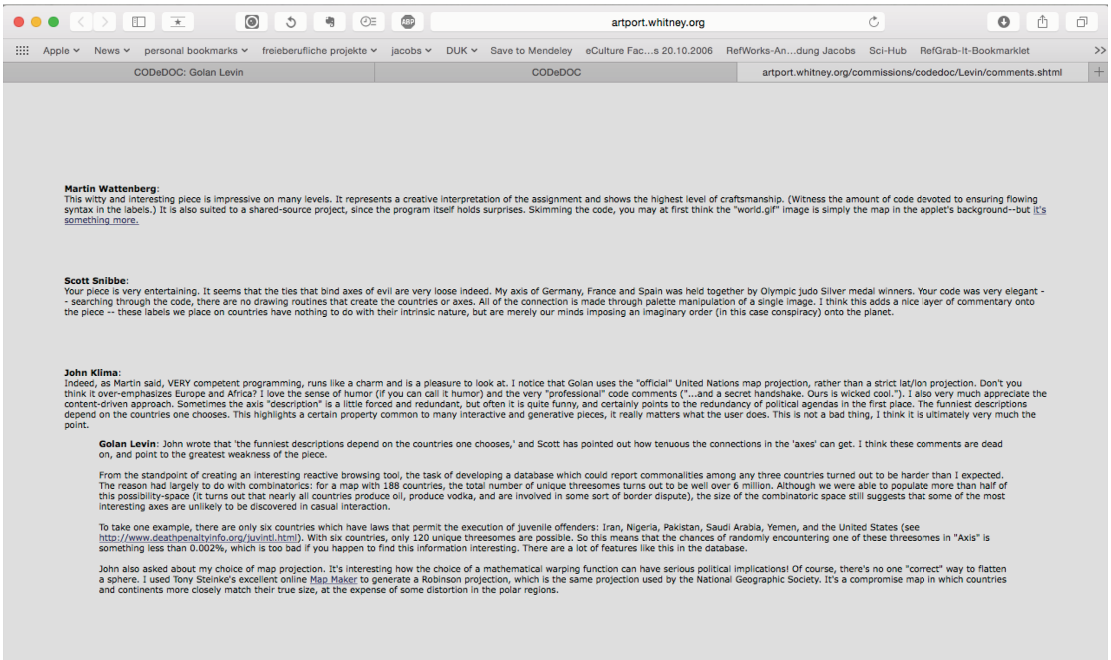

Figure 61: Discussion about Golan Levin's artwork „Axis Applet“ (2002) on Whitney Artport. Screenshot from 03.10.2016.

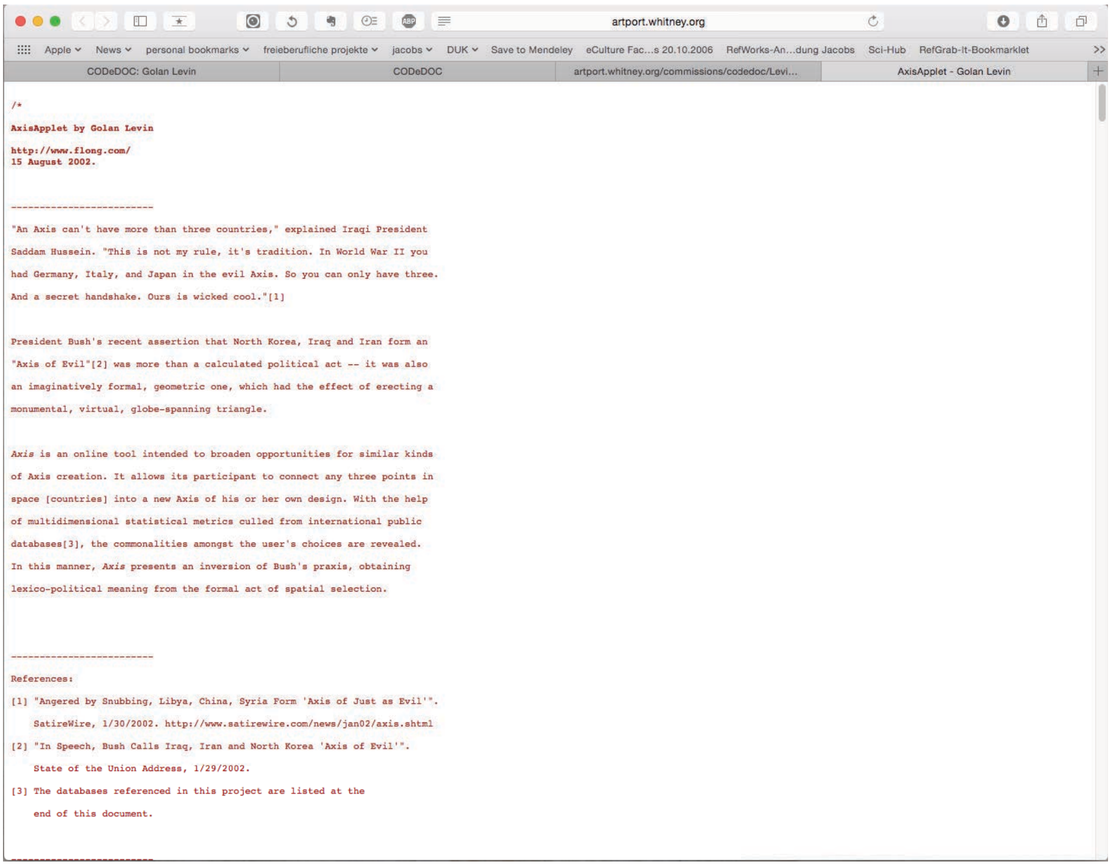

Figure 62: Codeview of Golan Levin's artwork „Axis Applet“ (2002) on Whitney Artport. Screenshot from 03.10.2016.

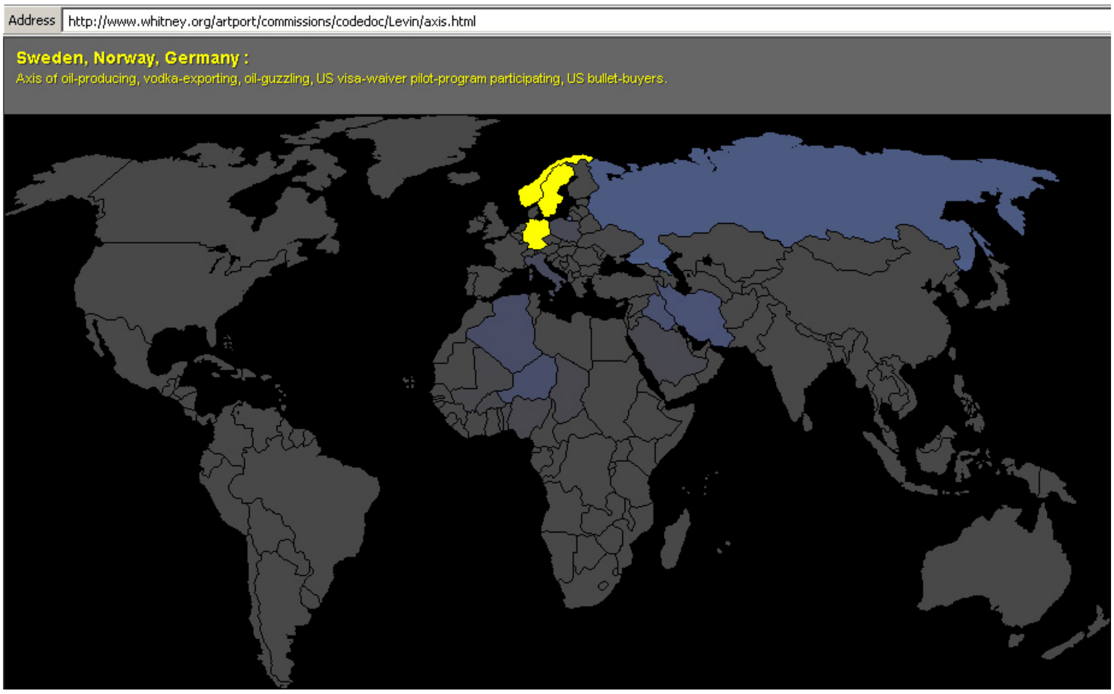

Figure 63: Application-view of Golan Levin's artwork „Axis Applet" (2002) on Whitney Artport. Screenshot from 03.10.2016. Image: © Golan Levin. Source: Archive of Digital Art (ADA). http://bit.ly/2cNM7nY

Even though the original exhibition is still online, the rapid obsolescence of digital technology makes the works age fast and results in the fact that even a bit over ten year old works are difficult to display today. Modern web-browsers may block content, certain plugins are missing in order to view the original content. Thus in order to preserve these pieces of netart it is not only needed to preserve the original functionality of the netart pieces, but also to document their possible experiences as well as highlight necessary steps for digital preservation as well as techniques on how to view the pieces on modern computers. Thus the remediated exhibition shows diverse documentation material archived within the Archive of Digital Art and transforming an already digital exhibition into an exhibition of documentation material about the original artworks. Thus the remediated online exhibition chronicles the original exhibition through archive material within the Archive of Digital Art. „In order to preserve the full range of these artists' expression, and not simply make a record of their artworks, we developed an analytical grid in which essays, images, keywords, and videos can be viewed simultaneously" (Grau et al., 2016, p. 4), wrote the ADA Team consisting of Oliver Grau, Wendy Coones, Viola Rühse, Janina Hoth and Devon Schiller in their introduction to the remediated exhibition. The documentation material includes image material and a video documentation of one possible experience of the project, descriptions and comments with multiple points of view as well as keywords to contextualize the individual project. Moreover the exhibition leads to the original netart piece on Artport as well as the full archival record. With this strategy in place the remediated online exhibition goes beyond documenting the exhibtion with its concept but shows archival records and documentations of the original pieces. Therfore one could describe the exhibition as a „meta-exhibition" offering „meta-experiences": thus an exhibition about an exhibtion where the exhibited archive records give an impression about the possible experiences of the pieces that were part oft he original exhibition.

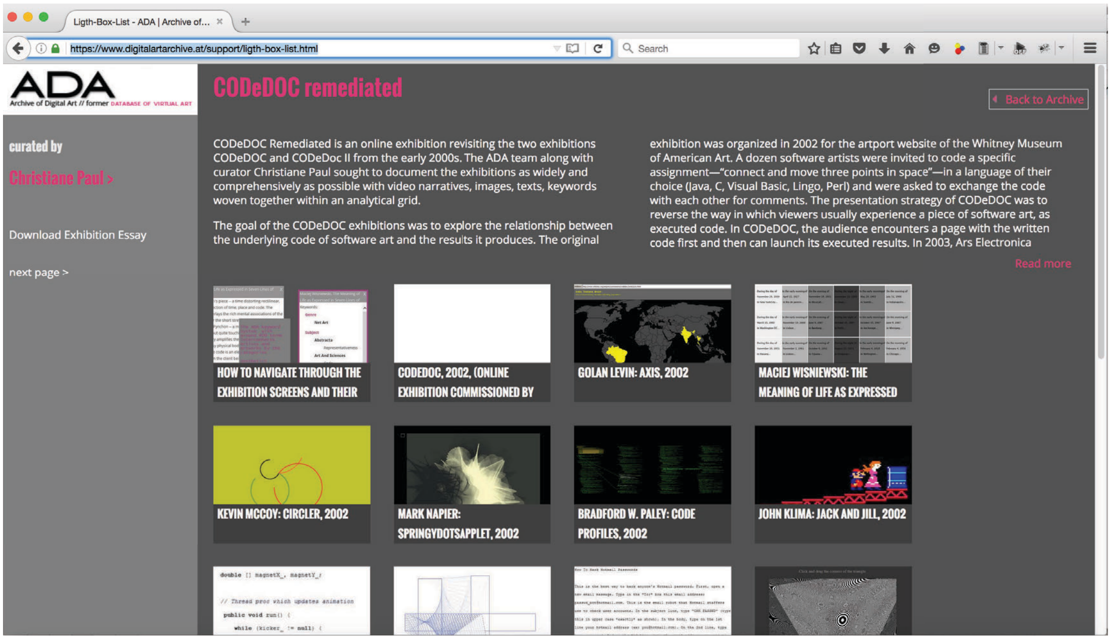

Figure 64: index-page of the CODeDOC remediated exhibition on ADA. Screenshot from 03.10.2016

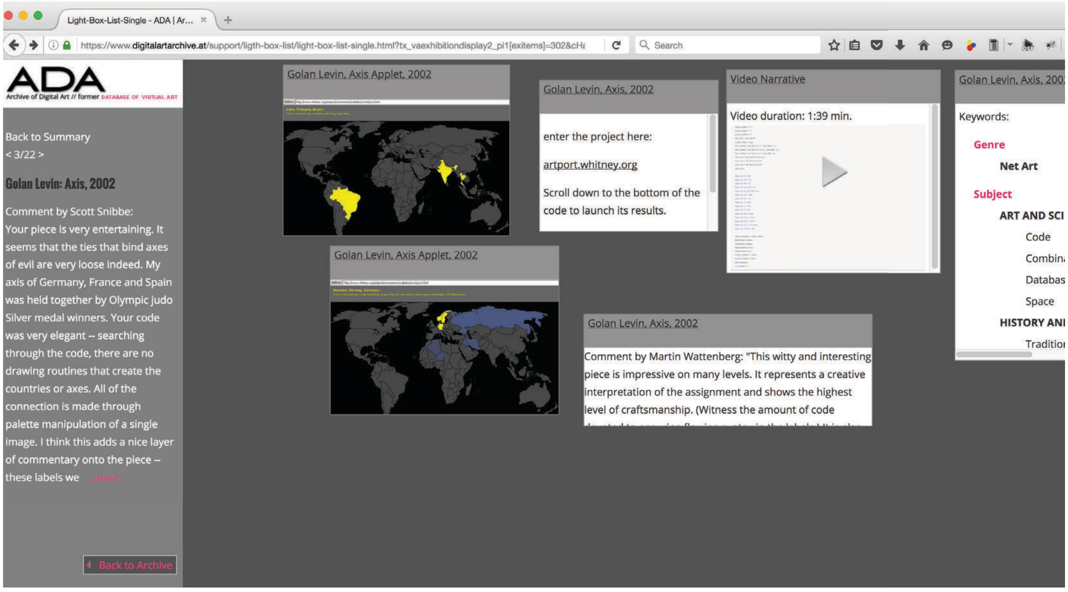

Figure 65: Detail-view of Golan Levin's "Axis Applet" (2002) within the remediated CODeDOC exhibition on ADA. On the left side is an excerpt of all descriptions of the piece available within the archive, that can be viewed in full. On the right side is a fixed arrangement of documentation material – including images, texts, a video of one possible experience of the piece as well as keywords describing the work. All headers of the „index-cards" containing the media items lead to the original record in the archive. One of the index cards also leads to the original artwork on Whitney's „Artport". Screenshot from 03.10.2016.

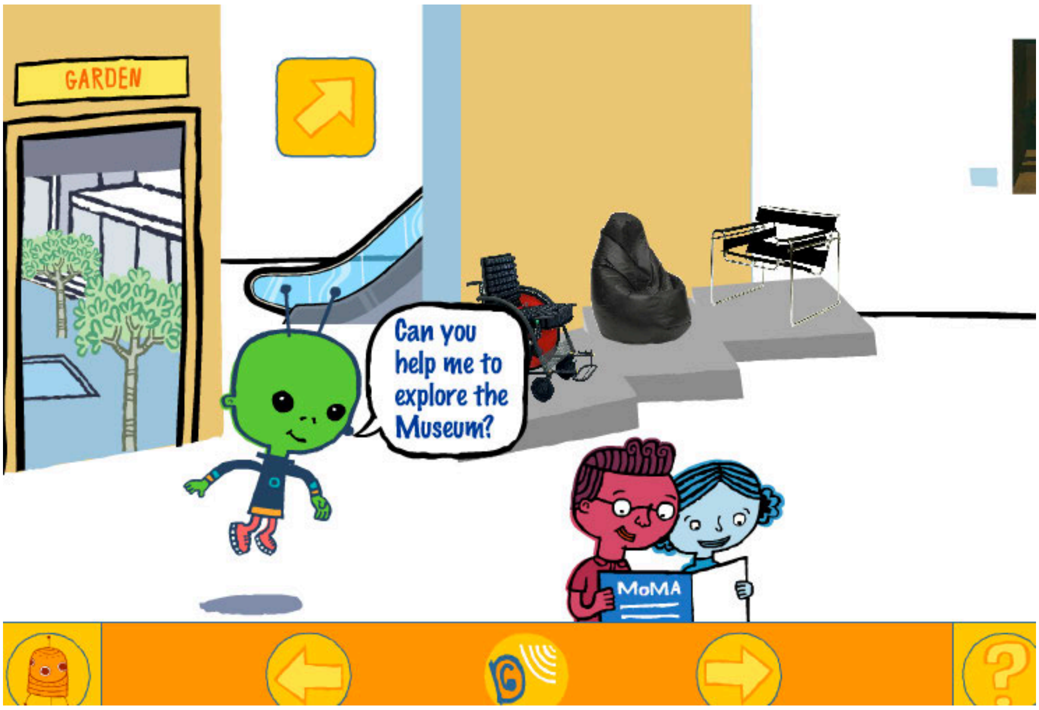

Figure 66: starting point of the educational game "Destination: Modern Art" by the Museum of Modern Art, New York, USA. The space creature starts the exploration on the first floor of the galleries, asking the young user to help him with the exploration. The navigation in space with the arrow-buttons is visible here, as is the quick navigation between different locations (MoMA galleries and MoMA P.S.1) on the far left. The difference between the illustrated building and the photographed artworks becomes evident already in this very first scene. Screenshot from 28.11.2013.

"Destination: Modern Art, An Intergalactic Journey to MoMA and P.S.1" by the Museum of Modern Art in New York is a different take on a virtual exhibition. It is not using a purely documentary approach but is rather a game-based educative application employing a drawn pseudo-3D environment together with a fictional reality and digital storytelling elements. "Destination: Modern Art" was launched 2004 as an animated tour of the Museum of Modern Art and P.S.1 Contemporary Art Center for children from five to eight years, with the goal of introducing works of the the museum-collection and site-specific works at MoMA PS1 to a young public and furthering engagement with it. The children are encouraged to look carefully at the exhibited works of art, learn about artists, their techniques and process and where they find their inspiration to create these artworks. This information is augmented with online- or home-activities, which are inspired by the artworks and artistic strategies or reuses them for own creative expression.

The game-like tour evolves around the story that a space creature[301] is sent to Earth on the mission to discover modern and contemporary art. Therefore it lands in New York to explore the Museum of Modern Art and MoMA PS1. It finds itself in the entrance area of MoMA and asks for the help of the player to explore the two different floors museum as well as adjacent spaces such as the sculpture garden as well as the Contemporary Art Center P.S.1. Thus the game gives an intrinsic motivation to explore and navigate the virtual museum by guiding the space figure through the premise. The user moves the space creature through the museum and exhibition rooms that are depicted in cartoon-like drawings by clicking on arrow buttons, similar to the navigation in the Google Indoor Streetview. By clicking on one of the artworks – which stand out by being the only photographic objects within a drawn environment – he or she will not only get more information about an artwork but rather is fostered to do activities around the work and its artistic approach in order to get to know the thinking behind a work and experiment with it. An activity shows a larger image of the artwork as well as artist title and year of creation and the little space creature prompts the user to pick one of the four content areas:

[301] The space creature is a good metaphore for somebody, who is a complete novice to modern and contemporary museums, and comes into the museum as a if he or she would step on completely foreign, unknown terretory: not knowing how to get around, how to behave properly in the situation, and most importantly not knowing how to approach the artworks and how to interpret them. Thus the creature, as the novice, is curiously exploring the environment and it objects and taking cues from the people around him.

1. **"Tools"** contains an creative exploration of the artistic strategies and techniques the artist used to create the artwork on display. This happens for example through activities inspired by or digitally applying the artistic strategy. To give some examples: William Anastasi's drawing 60 minutes from 1987 was a conceptual art piece, where Anastasi drew for 60 minutes without lifiting his pencil from the paper. The creative task asks the child to help to create a timed artwork by moving the mouse over a white box without stopping for 15 seconds, which are timed. After creating the drawing the game allows to replay the user's drawing process. For the work "Colors for a Large Wall" by Ellsworth Kelly, 1951, which is made out of 64 small colored canvases, the space creature asks the user to help him to create a color composition by filling a prepared four-by-four grid with colored squares of your choice. In a second step the application lets the user scramble the order of the squares to bring a chance moment into the process and to allow the user to see different configurations of the same colored squares. More complex techniques based on physical processes that are hard to translate into a digital experience are explained by an illustrated step-by step explanation of the process. Examples are the etching process used in Kiki Smith's work "Peacock" from 1997, or the explanation of sculpting in metal in comparison to stone, in relation to Umberto Boccioni's metal sculpture "Unique Forms of Continuity" from 1913.

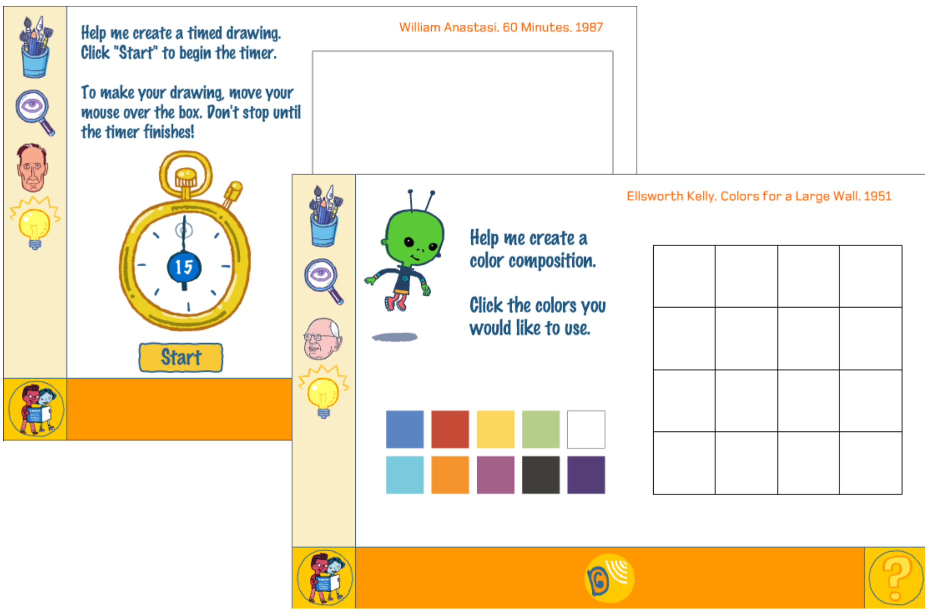

Figure 67: Examples for the "tools" section of the activities in the game "Destination: Modern Art". Left: timed drawing activity associated with William Anastasi's drawing „60 Minutes", 1987. Right: creating a color composition related to Ellsworth Kelly's „Colors for a Large Wall", 1951. Screenshots from 28.11.2013.

2. The second set of activities involves different modalities: visual, sound and text, which relate directly to the visual artwork to be mediated or transfer the work into some other form.

   "**Look**" fosters the young user to engage with the specific artwork, take a closer look at and visually analyze details of a specific artwork. The exercises lead the gaze. The activities follow the rule of thumb, voiced by a participant in the study for the Crystal Bridges museum by Welch et al. (2013) (I paraphrase): if you want to engage children, do not add more flashy elements but ask engaging questions (see Welch et al., 2013, p. 13). For the drawing by William Anastasi the user is asked to choose an area of the larger drawing to analyze in detail, and is then asked to assess the nature of the lines of this specific section with a series of questions: if the lines are curvy or straight, thick or thin, dark or light and if there are many lines or a few. Each adjective is illustrated with a visual example. In the end all the answers given are summarized. The described exercise is in the realm of a neutral description within the iconographic dimensions of Erwin Panofsky (see M. G. Müller, 2003; Panofsky, 1982), and thus training the eye to actually see the image and its details rather than interpreting the image. Other exercises in that realm ask the user to identify the colors that match the colors in the painting within selected colors presented, to identify used materials, or to find specific neutrally describable elements, such as a specific animal or parts of a depicted animal within an image. All these exercises work with tools to help to identify image-details better, be it by drawing an outline around them on mouse-over, or by magnifying details of the image. Another type of activity is a puzzle and therewith putting an image back together, which leads to thinking about the relationship of different graphical elements within the image. For the selfportrait "Fulang-Chang and I" by Frida Kahlo (1937) the user is asked to inspect different elements of the image by hovering over them and hearing/reading about the relation of the depicted element to the artist. This combines the depicted and neutrally describable elements with background knowledge – the second step in the iconographic presentation according to Panofsky.

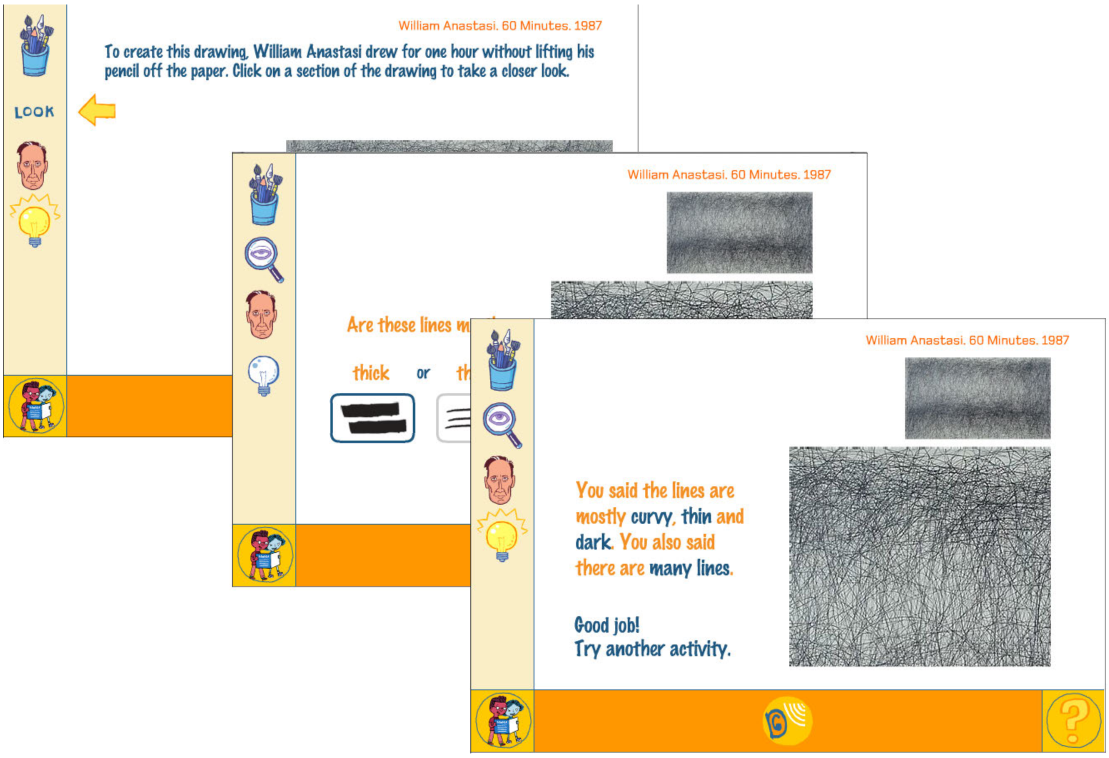

Figure 68: Screenshots from „Destination: Modern Art“ from 28.11.2013. It shows the "Look" activity, inspecting the lines in the drawing "60 Minutes" (William Anastasi, 1987). The screens show the initial prompt for the activity, one of the questions regarding an attribute of the lines, and the summary screen.

“**Listen**” fosters the children to bridge modalities. In relation to the metal sculpture “Unique Forms of Continuity in Space” (Umberto Boccioni, 1913) the user is asked to imagine what sound the sculpture would make, if it could move. By moving the mouse over the depiction of the sculpture, different examples are played.

“**Words**” asks the young user to transfer the visual impression of the artwork into a verbal expression, be it a poem, using specific words, or by telling a story about or departing from a visual artwork.

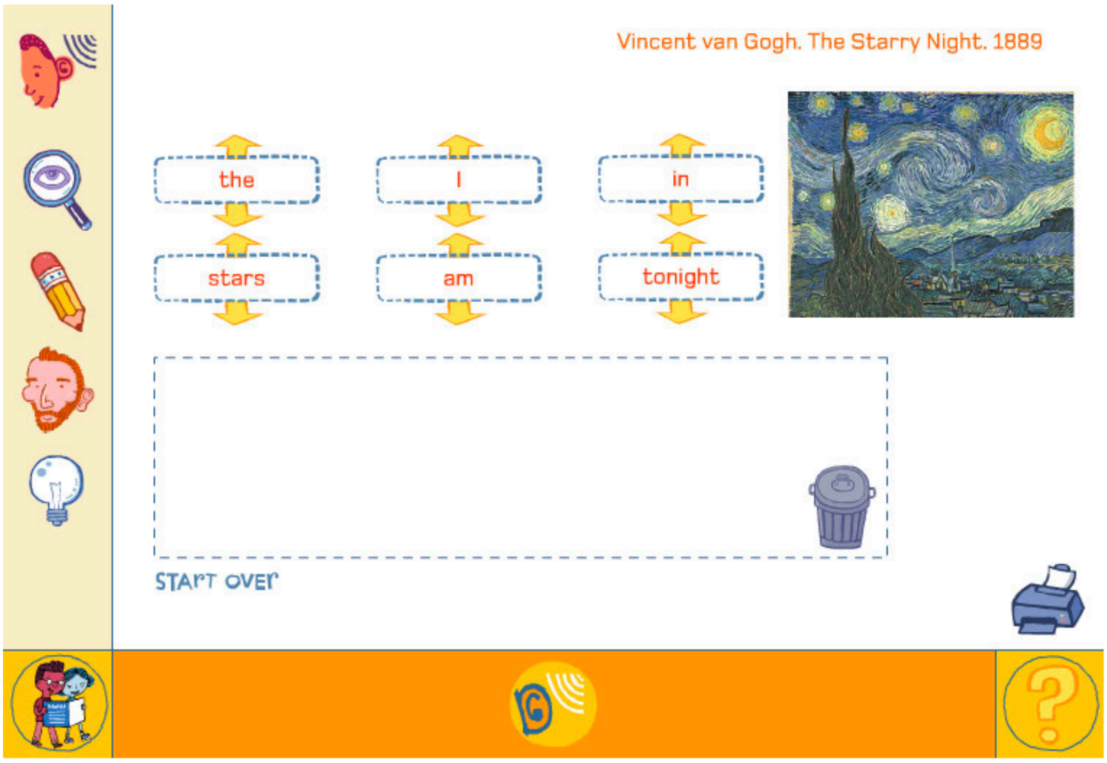

Figure 69: Screenshot from „Destination: Modern Art", showing the poem generator, a „Word" activity related to the painting „The Starry Night" (Vincent van Gogh, 1889). Screenshot from 28.11.2013.

3. The "**About**" section presents several short facts about the artist.

4. The last section "**Idea**" presents the young user with an idea for an creative experiment inspired by the artwork on display, which can be done with materials available at home: from creating a collage with pictures from newspapers and magazines inspired by "The Dove" (Romare Bearden, 1964); over creating a sculpture of somebody running, in which the child should express energy and motion, inspired by the sculpture "Unique Forms of Continuity in Space" (Umberto Boccioni, 1913); to creating potato prints in order to experiment with a form of print making, related to the etching "Peacock" (Kiki Smith, 1997).

Besides the two floors within the museum connected by an escalator, the user can lead the space creature to the Sculpture Garden and the MoMA P.S.1, which are both introduced on entrance with regard to their function and history. Here the mediation is more information- than activity-based. As the Contemporary Art Center houses mainly site-specific artworks, the building is represented not as a exhibition space but rather as cross-section, where – similar to a map – the user can click on specific areas, marked by drawn children looking for artworks, to reveal a photograph and a short description of the site-specific artwork. Some sculptures in the sculpture garden have time-lapse footage associated with them, which shows how they were build up in the sculpture garden.

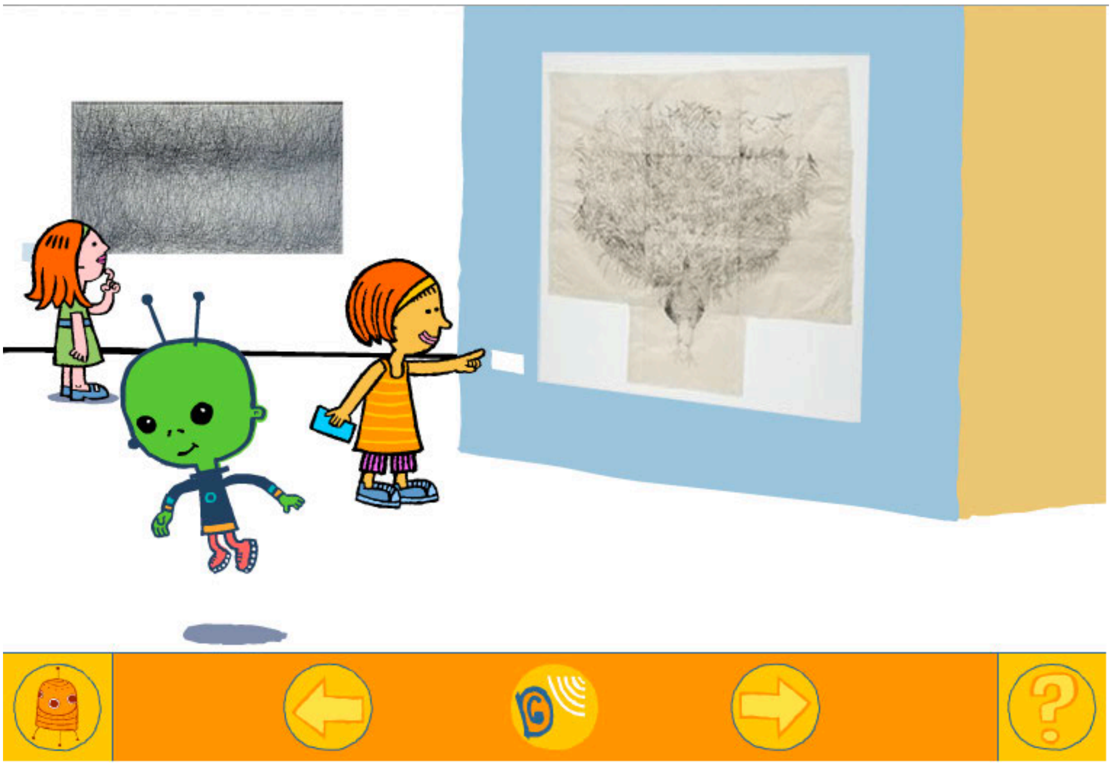

Figure 70: Scene from the second floor of the MoMA gallery in the game „Destination: Modern Art", showing two children enacting typical behaviors in a museum. The girl in the back is contemplating an artwork and reflecting about it, the girl in front of the etching (on the left of the space creature), is pointing at the label besides the artwork, looking for more information. Screenshot from 28.11.2013.

An interesting element within the game are the children in the museum, representing a wide range of ethnicities. All of them enact typical activities in a museum: contemplative watching of the artwork, hinting at labels of the artworks for more information, looking up information in a museum folder or sketching in front of an original artwork with a pencil on paper. In the MoMA P.S.1 all children are looking for site specific artworks in the building, which should remind the children to keep their eyes open when they visit this site. An artwork could be hidden even in the most unusual place. Thus besides introducing the artists, artworks and artistic practices themselves the game also educates subliminally on how to behave and interact with art in a museum. On click on the figures they say a sentence, ranging from information about the specific place, over a comment on artworks they are standing next to ("Ellsworth Kelly SURE used a lot of colors."), to asking a question that should lead the user to start exploring an artwork ("I wonder where he started this drawing?"). It is remarkable that there are hardly any authoritative figures inside the game, with the exception of two guards: one in the sculpture garden, who reminds the children not to touch the sculptures, and another who explains when a child asks if the fire extinguisher is art, that it is indeed just a fire-extinguisher. All other information, comments and questions come from children or the rather neutral creature from outer space. And even the artists are not presented as authorities, but rather their human side is emphasized.

Thus instead of building up a mirrorworld or documenting an existing exhibition the application creates a new online-only exhibition with selected works from the MoMA collection, situating it in an fictional, illustrated architecture loosely resembling the physical museum. The focus is not so much on showing dense information and allowing traversing a large information network of an exhibition but on the engagement with the artistic process and on learning about the artworks exhibited – similarly what an in-person tours or workshops would offer children. But the online environment makes it possible to do these activities outside of the museum in the private home together with parents or siblings or with caretakers in after school education. The alternation between virtual and manual activity diverts from a purely cognitive and visual engagement with the artworks towards an additional practical experimentation, which conforms to the learning needs of the target group. The needs of young children are reflected in other design features as well, such as cartoon-like characters, the use of bright colors, sound effects and a very simple navigation. All instructions and information are not only written out but by default also read to the user by young people, to facilitate the interaction for children, who do not read yet. For the same reason instead of only employing written menu items conclusive icons are used for navigation, which reveal the written item when the user hover over them with the mouse. The language used on this site is very easy, and all explanations are usually compressed to one-sentence facts, which are individually navigable. Besides being a targeted engagement and learning tool, the virtual tour in a partly fictional environment also can serve as preparation for a visit in a physical museum, as the game-play already familiarizes the children with the rules and workings of the environment. Thus with the experience from the game-play in mind children hopefully would recognize certain conventions and patterns within the museum and are able to get more out of their visit.

c) Exhibiting "Other Realities" Employing Virtual Reality Technology

As the last example has shown, digital exhibitions can go beyond providing a two-dimensional display for collection data, meta-data and descriptive content. This section will illustrate that it can also come in form of a meta-experience. By using the concept of the metaverse (Smart et al., 2007) and particularly employing Virtual Reality technology, the idea of a re-experience of historic spaces or events and their possible pasts can be pushed beyond the approach of "capturing the gallery" in a mirrorworld, which Google Cultural Institute did with the Indoor-Streetview. In this approach Google captured a specific state of a gallery space in the physical world in order to make it explorable and convey the idea of strolling through this particular gallery within a pseudo-3D representation. Through the ability to create "other realities" that do not have to look and behave like a copy of a current physical reality, meta-experiences can extend even to events and spaces that are not available anymore in the specific state portrayed in the reconstructions. These reconstructions are not meticulously captured by contemporary camera technology, but rather archive material can be re-used to construct meta-experiences about a historic experience, to re-create one possible historic state of a place as a creative product, in which users can be immersed. This re-creation and re-mediation of possible pasts results in a new, an "other", a virtual reality and transforms these reconstructed pasts based on documents, images, maps, drawings, stories and other primary source material into a completely digital experience. The experience is however not embodied in the physical world but takes place in the virtual space determined by software systems and interfaces. Moving through such a space with its own interaction rules and functionalities, the user can explore but also reflect on a possible past. This environment is on the one hand a curated display and process, built through conscious design decisions by the creators and therewith taking a stands towards one point of view on the past. Its curated character is also related to an object-based narrative of an exhibition. However the objects shown are not digitized versions of physical archival items or natively digital archived data that are displayed in a conventional exhibition setup as described before. They are rather a creative transformation of these items or an experience that is constructed based on insights of these items, which include already a level of interpretation by the creators. On the other hand the virtual reality environment is also a setting, a stage for actions of users similar to interactive artworks (see Mulder, 2007), and therewith a springboard for multiple new personal experiences within this digital setting.

This idea relates to the concept of online mediation projects as “fiction”, a play with realities brought forward by Lisi Breuss (2003, p. 37). In her writing she formulates the desire to use online projects in order to build up new realities.

> “Nicht mehr das reale Objekt aus dem Museum ist Thema der Online-Vermittlung – da es ja in seiner Dimension nicht anwesend ist–, sondern der Blick darauf, dahinter und ganz weit davon entfernt. Das Verlassen des Real-Sichtbarne hin zu einer fiktiven Sicht der Dinge ist Online-Vermittlung” (Breuss, 2003, p. 37)[302].

Considering different technological solutions the approach of “Virtual Reality” seems to be a perfect fit for this idea. According to Smart et al. (2007) a virtual reality can be described as a simulated world that is oftentimes avatar driven. The avatar represents the user or in multiplayer games the character that is played and enacted by the user.

It is worth to quickly look at the definition of the virtual, which stands behind the “Virtual Reality”. Many philosophers looked at the phenomenon of virtuality as mode of being (e.g. Bergson, 2004; Deleuze, 2001), whereas Pierre Lévy, one of the most notable philosophers with regard to this topic in the 1990s, looked in his book “Becoming Virtual. Reality in the Digital Age” (1998) at virtualization as the “process of transformation from one mode of being to another” (Lévy, 1998, p. 16). Pierre Lévy refers in his work to Gilles Deleuze’s differentiation of the possible and the virtual. In Deleuze’s terms the possible is the real that is not existent but can be brought to existence without any change, as it is already fully constituted. The virtual rather compares to the actual than the real – referring to ideas from Henri Bergson – as it „invokes a process of resolution: actualization“ (Lévy, 1998, p. 24). Actualization is more complex than actually bringing something into reality. „It implies the production of new qualities, a transformation of ideas, a true becoming that feeds the virtual in

[302] „The real museum object is not the topic of online-mediation anymore – as it is not present in its dimensionality – but the topic is the view on it, behind it and far away from it. Online mediation is the leaving of the visible reality towards a fictional point of view“ (Breuss, 2003, p. 37, translation by Florian Wiencek).

turn“ (Lévy, 1998, p. 25). And further: “The real resembles the possible. The actual, however, in no way resembles the virtual. It responds to it” (Lévy, 1998, p. 25). Lévy mainly gives the example of an actualization being the solution to a complex problem, which is “not previously contained in its formulation. It is the creation, the invention of a form on the basis of a dynamic configuration of forces and finalities” (Lévy, 1998, p. 25). Departing from that definition one can even go further than that. The idea of the virtual refers to something, which is not only not having a reference in the physical world, but that does not even need such a reference and is in constant flux with each and every actualization or rendering. The virtual therewith goes beyond the predetermined possible, as it constitutes rather a realm or space of possibilities, which inherently offers a range of possibilities to be actualized. In a digital or computer-environment this is determined by factors such as technology, software, points of view, user-interaction, etc., as for example Lev Manovich (2013b) or Claus Pias (2003) have discussed[303]. It is a never-finished process, it is always in flux and in transformation through interaction and (re)use. Therewith such a reconstruction or reenactment placed in a virtual environment surpasses the relatively narrow possibilities of interaction in a classical online exhibition by offering a platform[304] for meta-experiences, where the actions of the users also profoundly determine their experiences.

The definition of Smart et al. takes up this idea of virtuality. In opposite to, for example, mirrorworlds, virtual reality does not have to mirror the physical reality of the world we live in today, but can establish “other realities” to set the narrative or user driven action in. This quality is the basis of electronic virtual worlds, which, according to Smart et al. existed since the first personal computers. They started out first in text based form, but with improving graphical technology and increasing broadband connectivity the graphic component became more and more important and leading factor for differentiation between competitors on the market (see Smart et al., 2007, p. 6). The authors of Metaverse Roadmap distinguish two different forms of popular online-virtual reality applications, which both afford the contextualized co-presence of users in virtual (3D)-spaces (see Lombardi & Lombardi, 2010) – meaning “visualizing information in a social, collaborative context” (Lombardi & Lombardi, 2010, p. 114) –

[303] see also Part III, chapter 1.

[304] following the platform definition of O’Reilly (2005)

as well as communication and collaboration. However these two forms employ these features with different goals in mind:

- **virtual world-based multiplayer games** such as World of Warcraft are set in an internally consistent fictional or fantasy world, where the user tries to reach specific game-internal goals. Social interaction is used within the game as a tool to work together on completing different tasks (see Smart et al., 2007, p. 6).
- **virtual-world based social environments** such as commercial Second Life[305] by LindenLab, the open source project "OpenSim"[306] or different applications based on Open Croquet[307] usually need client software to be accessed outside of the browser environment.[308] These environments "exhibit fewer overt goals and value structures, and offer more open-ended user freedoms, creation of objects, economic and social interaction, and interpersonal networks" (Smart et al., 2007, p. 7). Thus the creation and inhabiting of virtual environments as well as the co-present interaction with other users of the same virtual space is the main use for these systems, the areas of application for these tools are manifold.

These evironments are what Lev Manovich calls "3D-navigable spaces", besides databases the second dominant form in computer culture, which can be used for data visualization of all kinds, from molecules to historical records. But most importantly they are a cultural form as in one way to "represent experience, the world, the human existence in the world" (Lev Manovich, 2001, p. 215). Virtual Worlds build on "the human experience of being in a world"(Lev Manovich, 2001, p. 214/215) where often narratives are represented or experienced as continuous navigation through space, similar to navigating the physical world. The element of psychological immersion and engagement is important, which might allow to foster a more sensual "experience" (even though significantly less sensual than embodied experiences) of information, rather than a rational one, for which Klaus Müller (2010) critiques database displays. Lev Manovich opens up a dichotomy of information and immersion, which he

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305 http://secondlife.com

306 http://opensimulator.org

307 http://c2.com/cgi/wiki?OpenCroquet

308 With the upcome of HTML5, CSS3, WebGL, complex JavaScript libraries and other advanced web technologies it is by now also possible, to realize these environments also completely within the browser. The OpenCroquet based system „OpenCobalt" (http://www.opencobalt.net) attempted to create a fully browser-based client in a follow-up project.

compares more generally to the opposition within what he calls "new media": between representation and action, relating to the supposedly opposite ways of display. Even though the author a argues that these two formerly opposite poles come closer together with the advancement of interactive technologies, where web application can offer true interaction and manipulation of data beyond representation, also outside of a three dimensional environment. The main differences are indeed in the affordances of the interfaces, the way the user can navigate and interact with the data-objects and with other users for that matter, as well as the degree of immersion and the modes of narration. Especially with upcoming technologies like "WebGL", which afford the rendering, display and manipulation of 3D-data in a browser environment, the author suspects users will see mixed environments that combine elements of both worlds, and employ both cultural forms to their strength: the two–dimensional, document-based hypermedia display and the "navigable space". This is shown amongst others in the experimental examples like the platform Smithsonian X 3D and its viewer application and virtual object-tours.[309] On this platform the possibilities to interact with three

[309] On this platform Smithsonian Institute uses an object-centered approach of mediation, where the individual, digitized cultural heritage object is the starting point of investigation. With the web-based viewer application the user can on the one hand freely explore the 3D object by rotating, panning or zooming. Moreover there are "hotspots" placed over the object marked by orange pins, which on the one hand lead the gaze and exploration to interesting details of the 3D object and offer a short explanation or annotation of the detail, with the possibility to navigate to more detailed information. Moreover the user can change the render settings of the 3D objects, for example the material properties and parameters, affecting the presentation of the object309: such as shading, color-model (ambient, diffuse, specular), opacity, specularity, reflection, occlusion, or the opacity of the photo texture. Moreover the user can configure the lighting of the scene, the color of the environment. Moreover the viewer offers a toolset to measure the objects and to inspect the object by creating cross-sections. Additionally to the free exploration the user can take a guided tour of an object, which is a linear sequence of "steps", each combination out of specific "scenes" of the 3D object – meaning specific set camera positions – with textual and visual information, where the user can navigate through. This should make sure the user gets to see the object from multiple perspectives and moreover allows self-guiding. The user is able to change the camera position starting from the set position, which offers a specific angle onto the object or zooms in to specific details. The information given alongside the model contains hyperlinks to more contextual information outside of the platform. For the future Smithsonian would like to integrate a possibility to annotate the objects and create own tours in order to enable students and teachers to work alongside Smithsonian

dimensional digitizations or replications of cultural objects go far beyond what a visitor could do in a regular museum setting. To quote Günter Waibel from the Digitization Program Office of Smithsonian Institute: “3D technology really affords us the opportunity to see an object from all angles, to tell the entire story of an object from front, back, bottom, top” (Günter Waibel, in Smithsonian’s Digitization Program Office, 2013b). And the quality of interaction, for example being able to actively engage the process of digitizing as well as manipulating, re-using and sharing the data, furthers a deeper engagement with the cultural items. (Neely & Langer, 2013, p. 83).

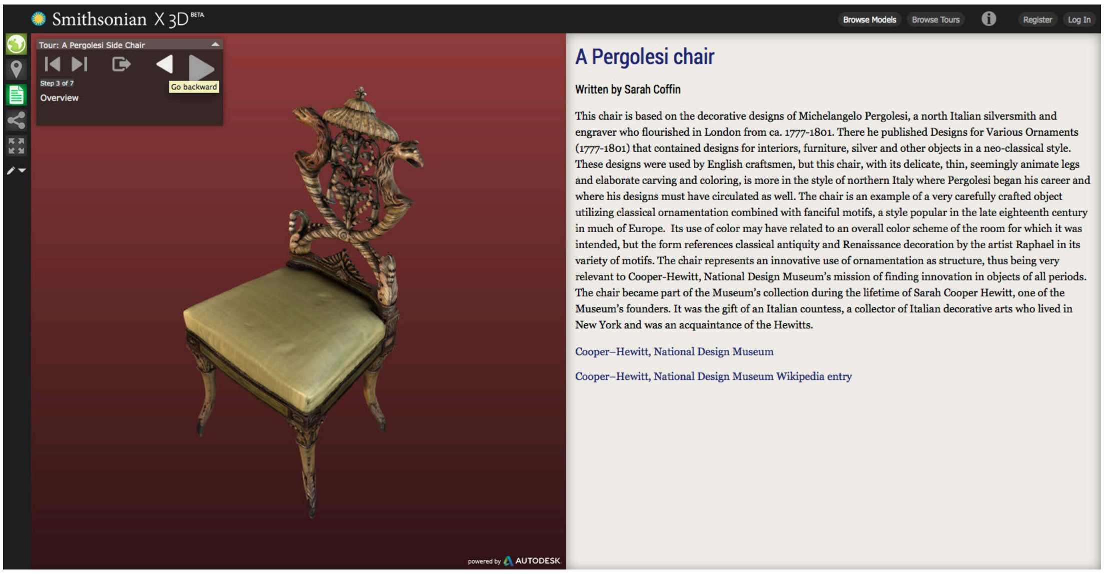

Figure 71: Screenshot of an object-tour in "Smithsonian X 3D" (http://3d.si.edu) from 01.12.2013. On the left is the explorable 3D object, in this case a Pergolesi chair from Cooper-Hewitt, National Design Museum, on the right textual information about the chair with links to external resources, amongst others the Cooper-Hewitt website.

Institute and share their knowledge and discoveries. In short they would like to crowdsource the meaning making but also allow co-creative processes to happen through the possibility to share and remix the objects and ideas about the objects – for example via social media – and therewith enable other people to use these ideas as starting point for their work (see Smithsonian’s Digitization Program Office, 2013a, 2013b).

Figure 72: Hotspots (in form of orange pins) for a self-guided exploration of an object in the 3D-viewer of Smithsonian X 3D. The screenshot on the right side shows a definition of what the hotspot marks, including the option to get more information. Screenshot from 02.12.2013.

However virtual reality platforms go beyond hybrid interfaces or engaging with individual objects towards an overall experience, oftentimes including a social experience and co-creative element as well. Two specific examples will show how online-virtual realities, especially virtual-world based social environments, can be employed for cultural learning.

A first example is the immersive 3D virtual learning environment **"Arts Metaverse"**[310] developed on the basis of Open Croquet by the Arts Instructional Support & Information Technology unit of University of British Columbia (UBC) (Canada) and launched in 2007. By integrating real-time rendered graphics and therewith the possibility of simulations with sound, collaborative technologies and communication tools, the "users will be able to create 3-D environments that could include buildings or spaces developed alongside their related video and audio clips, websites, and Microsoft PowerPoint presentations" (University of British Columbia, 2007a). The idea behind the environment is, to provide students with a platform to enable them to go beyond books, images and videos for learning about far away or long gone ancient places. The traditional media afford to "imagine how it would feel to be in a particular city, country, or community" (University of British Columbia, 2007a). Such an environment allows to manifest before imagined places as digital reconstructions in a

[310] http://artsmetaverse.arts.ubc.ca

state as they supposedly looked like in the past, going beyond the ruins you can visit nowadays and that are captured for example in the World Wonder Project of Google Cultural Institute. Thus where mirror worlds show the remains from the past in the presence, virtual reality can evoke the past. Looking at the interface of the Arts Metaverse, the different spaces provide quite literally a window into a historic site or culture – hinting towards the graphic effect of walking into a floating window in order to enter to a linked virtual world within the Croquet environment.

Within the project 3D spaces amongst others for historic sites such as the archaeological site of "Machu Picchu", an Inca ruin located in southeastern Peru, or the "Temple of the Murals" at the Mayan archaeological site of Bonampak in Chiapas, Mexico were built in collaboration with Dr. Marvin Cohodas from UBC. About the Machu Picchu the development team writes:

> "Dr. Cohodas wanted his students to experience walking on an ancient ruin site such as Manchu Picchu, and to interact with the environment - an experience they could not have by looking at pictures or viewing a video clip. Arts Metaverse allows students to travel virtually to Machu Picchu, to touch it and to move objects around it; to look at 3-D art that could have been placed in it or nearby, and to even have a class on the ancient ruins. While in the virtual Machu Picchu metaverse, students can interact with each other with text messages or verbally with computer microphones. The instructor, meanwhile, can lecture digitally, show them a video clip and an interesting webpage while they sit on the ruins. Furthermore, students can instantly see any changes that the instructor makes on his/her computer while they are virtually inside the Machu Picchu metaverse while potentially sharing their own resources with their peers as well" (University of British Columbia, 2007b).

In comparison to the virtual reality environment, the Street View photographs by Google, 3D-scans or photogrammetry can do a much better job in documenting the current state of the buildings in delivering an accurate representation of it. And high-end 3D-reconstructions and renderings also do a much better job in conveying more realistically one potential past of a historic site and a comparison to how the site looks today – for example in the project "Colonia 3D", which displays a in parts high detail 3D-model of Roman Cologne in an interactive kiosk at the Romano-Germanic Museum in Cologne (Germany) (see e.g. Trapp et al., 2012). The Arts Metaverse-representation with its much lower, rather childish, cartoon like graphic quality – a limitation of the networked real time rendering of the graphics but also of the skills, time and resources that can be put into creating the 3D reconstructions in an academic environment outside of the entertainment industry – asks a "what if" question. It makes clear that it is not and does not want to mimic the reality, but is rather an imagined reality based on scientific evidence and research results, telling a story and letting the students immerse into a world, how it might have been based on what we know today[311]. Thus it is a more fictional approach. One point of critique is though, that the low-end graphic could hinder the immersive effect and the acceptance of the tool and it does not allow the close examination of the buildings.

Thus this project is more about action and interaction, about potentially simulating the life of far away or long gone cultures – for example potentially through automated avatars carrying out specific tasks or through virtual reenactment – than it is about accurate representation of only the architecture. And where projects like Colonia 3D only allow the exploration of a 3D-environment at a fixed place – being a site-specific installation, or needing a high end technology to be displayed – the technology of this virtual-world based social environment lets students access this environment at a regular computer work space.

Moreover the technology enables a "multi-user mode", affording the students to not only explore the site collaboratively while still acting as individuals, but also to communicate with each other within the virtual world as they do so. And this co-presence and communication aspect is one of the most important advantages of the Croquet-based learning environment, allowing for example to move a whole class into a historic environment, as done in the "Machu Picchu"- project. Thus the project evokes the comparison to a "virtual field trip". To quote the developers: "Digitally interacting with peers and thinking critically as they wander and explore a virtual environment helps students better construct their own understanding of the

[311] Here it becomes very important to communicate clearly, on what evidence, on which the reconstruction is based (see e.g. Trapp et al., 2012), something which is also missing in the existing Arts Metaverse projects. The communication of evidence is something that the intercative project „Colonia 3D" does very well, by including a view that highlights the archaeological sources a particular model is built upon or by allowing to compare a contemporary 360 degree image of the site with the reconstructed 3D graphic (see e.g. Trapp et al., 2012).

architecture, culture, or society they are studying" (University of British Columbia, 2007a).

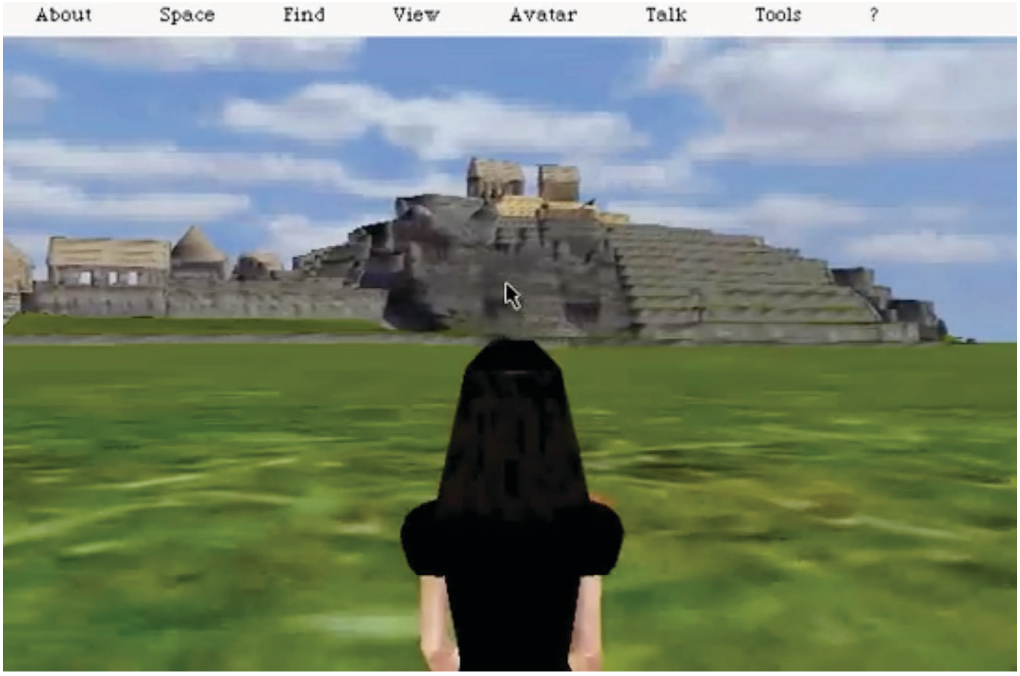

Figure 73: Screenshot of an avatar exploring the exterior of the Machu Picchu in the Arts Metaverse. Screenshot from "Arts Metaverse – Machu Picchu" by Liang Shao from 18.05.2007. https://www.youtube.com/watch?v=YV_xKGJ6Hug. Screenshot from 28.09.2018.

Where the Arts Metaverse uses a virtual-world environment to make an historic built heritage and cultural environment explorable for learning purposes, a second project – the series **"Reenactments" (2007-2010)**, an artistic project by Eva and Franco Mattes, working under the name "0100101110101101.ORG" – taps on abilities of the virtual world "Second Life" as social environment and a stage to reenact historic performances in a virtual space. These "synthetic performances", as the artists call them, included "Imponderabilia" (Marina Abramovic and Ulay), "The Singing Sculpture" (Gilbert & George), "Seedbed" (Vito Acconci), "Shoot" (Chris Burden) and "Tapp and Tastkino" (Valie Export and Peter Weibel). These performances were reenacted in "Second Life" using avatars constructed from the bodies and faces of Eva and Franco Mattes, thus impersonating the two re-performing artists. As these performances were originally public performances, the public space was moved to the virtual public space of Second Life, where users could connect to and participate. In this environment the performative space of the re-enactments was only one amongst many other spaces or rooms within the large virtual reality environment. Additionally the artists organized screenings of live-performances in a cinema-like environment, where the audience could watch a large screening of the actions played by the artists sitting behind the audience, or video installations showing screencasts of the performances (see 0100101110101101.ORG, 2013).

Figure 74: Screenshot of the online performance of "Tapp and Tastkino", originally performed by Valie Export and Peter Weibel; reenactment Eva and Franco Mattes aka. 0100101110101101.ORG in "Second Life", October 2007. Screenshot of "Reenactment of Valie Export and Peter Weibel's Tapp und Tastkino" by Franco Mattes, from 01.12.2009, https://youtu.be/YrM8SUEvhsg (2:36).

For a documentation of the historic performance in 1968 see https://www.youtube.com/watch?v=rfcNYGrdxfc.

In their re-enactments the artists are transforming the available documentation material of a historical performance into a re-performance and re-mediation in the virtual space, therewith not only transforming the environment of the performance but also the experience. In many of the "original" performances the embodied experience was an important part, which could not be captured by documentation. The performance of "Tapp and Tastkino" is a very poignant example, as it transformed the passive film experience of sitting in a dark space watching somebody on the screen touching another actor into a haptic experience of actually touching the breasts of the performer – in the original performance this was Valie Export. The act of touching happened inside a box with openings for the hands worn by the performer, emulating the dark of a cinema space. The second performer, Peter Weibel had the role to invite people to try out the experiment and reiterating the idea behind the project. In the synthetic performance by Eva and Franco Mattes they set up the scene as it was in the original. Two virtual performers, avatars representing Eva and Franco Mattes: the female with bare breasts wearing a box and a timer in her hands, the male with a megaphone in his hands inviting the audience to participate. The whole experience, be it for the performers as well as for the participants, is a meta-experience, embodied and enacted by avatars on a computer screen. This can be described as an experience about an experience, without being able to actually make the experience in the real world, but in mediated form. The act of touching is reduced to a computational function allowed to perform on the female avatar. The act of touching from the point of view of the participant is reduced to right-clicking on Eva Mattes' avatar and select "Touch Eva" in the menu. Thus where the documentation material affords to imagine from the texts and images what the original performance must have been like, or be a retrospective spectator in case of a video performance, the whole experience is virtualized in the case of the synthetic performance. The avatars virtually "experience" the performance in place of the actors as well as the participants – both groups are sitting behind computers and navigating avatars. The humans behind the avatars are again left to imagine, how the avatar could experience what they perceive as spectators on the screen of what was set out as a non-visual but haptic experience. The difference to a video documentation is the possibility to be able to change the point of view and to virtually influence the progression of the performance. This allows a better understanding of the rule-system underlying the performance. Thus what this project does is to create a new kind of experience out of the documentation material, a new manifestation, a re-instantiation of the original performance by different actors in a virtual environment, producing re-documentations that are later shown in a gallery space or online. Where it is originally not set out as educational project, it still enables to learn about the performances and to think differently about the experience they were set out to enable. Instead of using text or moving images to tell a story, the historic performances are brought to life and at the same time convey the story through the actions of the players – a typical narrative strategy for computer games.

Where other forms of metaverses work with either enhancing the real-world experience (Augmented Reality) or allow the navigation through a mirror of the real world (Mirror

World), these projects are re-interpreting how the real world might have been like – based on the interpretation or re-interpretation of the core data, found in databases or archives. Both discussed virtual reality projects are using documentation material and cultural data as starting point to create new, virtual experiences or meta-experiences. Where the first project manifests a reconstruction of a historic place, how it might have been like in the past, the second uses a fictional world as a stage for the re-performance of a historic performance, which only exists as documentation material and therewith embodiment of memory (Jean-Marc Poinsot) until its re-performance. And they are curated spaces, but the curation in that case goes beyond the assembling, ordering and displaying of information or information streams or constructing an object-based narrative. Similar to other participative forms of mediation within museums, the act of curation is transformed into taking decisions within the design process of the re-construction of cultural items as creative products that affect the process of re-experiencing in these cases historical sites as well as performances. It is about designing an experiential space taking the soft- and hardware as technological agents in their own right into account.

d) Online Collections

Where online exhibitions usually curate selected works into an object-based narrative – sometimes similar to a physical exhibition in a gallery, sometimes creating a unique digital experience – an online collection often presents a wider scope of a museum collection in its breadth. This form of display can very well serve the goal to display also hidden parts of the collection that cannot be shown in the physical museum space due to spatial limitations and therewith also allows a broader meaning making. Early online collections were developed coming from the narrative tradition of the Virtual Museums or virtual exhibitions as well as digital catalogues, but changed to a more open approach facilitating multiple points of view over time. In 2003 Fiona Cameron (2003) defined two generations of online collections by inductively analyzing existing online collections at the beginning of the 2000s. She was analyzing if there were new styles of content and information architectures emerging. Does a novel narrative form emerge, which promotes “polysemic (plural) models for interpreting” (Cameron, 2003) and goes beyond the modern grand narrative? How do digital collections encode cultural ideas? And what role does the museum take in this form of two-way communication?

According to Cameron the **first generation** of online collections is employing "thematic solutions to narrative" where "digital objects are presented in a hierarchical story line with theme and sub-theme" (Cameron, 2003). These solutions transfer classical museum devices such as object labels, graphic images and panels with didactic texts, which are presented in a fixed sequence into an online environment, making only scarcely use of interactivity or the power of hyperlinks, in order to build an information network. Rather the sites are employing "hierarchies of information structured around a central theme" (Cameron, 2003), following the modernist paradigm of a grand narrative, and privileging one narrative over other possible ones through the hierarchies and fixed sequences of access. This reinstates the museum as interpretative authority and author of the platform. An example for this type of online collection is the microsite for "American origins, 1600-1900"[312] by the Smithonian National Portrait Gallery, which starts off with a linear, animated sequence of quotes about the greatness of America with the glorious music of the "Moderator-Coda" from Leonard Bernsteins Appalachian-Spring playing in the background. This sequence leads over to an introductory text and then to a "Gallery Overview", where the user can choose between several thematic galleries. After an introductory text on the topic the galleries offer portraits navigable in a non-linear fashion, each paired with information about the portrayed person as well as details visible in the image and the regular tombstone information. Therewith carefully curated information and interpretation are on the forefront and the website resembles a traditional catalogue format or a traditional museum exhibition setting, with the add-on of multimedia capabilities Adobe Flash offers. The non-linear elements on this site are the navigation between the images within a gallery as well as the navigation between different galleries.

[312] http://www.npg.si.edu/exhibit/origins/index.html

Figure 75: Screenshots of the microsite „American Origins, 1600-1900“ by the Smithsonian National Portrait Gallery, produced completely in Adobe Flash. Left: introductory text for the gallery „Faces of Many Nations“. Right: detail view for the portrait by Elizabeth I, 1533-1603, including biographical information and information about specific objects visible in the portrait, along with tombstone information. A direct jump to another gallery as well as another image within the same gallery is possible. Screenshots from 10.12.2013.

Where the first generation of online collections very much resembles a classical exhibition online as well as offline, the **second generation** of collections enables the user to create and explore new and alternative pathways through the collection within given boundaries. It moreover offers greater possibilities of contextualization of the data through "additional multimedia text-based and image-based navigational systems, such as semantic maps" (Cameron, 2003; Strauss et al., 2004). Thus the network character of an online collection and the relationships between data nodes are emphasized. "Parallel and intersecting narratives are graphically created. Spaces are offered for play: for individual choice, not fixed interpretation" (Cameron, 2003). This generation follows a postmodern approach by empowering multiple points of view and promoting a non-hierarchical system ruled by relationships. "Knowledge is presented as separate modular elements to be assembled in an almost infinite series of sequences" (Cameron, 2003), which result in individual organizational systems for these modules.

In this second generation a collection thus has a different character in comparison to a physical collection or a first generation online collection. Fiona Cameron summarizes the move from physical museum collection to online collection:

> „Collections in a digital format become a database of encoded knowledge made up of images, sound, video clips and text; individual elements can be linked and navigated in a variety of ways. This collection of data not only mimics older forms of representation and communication such as the printed word and cinematic experience but also engages newer ones such as 3D space“ (Cameron, 2003).

And thus the online collection is engaged in different forms of discourse. Cameron states a clear movement from information access towards action and engagement. Through exploratory interfaces and visual navigation the collection becomes a „catalogue of discoveries; interpretation becomes dynamic and subjective“ (Cameron, 2003). A poignant example for this generation is the platform netzspannung.org with its already described knowledge discovery tools (see Part V, chapter 2.3.1).

The hyperlinked structure allows the „telling of collections stories from a broader context by incorporating other cultural traditions and voices“ beyond linear, hierarchical narratives and linear spatial structures of for example an exhibition. And this form also strengthens the individual interpretation. But, as a user study that Cameron conducted has revealed, the curators still want to retain control over the authoring and selection of information as well as the definition of possible links and trajectories. And also users want and value a degree of certainty in the process of exploration as well as trustworthy scholarly information. Thus the „modernist approach“ has not completely vanished. Even though at least in institutional collections the curator retains the authoritative interpreter, the user has new ways to select and recombine information on his own through the modularity of data. The

> „user is conceived as a spatial wanderer, traversing information and freely selecting trajectories and viewpoints. The user is also conceived as an individual, whose thoughts and desires are treated as unique through devices such as user profile interfaces“ (Cameron, 2003).

Thus the act of curation changes from selecting, authoring and presenting information to designing a platform[313], curating the available data and designing a process for the users to engage rather than a specific, pre-defined experience.

In this new notion of curation the interactive process has the potential to realize mediation of art as a collaborative approach to storytelling in the sense of critical mediation of art. For this approach Aaron Koblin’s notion of data-driven storytelling becomes interesting. Relating to the platform-concept of O’Reilly (2005), the digital

[313] The idea of the platform is one of the key ideas of Web 2.0, as discussed in Part III, chapter 2.1.3. Tim O’Reilly defined the Web as platform, meaning that the World Wide Web provides an environment, a technical basis for different services or applications, or a basic mode of operation (see O’Reilly, 2005).

media artist defines digital storytelling as setting up a framework, constraints, and parameters for stories to emerge (see Koblin, 2012). Once this scenario is set, people can contribute in the creation of something bigger than the sum of its parts. For a cultural institution this means that the organization provides an open framework as a basis for diverse possible experiences – be it online or in the gallery space – which are dependent on the visitors' interaction. The user or visitor is in charge of his or her own experience.

GAMA Wiki

Moving away from the metaphor of an "online exhibition space" to another museum education instrument – the "guided tour" – GAMA, that is offline by the time of publication, integrated authored spaces in form of different "Featured Tours" that relate works from the subject gateway for media art archives in an editorial context on the GAMA Wiki[314] (see Figure 77). The multimedia Wiki was one way to "integrate the works and documents in contexts that are defined by the users – teachers and their classes, or curators" (Blome & Wijers, 2010, p. 56).

The tours implemented within this structure came in two forms: thematic "guided tours" as well as playlists of specific types of the work, for example dance, portrait or animation. The guided tours were Wiki-pages authored by invited experts and artists, providing a narrative around a selected group of artworks from the subject gateway. These pages presented the artworks within a thematic context and built relations between the works through narration and writing, while being able to also bring in external contexts through hyperlinking to other websites within the text. Through specific wiki-markup within GAMA the works were embedded into the Wiki page

[314] http://wiki.gama-gateway.eu/ – offline by the time of publication; As the name already suggests, the platform is built up on a wiki platform, one of the prototypical Web 2.0 tools. This platform "allows collaborative modification, extension, or deletion of its content and structure. In a typical wiki, text is written using a simplified markup language (known as 'wiki markup') or a rich-text editor" (Wikipedia, 2015). A wiki has usually only little implicit structure. The structure rather emerges through the needs of the users and authors during the collaborative writing and editing process. Therefore wikis are often used for knowledge management or community websites.

Thus GAMA opens up a space for (selected) users to contextualize the archive data with their knowledge or research, express their points of view and create discourse around the work. And for users with less knowledge about the work these wiki entries together with contextualized playlists can provide an entrypoint to the works. However, this tool was unfortunately not taken up by a wide range of users.

including a direct embedding of video as well as the thumbnail information and description of the work, taking full advantage of the modularity the web-technology enables. This allowed the reader to directly view the work on the multimodal wiki-page, without having to go back to the database interface itself. A playlist contained the same information and format as the search result page of GAMA and also allowed to either directly play media files from this page – which opened up a pop up window with a video player – or to go to the detail view of a respective work in the database. But unlike the search results this list was authored by humans based on expertise or curatorial decisions and not on relations expressed in meta-data. And it did not include dynamic features such as filtering or sorting. It rather stood in the tradition of music-playlists, which are in its most basic form an ordered list of songs that can be played sequential or in random order. According to many dictionaries the term comes from broadcasting and denominates "a list of recordings to be played on the air by a radio station" (Merriam-Webster, 2013), but the same sort of list is used to organize your private music collection or titles from online streaming services, as the term and functionality are the same. The same metaphor is used in the realm of web-video. YouTube for example lets the user add videos to a personal playlists. A user can subscribe to channels – like RSS feeds for video – which are essentially playlists of videos, specific users have uploaded. And also users can compile a playlist of their videos for others in their channel, which resembles in the functionality a media player playlist, where the video stream does not stop after playing one video but goes on to the next either in sequential or random order. Thus the GAMA playlist has to be seen in the realm of this interface pattern.

On the other hand the act of creating a playlist is also an act of personalization, of appropriating the content in a Web 2.0 sense. But it stands as well in the tratdition of collecting and, with making the playlist public, also exhibiting the collection, putting it in an order and therewith maybe even constructing a particular narrative with the items. Publishing a playlist opens up the collection as a resource for multiple possible narratives.

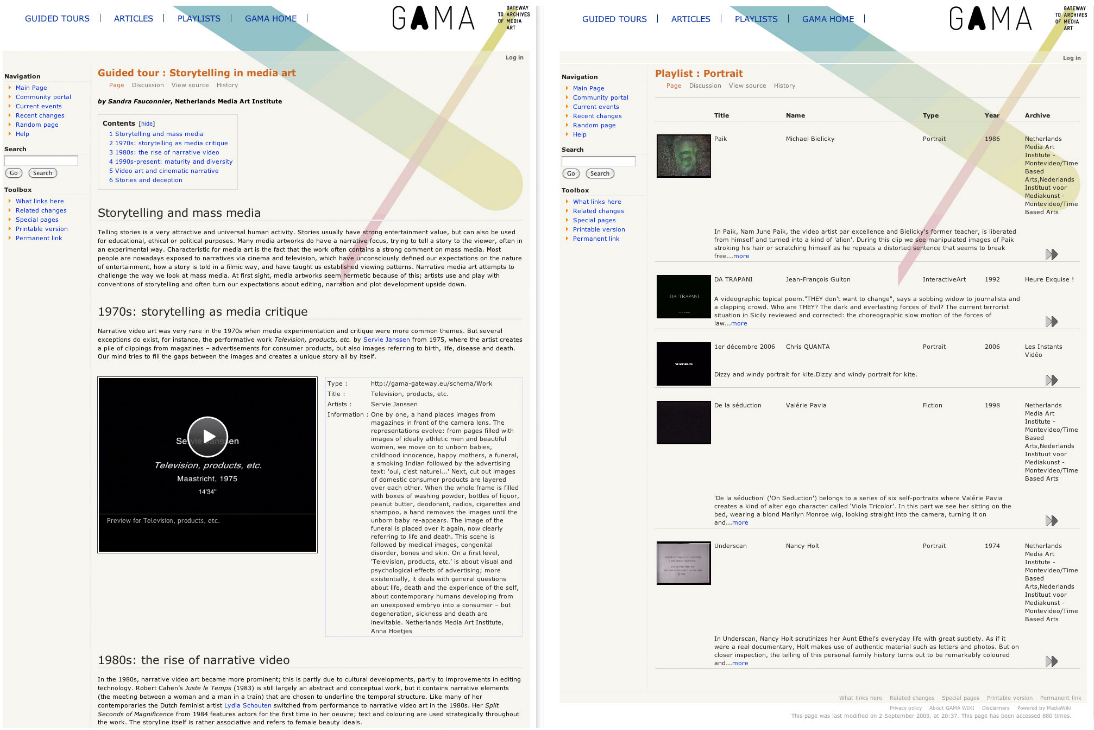

Figure 76: Screenshots of the GAMA-Wiki from 05.09.2013. Left: a guided tour with artworks embedded by specific wiki-links. Right: a compiled playlist.

Medien Kunst Netz

Where the GAMA-Wiki-texts are mostly short and the narratives revolve around the featured works[315], Medien Kunst Netz[316] works with topical essays, referring to artworks as examples. The format is therefore a long form scientific publication, where essays are in the foreground and the corpus of documented artworks evolves around the essays, illustrating pertinent topics in media art history, rather than the essays reusing selected items from an already existing collection. Medien Kunst Netz was conceptualized by Dieter Daniels and Rudolf Frieling as an answer to what Dieter Daniels calls "mediation paradox of media art" (Daniels, 2004). This paradox takes as starting point that time- and process-based media art projects cannot be adequately mediated by traditional image-text formats in books or journals, as they can hardly be understood without experiencing their media qualities. Thus the descriptions of writers can only be subjective and render a snapshot, a moment of the work. Moreover the

[315] This is what one would expect it at a guided tour in a gallery space, which introduce the works and give some contextual information to enable a basic understanding of the works and the topic of the exhibition. The gallery tour was the role model for this type of narrative contextualization of data from the subject gateway.

[316] see also http://mediaartnet.org/ for the English version

challenges in mediating are access to the works to be able to experience them, as well as the need to see the works not only in the context of art history but also of media history and media theory. These challenges result in Dieter Daniels' thesis, that media art needs to be mediated using multimedia in order to be able to translate and get across the time-based, process-based and interactive aspects of media art projects. Additionally the multimedia representation of the projects needs to be related to relevant theory, which should include art theory, media studies and media technology (see Daniels, 2004). These relations are encoded last but not least through a hyperlink and reference network in the "Medien Kunst Netz" project.

The project „Medien Kunst Netz" was ongoing between 1997 and 2004 and published two CD-Roms/books, and two books in conjunction with an online project – the website „medienkunstnetz.de" – in 2004 / 2005[317]. The print- as well as digital publication discusses different topics with regard to media art history in the form of scholarly long form writing. Where the early projects divided content between book and CD-Rom – in which case the book held the written theory content and the CD the multimedia content and documentation material about the artworks – the online project brings both content layers together and intertwines them through a hyperlink structure. This also changes the way of writing. From only forming out a linear argument the writer is constructing a content network through hypermedia. Instead of citation or including lengthy descriptions of artworks and subjective experiences of media artworks in an essay format, one can directly refer to the content or documentation[318] and metadata about an artwork as well as the artist in question[319] through hyperlinks, as long as it is present in the digital ecosystem. It allows for the essay text to be purely contextual and to build links between different artistic projects related to a topic through narrative writing. Details about the projects referenced in the

[317] The online publication was not updated since the end of the project in 2005 but is still accessible online and serves as .

[318] For a discussion of different ways of documenting media art see Wiencek (2012a, 2012b). To discuss this issue in detail would lead to far for this thesis.

[319] the "detail view" of projects and the artist also includes relational metadata contextualizing these projects: from categories over keywords, which can trigger keyword searches on these terms that reveal relations of works through their characteristics captured by keywords rather than art historic relations, which go beyond characteristics stemming from the work itself, to links to the positions in the text where the specific art project or the artist is mentioned as well as other works of the same artist and a link to his / her website are listed.

essayistic forms are directly accessible through hyperlinks. Following the hypermedia paradigm the platform

> "foremost promotes topical cross references offering various access points:
> - specific: the classic index and search engine based on a complex structure of database links
> - the exploratory approach: via visual summaries
> - the artistic perspective: as it emerges in newly commissioned Net projects […]
> - scientific-historic aspect: as formulated in topical essays by competent authors"
>
> (Medien Kunst Netz, 2004).

Thus the platform can act as reference for documentation of media artworks and artist biographies, using classical database mechanisms such as retrieval interfaces or indices as entrypoints to the platform and corpus, leading to single items within the corpus. But the single items can be again a starting point to explore media art history further, since they lead to their contextual usage within the narratives as well.

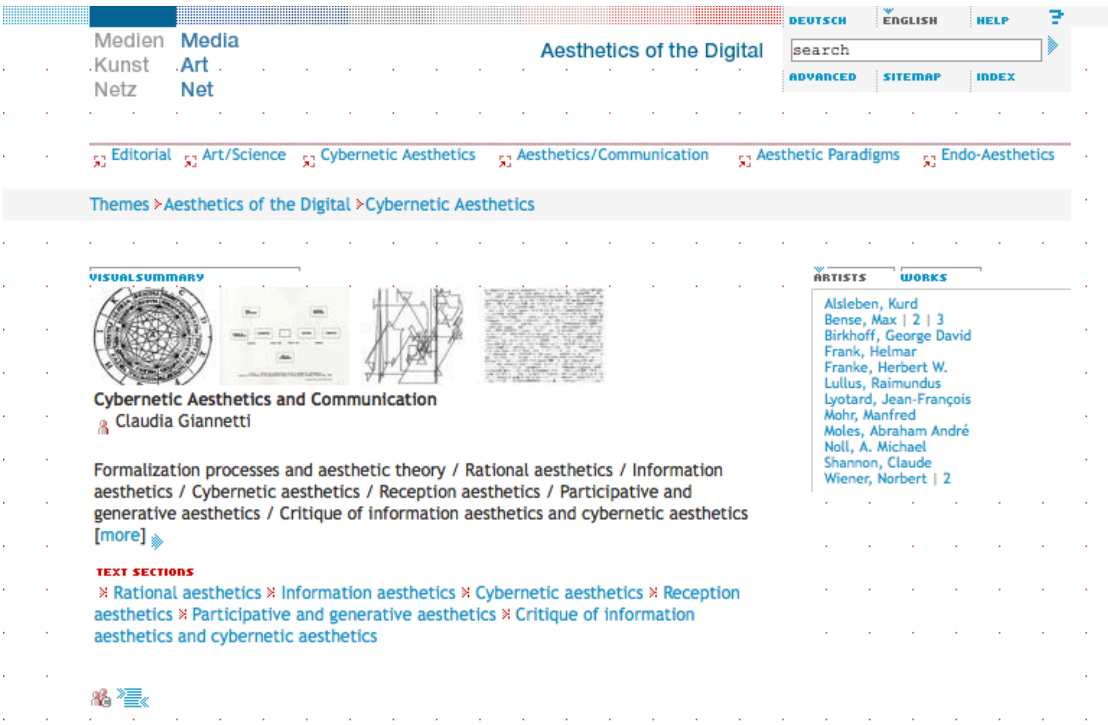

Figure 77: Summarty section of Claudia Giannetti's essay "Cybernetic Aesthetics and Communication" on medienkunstnetz.de. Screenshot from 15.10.2015.

Many topical chapters offer summaries of the topics in form of representational artworks for the section that are presented in a visual summary. Moreover these summaries feature keywords and a full list of artworks and artist names that are dealt with in a chapter, as well as direct links into different sections of the chapter, describing the reading paths and giving the opportunity to also jump directly into a specific topic. The summary display focuses visually and in its order of the elements on the discussed artistic projects as well as the artists brought together as examples representing a specific topic. It can be used as additional entrypoint into a chapter instead of the text. Moreover the projects and artists serve as bridging or traversal points inbetween different topics, since they might be used as example in different contexts.

The commissioned Net Art projects featured on the platform offer a point of reflection of the endeavor of creating and publishing a networked online publication: ranging from a conceptual reflection of what one might be able to know through the Internet as medium, marking the technology as active agent; how one might interact with and collaborate on information networks on the Web; reflecting the design of interaction processes; reflecting language as linguistic system of description; to thinking about the Web as discursive space. Thus through commissioning and carefully curating seven artistic statements within the same medium of this publication as stage and exhibition display for them, artists offer their points of view on the meta goals and the topic of the publication in form of media art projects. Even the form of the arguments is self-referential and confirms the Internet also as artistic medium to think about contemporary media.

The main device of contextualization are however the long-form scholarly articles, which serve as introductions to several topics around media art history with a theoretical focus and the objective "to establish theoretically and audio-visually convincing forms of relationships and references that cross the boundaries of genre" (Medien Kunst Netz, 2004).[320] Thus with the interlinking of contextualizing essays and project documentations the publication does not only include relations on basis of essays but also through grouping within categories, through keywords, other works of the same artist or by proposing other related artists. Therewith this online project builds

[320] These texts correlate with the content published in the book project, which was published mainly because an online publishing-format did not have the same credibility as a print publication at the time of publishing.

up a complex authored network of relations and contexts to explore and to learn, which is also reflected back into the search results that differentiate and serve as hub to all the different context layers of the project in which the search term is featured (see Figure 80). And this network extends also across media, as a printed version of the texts in book form also offers the links to the source, artist and art project layer in the margin of the pages, creating a linkage between print and online medium.

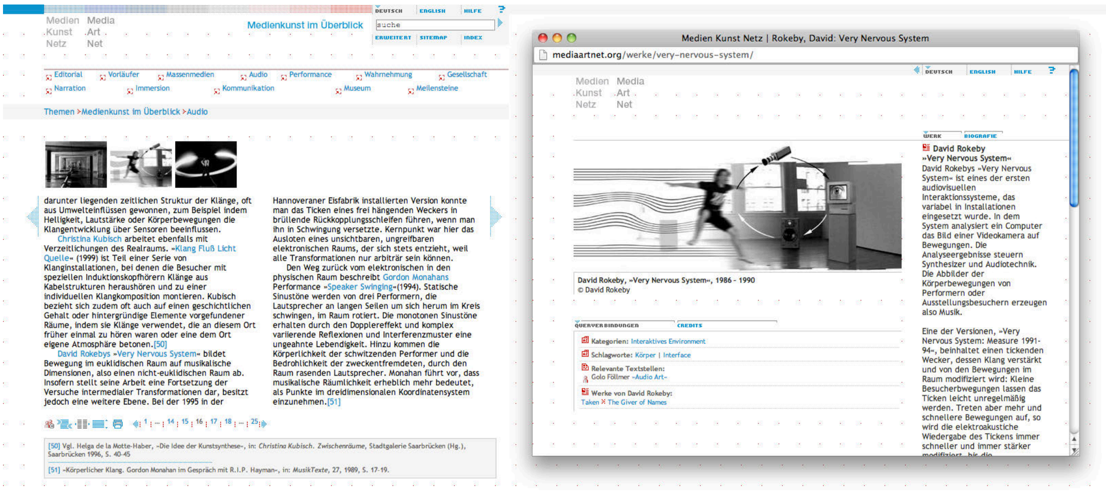

Figure 78: Screenshot of „Medien Kunst Netz“, juxtaposing an essay with the detail window, opened by clicking on a hyperlink in the text on the left, referring to the art project. Screenshot from 05.09.2013.

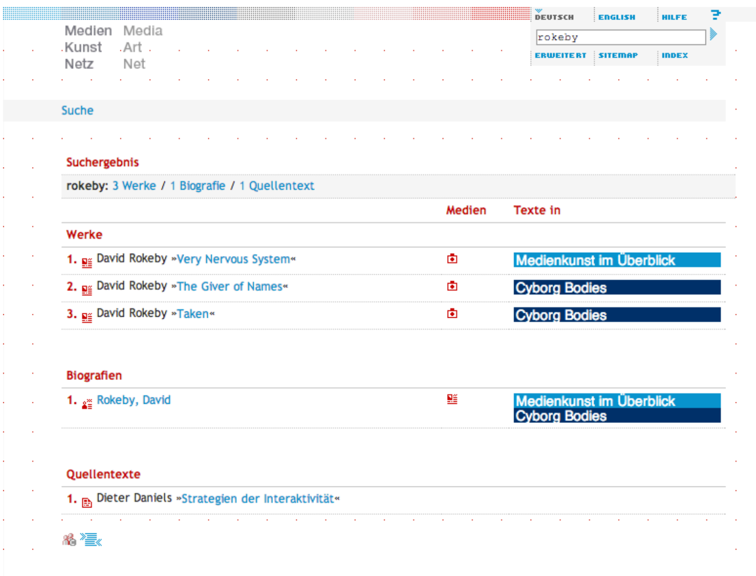

Figure 79: Screenshot of the search results of Medien Kunst Netz, showing the differentiation of different contextual layers within the result list. Screenshot from 05.09.2013.

2.3.3. The Database as (Storytelling-)Tool for Object-Based Research

These platforms and databases as curated contexts cannot only be used as a display for object contexts and object stories or to be able to traverse the database on basis of relations and contexts, but also as research tools for conducting object-based research on cultural heritage data. In addition to already discussed approaches of computational analysis as one entrypoint for qualitative analysis and knowledge generation processe this is another qualitative and inductive approach translating traditional processes of archival and corpus-based research into digital tools. In order qualify as a tool for research, a platform needs to give the user possibilities to interact with these initial collections, to allow new insights, to generate meaning out of the compiled objects and maybe even communicate a subjective point of view based on them. There are different mechanisms in use in order to facilitate research and meaning making. One approach is a curatorial one that enables the user to order and group collected items (through like, favorite, etc.), for example by creating multiple collections. A basic feature many databases offer, is to create custom collections – private or shared – using often a lightbox or a list metaphor to manage and represent a user's or somebody else's collection(s), which were gathered to view the items later or to compile items of interest. These collections build up what is called a corpus of cultural data (as subset of a bigger corpus) that can amongst others be used as basis for research. This feature is from its logic related to playlists or lists of favorites, which were discussed earlier. Some sites like for example Europeana also allow to save searches, which enables the user to easily re-perform a specific search at a later point in time and keep up with the development of a topic or the collection with regard to a specific aspect by comparing the results at different points in time.

Another approach is to dynamically order and annotate data by using tags, as seen on many social media platforms as well as on a subject gateway like Europeana. Tags can be used to dynamically group data into what is often called "smart collections", a technique that is based on filtering combined with displaying the results in a folder or collection structure. And this personalized meta-data can be included into searches or be further mined for meaning generation. With these tools the platforms allow a behavior of personalization which Eric Gordon – a visual arts scholar researching the effects of games and social media on urban life and democratic processes – refers to as "digital possessive". According to this concept "practices of networked media encourage (…) the possession of thoughts, actions, and memories in personal folders, accounts, and devices" (Gordon, 2010, p. 175).

On the other hand web-based tools can also support the user in building his or her own relations between the data nodes or to shape narratives on basis of database content. This relates to the database as source for many potential stories, where each user shapes his or her own story on the basis of the available and findable content and his or her traversal through the database.

a) Storyscope (Decipher)

One tool, which assists in research work, is Decipher's prototype software "Storyscope"[321]. Having its origin in a Europeana Hackaton from 2012, the tool is building up on the Europeana API and connection to collection management systems for access to the collection of a cultural institution. Under the slogan "Exploring Cultural Heritage through Stories" the tool is a research workspace, which allows the user to bring together multiple online collections and should facilitate communication and collaboration for the process of exhibition planning. The software aims to assist the creation of the basic mediation form of a museum exhibit: the story told through objects.

> "Storytelling is an integral part of human nature, enabling us to understand and find meaning, the world around us. Through stories we can organize knowledge, share information and identify patterns and relationships between events and experiences. Stories are used within museums to engage visitors with cultural collections and to facilitate meaningful understanding of museum objects. Through stories, visitors can explore not just collections of objects, but the knowledge structures that connect and give them meaning" (Digital Media Centre – Dublin Institute of Technology, 2013).

The software enables the user to create so called "Dossiers" (see Figure 81), a private or shared research space which allows him/her to collect, organize and view the research material and create diverse narratives out of it. A dossier can contain cultural objects – better said their respective records in the database – events adding dates, people, places, themes and activities, as well as references, which allow to gather information

[321] for information and demonstrations see https://vimeo.com/channels/storyscope/

from different external sources. These elements are the basis to one or more object stories, the user wants to tell, possibly bringing forth different perspectives and interpretations. The user can organize, compare or show differences or connections between the objects, as well as contextualize them with other stories from culture, history, society or economy. The material can be queried based on their content, for example the relation to a specific historic event. The structure offers a recommendation system for related objects or stories and the user can generate visualizations such as maps or timelines out of the content of a dossier. Last but not least there exists a mechanism for harvesting feedback from direct review to social media comments. Thus in short this software allows to build research collections across single repositories, and network the content in order to (collaboratively) create object stories out of it.

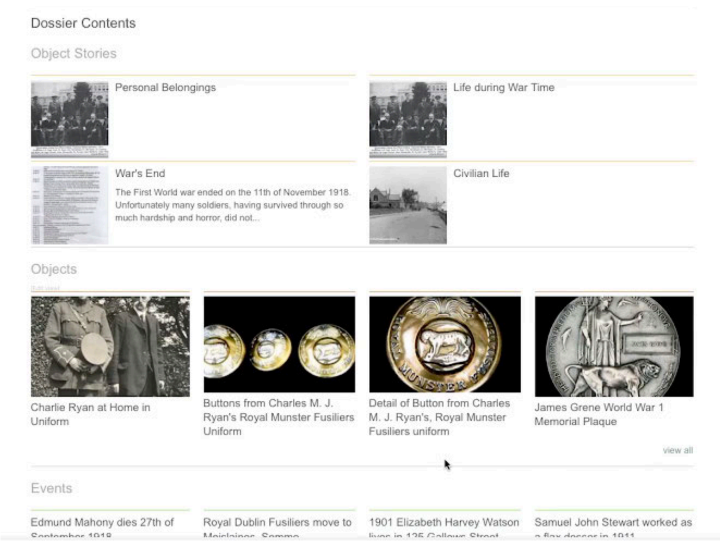

Figure 80: Example of a Dossier in the Storyscope Prototype. Source: Screenshot of Storyscope (2013, 01:48)

b) Meta-Image (Leuphana University Lüneburg, Humboldt University Berlin, Prometheus Image Archive) and ADA Lightbox (Archive of Digital Art, Danube University, Krems)

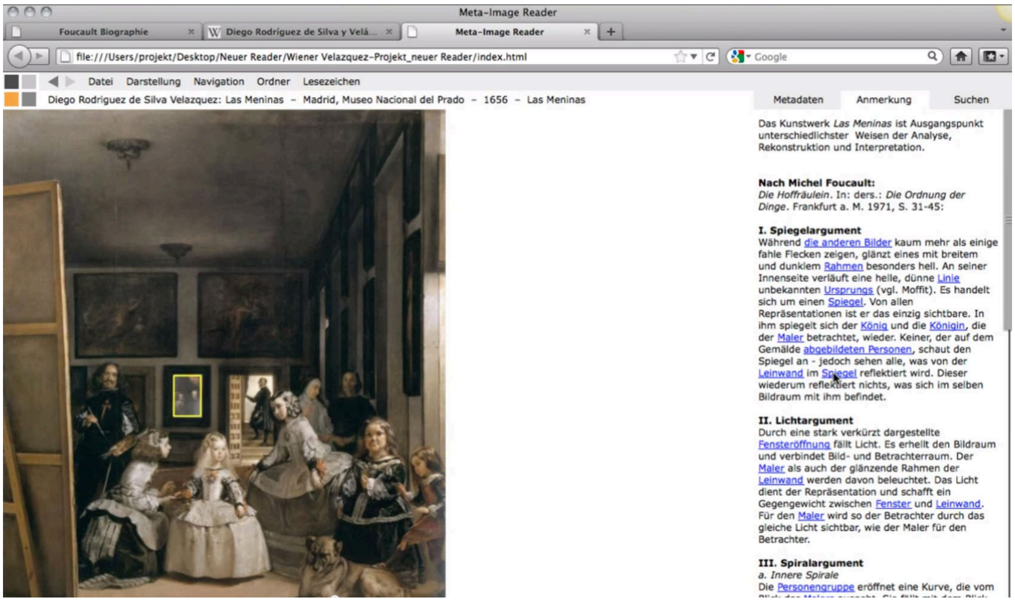

Figure 81: Meta-Image publication. Source: Screenshot of Meta-Image Tutorials (2011)

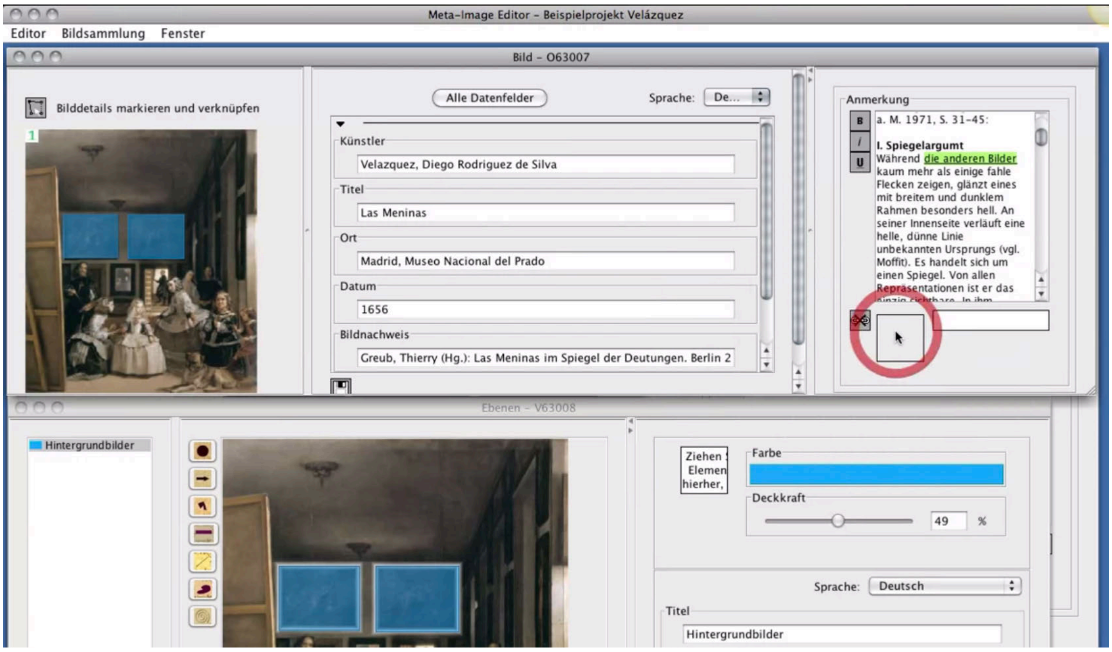

Figure 82: Meta-Image Editor for annotating images. Source: Screenshot of Meta-Image Tutorials (2011)

The Prometheus image archive[322] offers with the Meta-Image project a tool for establishing a visual discourse, following the analog predecessor of the Mnemosyne-Atlas by Aby M. Warburg, a German art historian (see Part V, chapter 1.3.). "Attached on wooden boards covered with black cloth are photographs of images, reproductions from books, and visual materials from newspapers and/or daily life, which Warburg arranges in such a way that they illustrate one or several thematic areas" (Media Art Net, 2013). Within these images he built visual clusters on the basis of extensive literature research, and he marked motif relationships found within the images using woolen threads, building up a literal spatial network of images (see Media Art Net, 2013; Warburg, 2008; Warnke, 2012). Inspired by this physical interface of relating images, the project HyperImage[323], and then later the project Meta-Image[324], which was integrated into the art historical image archive and gateway "Prometheus", translated Warburg's way of building motif relations into a software structure that enables the hyperlinking of image details. On the one hand these relations can take the form of a link from text to image details in an image presented next to it and highlights the annotated image details. On the other hand they can be a path of image details from different images. Moreover a description of image details is shown on rollover over the marked detail in an image, allowing to drill deeper into levels of detail analysis within the publication and show different levels of context next to each other: the annotated image, a contextualizing analysis-text with a broader, more overarching analysis as well as a focus on specific details. Thus this tool unites different interpretation levels from looking at the image itself as visual phenomenon, over interpreting iconological details and referring to specific motifs, to a broader, literature-driven interpretation, taking different sources into account.[325] Specific motifs can be traced across different images as a click on a motif can trigger a relational view or visual indices, that reveals all images where a specific motif was annotated on and therewith represents an automated analysis of the interlink-structure between images.

Thus the connections of the woolen threads within Warburgs Mnemosyne Atlas are translated into hyperlinks. But different from conventional hypermedia, which also

[322] http://prometheus-bildarchiv.de/

[323] http://www.uni-lueneburg.de/hyperimage/hyperimage/

[324] http://www.meta-image.de

[325] For a practical guideline on how to interpret images see Marion G. Müller (2003) but also Erwin Panofsky (1982).

allows to create links between images[326], Meta-Image also enables to link and annotate image details instead of only the whole image.

> "After you've assembled a collection of images at prometheus, you can mark, annotate and link your collection using the meta-image-editor, and they are zoomable, whatever the size and the resolution of the image. In place of the wool thread and needles you have a pointer that can reveal the associations between the picture details using the technology behind the image. What Warburg did with needle and thread can now be achieved by hand with a computer. One only needs to manually and intellectually designate the place and type of two motifs and to link then with each other—a simple drag and drop operation. […] This structure can then be used in two ways. It is presented to the human eye on a website, and the internal referential structures are assessed by the computer and offered in the form of indexes." (Warnke, 2012, p. 13).

Thus with this process the user creates a hyperlinked publication, which is publishable on a Webserver or can be viewed from the local harddrive and which lets users follow the authored network of related motif details. "Out of a seemingly insignificant detail of a picture arises a link in a chain of arguments or, if you continue the referencing even further, a nexus in a web of references" (Warnke, 2012, p. 14). And this could, as Martin Warnke argues, possibly lead to a schema for the constitution of meaning within an image corpus through the traversal of the hyperlinked network – in that case not only of documents but also of annotated iconological image details. And the tool solves practical problems of re-grouping and re-arrangement of objects, which are outsourced to the computer. Therewith it makes it much more feasible to follow Warburg's tradition of visual research and get to the meaning of a particular image within a corpus. According to Warnke this relates to the tertiary or intrinsic meaning or content (iconology) as defined by Erwin Panofsky. This particular step of image interpretation takes into account personal, technical and cultural history in order to understand an a visual, and thus it does not look at it in isolation but rather as a product of a specific cultural or historic environment, within its context (see e.g. M. G. Müller, 2003;

[326] HTML also allows to create so-called „image-maps" which allow to set a link on a part of an image. However „Meta-Image" offers an authoring tool, which makes it easy to work on images in a database and allows in its data structure links between image details besides links between text and images or image details and to visually mark and highlight several layers of details.

Panofsky, 1982; Warnke, 2012)[327]. In an environment like an image corpus or a database, this context is determined on the one hand by the personal knowledge of the interpreter, but in a more narrow sense by the context within the database, which for the purpose of this tool within Prometheus determines what a user can know and refer to. Thus all other images within the database build the potential context of a specific image and can be potentially related to it for the meaning generation of this image. Through the nature of a subject gateway like Prometheus, the corpus is not determined by a single person, as in the case of Warburg, but is determined by a multitude of people through the aggregation of several databases and is constantly in flux. And through the possibility to use the tool additionally with own images that are not in the database and the ability to link to online resources, the whole web is potentially the context for the image analysis and the resulting digital visual publication. "So it's all a matter of contextualisation in a never-ending interpretive movement, of placing the motif in ever new contexts from which its representation in the particular image had torn it" (Warnke, 2012, p. 13). Thus according to Martin Warnke (2012) the actual value and meaning within a fluid corpus lies in the cross-references between the items within the system of the database which are at best also dynamic in nature, to take into account changing contexts.

The Lightbox tool within the Archive of Digital Art (Figure 18) goes into a similar direction of facilitating methods of classical comparative visual analysis. Also inspired by Warburgian methodology and an analogue lightbox in a diathek the user can place dia-like squares containing multimedia-documentation documents of digital art projects – such as images, texts, videos or keyword-trees – freely on a screen-canvas including overlapping them and changing their size. The material is previously collected from the Archive of Digital Art and the tool enables the user to sort and view a range of data and meta-data in order to compare them and relate them visually to each other. As already shown in Part VI, chapter 1.4 the same functionality can also be used, to create an

[327] The first level of interpretation takes into account the image as pure form in itself, and is thus based on the neutral description of the visible visual characteristics. The understanding of the work is just derived by looking at it and not adding any cultural knowledge. The second level, also called iconography, is the analysis of intrinsic meaning of the image, taking into account cultural and iconographic knowledge. But it still looks at the image isolated image, only related to iconographic and cultural conventional meaning in the art historic tradition, which often derives from literature. The wider and also personal context only comes in in the third stratum, the synthesis, to which I referred in the text.The separation of the three steps is of course an ideal model, in reality these layers can overlap (see M. G. Müller, 2003; Panofsky, 1982).

exhibition with the collected material by using the canvas as a plain "wall" where data elements can be placed and fixed in a specific presentation by the curator and the sidebar can be used for a textual narrative. Several screens like this can be put in a linear order and can also be non-linearly accessed through an index page. Therewith similarly to MetaImage this tool does not only facilitate research and knowledge creation of an individual researcher, but also the publication of resulting insights based on the data of a specific archive.

2.4. Participation and Collaborative Meaning Making

The described Web-based tools for object-based research are forms of manual contextualization of and interaction with content from online-repositories based on knowledge-driven actions by humans. But they are also forms of participation. Web-based tools can go beyond supporting personal research and adding value only for a single user. On the one hand they allow sharing of the created knowledge, be it on social networks or digital publishing tools, from simple weblogs over complex hypermedia-publications to annotated public collections. This enables the content to become part of a broader discourse and contextualizes it at the same time by placing it into a networked context like the Web as well as relating it to other assets or meta-data. On the other hand web-based tools enable more participatory and even collaborative forms of knowledge generation and contextualization. Laura Carletti et al. (2013) roughly differentiate between the integration and reconfiguration of existing assets as well as creation of new assets as crowdsourced practices in the realm of Digital Humanities. These authors build up on the crowdsourcing definition by Enrique Estellés-Aarolas and Fernando González-Ladrón-de-Guevara, who defined crowdsourcing as "[…] a type of participative online activity in which an individual, an institution, a non-profit organization, or company proposes to a group of individuals of varying knowledge, heterogeneity, and number, via a flexible open call, the voluntary undertaking of a task" (Estellés-Arolas & González-Ladrón-de-Guevara, 2012, p. 197). In the following the thesis will distinguish between collaborative classification and (re-)configuration, co-creative knowledge generation and – as added item to existing literature – algorithmic meaningmaking and collaboration.

2.4.1. Collaborative Classification and (Re-)Configuration

A collaborative form of categorization is collaborative tagging, as it is employed for example on Flickr Commons, which actively encourages the users to collaboratively tag items in a database. These tags allow to bring multiple subjective points of view and assessments of the tagged items together, and therewith contextualize the database content with multiple personal backgrounds and (hi)stories from an online community. This activity goes beyond personalizing the order the database content, but through harvesting these tags and adding them to the general metadata these tags produce added value for the platform and for the community. The resulting folksonomy (see Part VI, Chapter 2.1) is reflecting the actually used vocabulary within the latter.

With the project ARTigo[328] this mechanism is gamified in order to provide metadata for the images of the "Artemis" database of the Institute for Art History at the University of Munich. The game was created as part of the project „Play4Science"[329] at LMU Munich (funded by the DFG) that developed an infrastructure for serious games allowing to tap on the knowledge of the players for scientific purposes. This specific game asks players to tag images from the Artemis database in six different games, offering interfaces in German, English and French. The main ARTigo game provides the player and a co-player with the same artwork simultaneously. The task of the players is now to enter tags to describe the artworks accurately. Tags can describe what is visible in the image but also style, quality or emotions. The input is timed to 60 seconds per artwork and the total duration of the game is five rounds. The most relevant tags for the game are the tags that either your co-player entered or which were entered for this artwork in previous games – all of these give points to the player. Thus it becomes evident that the game strives to get to a vocabulary shared across a community and not descriptions by a single person, as matching tags are gratified. Each tag is recorded, but for the search of an artwork within the database – which is also possible through the platform – only tags that were at least entered twice are relevant.

There exist further variations of this game on the platform. In the ARTigo Taboo game already verified tags cannot be used and are indicated as taboo words, aiming at verifying further going descriptions beyond the existing ones. And ARTigo Karidoo the

[328] http://www.artigo.org/.

[329] http://www.play4science.uni-muenchen.de/index.html

two co-players see nine artworks at the same time. While one of the players describes an artwork, the other one guesses which of the nine works it is. "Tag a Tag" aims at the relation of a predefined tag to the depicted image. The player can confirm suggested relations, which are highlighted if they are used more often through size and color in a tag-cloud. Additionally the player can suggest a not yet used connection of a tag to the image. The Combino-Mode asks the opponents to build tag-pairs of suggested tags describing the image. Last but not least the ARTigo Quiz is a game after the model of the TV-Game format "Wer wird Millionär". This game aims at a more in depth description of the work combined with some knowledge test components. Players are asked to select the artist of a depicted image from a list of four or to rate the artworks' formal qualities from art-history on five Lickert-scales between two opposite ends (e.g. clarity vs. unclarity of a painting, open or closed forms, surface vs. depth). The pairs of characteristics are introduced in the beginning paired with image examples. Overall this game-platform shows the potential of tapping onto the knowledge of the crowd by offering them something in return, in this case entertainment through the gameplay and competing with each other.

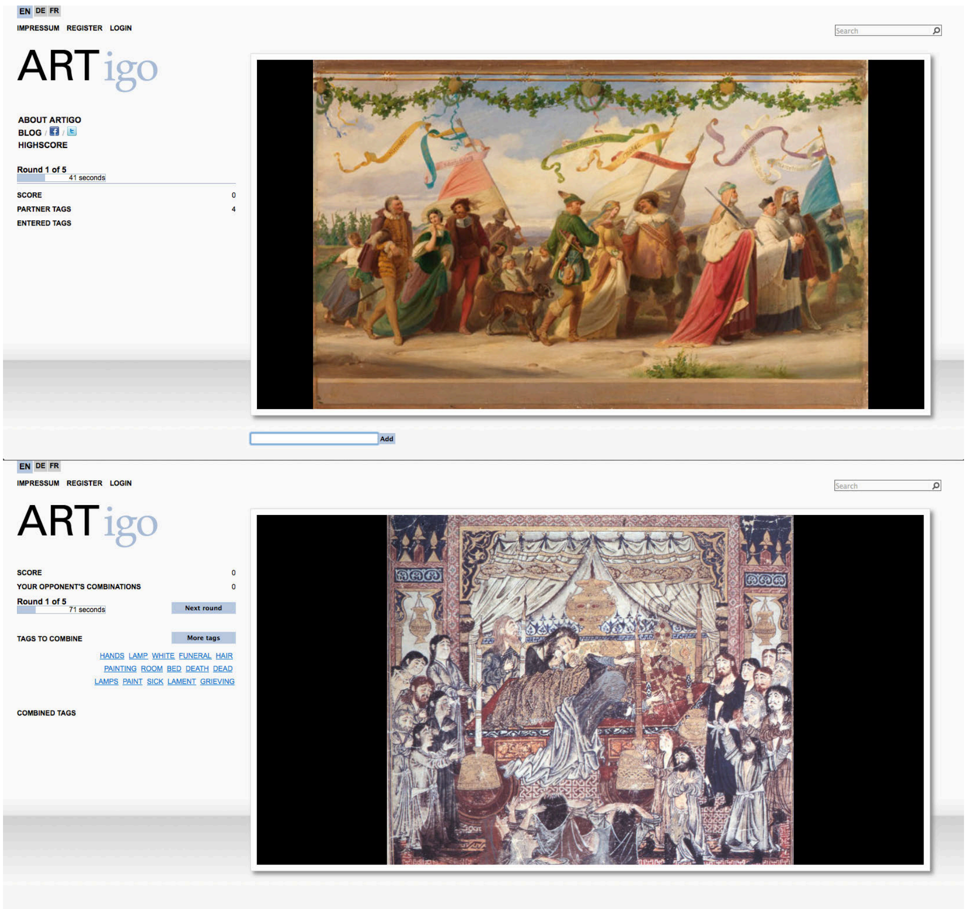

Figure 83: Different modes of the ARTigo game: top: the main game, bottom: "Combino". Source: Screenshots of artigo.org from 13.08.2014.

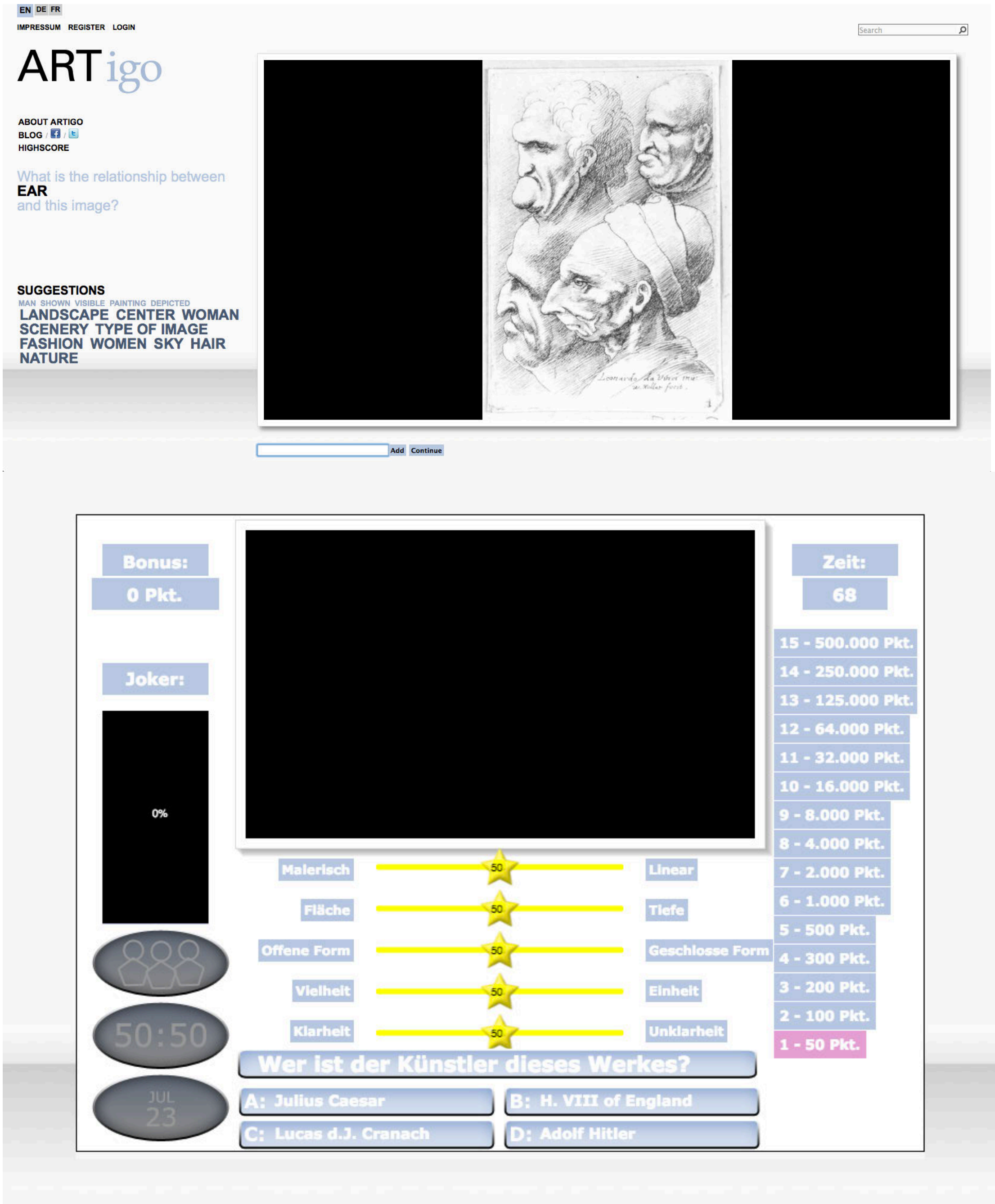

Figure 84: Different modes of the ARTigo game: top: „Tag a Tag", bottom: "ARTigo Quiz". Source: Screenshots of artigo.org from 13.08.2014.

Other examples are the contribution of cultural data, such as adding images on platforms like Flickr, to topic specific collections, or even binding a depiction of an object back to a database entry on that specific object in the collection of a cultural institution. This is possible by using so-called machine-tags, which follow a specific pre-defined syntax ([namespace]:[predicate]=[value]) and therewith allow to be more precise in enhancing the information a tag can convey. They are structured metadata that can include an exact description of what the tag-value represents and are machine-readable.[330] As already mentioned before, the "Smithsonian Cooper-Hewitt, National Design Museum" uses this specific function and states on each detail page of the online collection the machine tag for associating an image on Flickr with a specific object.[331] This move makes it possible for the institution to associate user-generated material with a specific object in their collection and therewith crowdsource the contextualization. But also educational platforms such as "Smarthistory" use tags containing the name of an artist or artwork to allow a user to contribute their image material to be used on the platform and being associated to the discussion of specific topics.

This falls under the task that Laura Carletti et al. name **curation**, which, according to them, also includes for example image selection or the curation of a collection or exhibition on basis of an existing dataset (see Carletti et al., 2013, p. 226). Anne-Marie Schleiner (2003) describes a shift in the practice of curating with the move online, where a curator is "creating chains of meaning through association, comparison and juxtaposition" as Christiane Paul (2006) summarizes Schleiner's point so well[332]. These associations are expressed in networks of hyperlinks. Carletti et al. also identify two other crowdsourced tasks when it comes to the interaction with an existing resource:

- **Revision**, which implies "analyzing, reconsidering, correcting, and improving given objects" (Carletti et al., 2013, p. 227). An example Carletti et al. present is the project "Freeze Tag!" by Brooklyn Museum, which gives the opportunity to review tags, which have been flagged for removal by other users, and therewith give a second opinion with regard to the relevance of a specific tag (see Bernstein, 2009). But also the revision and fact check of a Wikipedia article would fall under this category.

[330] see discussion of the usage of machine tags a.o. by the Cooper Hewitt collection (Part VI, chapter 2.3.).

[331] In practice this works by each object in the collection having an object number. The machine tag including the object id to directly address this object and make it possible for the Cooper Hewitt Museum to connect to it automatically is displayed at the bottom of the detail page. An example of a machine tag looks like this: *ch:object=18618175*. „ch" is the acronym for Cooper Hewitt, „object" denominates the object ID related to the specific museum collection, and the value is the actual object ID associated to in this case a offset lithograph of a poster designed by Richard Avedon in 1967.

[332] This is also what is happening in online-exhibition spaces described in Part VI, Chapter 2.3.2.

- **Location**, which includes "placing given objects in physical space, telling stories, and providing information on locations" (Carletti et al., 2013, p. 227/228). One could also name this "collaborative mapping".

2.4.2. Co-Creative Knowledge Generation

A step beyond inter-subjective ordering of data is the possibility to express the user's personal point of view and research results. Such an environment goes beyond simply compiling and displaying the material in generative or human-curated contexts, but offers participative options to communicate about these items. It allows collaborative and co-creative meaning making on a global and cross-cultural scale. Following Nathan Shedroff (1994) and his "continuum of understanding" (see Figure 27) communication about information[333] is tantamount in order to create knowledge. The information is the stimulus for conversation and storytelling and thus bringing the ordered data together with the users experience and background. This process contextualizes the information on a global, local and personal level, and therewith expresses a point of view. One could describe it as knowledge generation through discourse, which at the same time is a form of contextualization. A simple example for this kind of process would be the comment space in social media, where people can comment on specific items, like or dislike comments, answer on them and therewith get into threaded conversations sparked by a specific item or data.

According to Shedroff experience also plays a huge role for the generation of knowledge[334], which he defines as "understanding gained through experiences" (Shedroff, 1994, p. 4), referring to shared experiences as the basis of knowledge. And he expands: "Knowledge is communicated by building compelling interactions with others or with tools so that the patterns and meanings in their information can be

[333] This is defined in Shedroff's model as organized and presented knowledge, and thus what a user usually finds within a database interface

[334] Shedroff differentiates between three types of knowledge, conferring with different types of experience: personal knowledge is the meaning of something related to the experience of a specific person. Local knowledge is shared by a small group of people and is related to the shared experience of this group. For global knowledge the group which needs to share the experience is significantly larger, therewith the type of knowledge is more general (see Shedroff, 1994, p. 5).

learned by others“ (Shedroff, 1994, p. 4)[335]. Thus knowledge and communication are interlinked: shared knowledge can support communication between people, but communication between people as well as providing interfaces, which allow compelling experiences with cultural objects or data about cultural objects, are also an important step for generating new shared knowledge about them.

Shedroff's model is also related to the concept of "co-creative knowledge generation, which Mary Leigh Morbey, Julian Lombardy and the author of this thesis developed and presented at for the first time at the 4th European Communication Conference from the European Communication Research and Education Association in Istanbul (Turkey) in October 2012 (see Wiencek et al., 2012). There we defined co-creative knowledge production as a process, which involves

1. a communicative, social space (real or virtual / remediated), which enables members of a community to explore, navigate and interact with knowledge systems / data as well as interpersonal communication within the community, opening up the possibility to express their experiences and points of view
2. the creation of content by members of a community in relation to a seed (be it a dataset, an artistic project, an experience etc.) which results an expression of their point of view
3. communication about the different perspectives to produce a socially negotiated form of knowledge and meaning by using the perspectives and experiences as well as the diverse body of gathered background knowledge of the community as a starting point for productive dispute, without having to reach a consensus, which results in an outcome which is more than the sum of its parts.

The process results in knowledge created out of a community, which is socially constructed and the result of a (mediated) creative process. Co-creative knowledge-generation is based on different theories regarding knowledge production and learning such as connectivism (Siemens 2004, Downes 2012) or collective intelligence (Lévy 1997). Connectivism incorporates the idea of knowledge networks.Stephen Downes

[335] Shedroff mentions a last step called „wisdom", which is a sort of "meta-knowledge", an understanding gained through the contemplation of knowledge or better said the experiences related with it. It results of an act of interpretation and evaluation of the personal or shared experiences by a single person (see Shedroff, 1994, p. 5).

(2012) fosters the idea that knowledge is not just a collection of facts or statements, but "distributed across a network of connections" (Downes, 2012, p. 9) between entities – on a societal level between humans – and therefore consists of "patterns and regularities in that network" (Downes, 2012, p. 10). Thus knowledge is about the relation between entities, where learning and knowledge production becomes pattern recognition as well as a construction and traversal of networks, "the creation and removal of connections between the entities, or the adjustment of the strengths of those connections" (Downes, 2012, p. 9). This is a model which relates strongly to databases and data-based knowledge generation. But also community plays according to Downes a vital role in this process.

> "The community is the place in which we have learning experiences, and the environment through which we communicate with each other about these experiences. It is at one moment the place where we learn and at another moment the instantiation, as an artifact, of what we have learned, as a society. It is at one moment the place where we communicate, and at another moment, an expression of what we have communicated. A community is the totality of a society's knowledge, and that knowledge is contained not only in its law courts and libraries, but also in its buildings and bridges, statues and artwork, community halls and schools and taverns, houses, apartments, and cardboard shelters built by people who live on the street" (Downes, 2012, p. 15/16).

Downes compares the learning of a community with the learning of an individual. "A community has experiences […]. These experiences imprint and shape the community as a whole – each person, working alone and with others, creates one or another aspect of community in response to these […]" (Downes, 2012, p. 16).[336]

The focus on community and their learning together as well as their accumulated knowledge relates to the term of "collective intelligence" by Pierre Lévy (1997), who sees knowledge as "the sum of what we know", and regards intelligence as a societal process which joins together not only ideas but people. "Through our relationship to others, mediated by processes of initiation and transmission, we bring knowledge to life" (Lévy, 1997, p. 11). But co-creative knowledge generation also relates to the connectivist view on learning as creative act, "a process of immersion in an environment, discovery and communication" (Downes, 2012, p. 11).

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[336] This relates to Maurice Halbwachs' concept of "collective memory".

In general, the practice of co-creative knowledge production allows living up to the potential of the data to be a basis for more than one narrative and to paint a bigger picture of the field of research, as a datasource can be the source for more than one narrative, more than one point of view. It also allows for the enrichment of meta-data through contextualization and a tracing of emergent lines of thought in a research-field by treating the discourse and co-creative expression as a process. Moreover it strengthens the “social meaning” of data (Langlois, 2011, p. 4).

Figure 85: Screenshot showing the map-view of the online-exhibition "Europeana 1989" (http://www.europeana1989.eu/en/). Screenshot from 12.09.2013.

How does co-creative knowledge generation look like in more concrete terms? One example employing different forms of collaborative (re-)configuration and classification as well as co-creative knowledge production, is the collaborative online exhibition "Europeana 1989: We Made History"[337]. The goal of the online exhibition is to showcase the lived experience of European citizens from the events of 1989 in Central and Eastern Europe. Thus Europeana asks people to upload stories, pictures, films or other digital media items relating to the fall of the Iron Curtain and invite the users to explore multiple points of view and to draw their own conclusions: either by exploring content mapped by the event-locations or by exploring galleries of multimodal stories (text paired with media items) or media items themselves. The exhibition is built up on the Historypin[338] platform

The platform "Historypin"[339] is an example for a cultural heritage platform that allows digital storytelling about memories and digitized cultural artifacts. The platform was developed from the not-for-profit company "We Are What We Do"[340] in partnership with Google. The developers describe the platform as follows: "Historypin is a way for millions of people to come together, from across different generations, cultures and places, to share small glimpses of the past and to build up the huge story of human history" (Historypin, 2013). Thus the platform is built to allow organizations and individuals to share media assets and narratives related to history and geolocate the content. It externalizes the memory of people and allow it to stay active and part of the collective memory as defined by Maurice Halbwachs (1992) through many people reconstructing and sharing their own past and by the virtue of active engagement with it on many different possible levels. Therewith it builds the basis for broadening the collective memory about these historical events by offering an environment for collaborative and co-creative meaning making.

Through using this platform that fosters geolocating individual memories, cultural artifacts or items from institutional collections, the content becomes explorable on a map interface and can be filtered by time and subject. From the point of view of

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337 http://www.europeana1989.eu/

338 http://www.historypin.com/

339 https://www.historypin.org

340 http://wearewhatwedo.org/

exploration it would not make it per se different from the map-interfaces and platforms the thesis discussed Part VI, chapter 2.3. But this platform goes beyond sharing historic material as only form of participation. Being an online community there is the possibility to discuss in the comment section of each asset and add the user's own stories related to it. One can share the asset on different social media platforms, which is also possible as participatory action on many other contemporary platforms, or favorite it. Therewith the users become ambassadors of a memory and keep it active in the collective memory. And besides the map interface the content is grouped into "channels", containing all contributions of an individual or organization; "collections", which group together content around a specific topic or theme; or "tours", which lead the user step by step through a series of items and can tell a linear story as well as let the user explore a place or virtually move through time. One of the features is to offer a glimpse into the past from of a specific location by visually placing historic media material into or on top of contemporary street-views at its historic geolocation, while also providing a narrative about the material and the possibility to fade the overlay in order to gradually compare the two states of the location. Last but not least the platform offers the collaboration on projects, for which "Europeana 1989" is one example. Oftentimes these projects involve "challenges" for people to share and contribute their material and stories with regard to a specific topic, which is then compiled into a project channel. Besides the web-platform Historypin offers an application for Android, iOS and Windows phones, which on the one hand enables the user to take the content of Historypin into the field and potentially on site of the historic location. It also lets the user explore historical content in a radius of two kilometers of the user's geolocation, enabling the augmentation of the site by overlaying historical visual content over the camera image, creating an historic comparison, offering a similar view as the image overlays in Google StreetView. Additionally the user can create "contemporary replicas" by taking a photo of a site from the same perspective as the uploaded historic content with the camera phone, which enables to crowdsource capturing the development of a specific place over time.

This example relates also to the tasks which Laura Carletti et al. (2013) identified with regard to the crowdsourcing of creation of new assets for Digital Humanities (see Carletti et al., 2013, p. 228 ff.):

- **Documenting personal life**, which is related to intimate, personal moments as well as logging everyday life situations.

- **Documenting history**, which entails all crowd contributions related to historical events
- **Augmenting locations**, which refers to all crowd-contributions related to a specific place.

These actions do not only work with already available data, but the users can actively contribute own content to a platform. These contributions are placed in a co-creative meaning making-process and into a wider context or discourse. But already the act of bringing content[341] into a specific format, choosing what is worthy to share, or the active decision to attach data to a specific place on a map or a specific context – as it is done in the example of Historypin –, is a first step in the process towards meaning making out of the data.

2.4.3. Dialogic Contextualization on Social Media Platforms

Besides the portrayed platforms or tools specifically developed for cultural content also the commercially available social media platforms such as Facebook or Twitter can be used for dialogic communication from the institution with the visitor, but also between visitors or users. Thus the platforms can be facilitators of mediated social interaction and potentially can be employed as one tool amongst many to engage audiences with the collection and with cultural data. Therewith these platforms are not only a marketing tool but can serve as potential springboard for co-creative knowledge generation.

Social media platforms are virtual places, where people connect and interact; where they come together to communicate asynchronously as well as synchronously with each other; places to publish or show own creations and expressions; places to share what moves the people – from information, over media to experiences; places to crowdsource, to collaborate or to co-create; places to learn to empower or mentor (see e.g. Allen-Greil, 2013, p. 1). Thus social media are about people. They are about community, about activity and about content that resonates with people and therefore gets shared, as digital engagement specialist Jasper Visser argues (see DRs

[341] All contributions can be in various media forms, from texts over images or moving images to sound recordings or oral history.

Kulturarvsprojekt, 2012)[342]. Social media platforms are digital places where people already come together. And each of these platforms has its own strengths, possible uses determined by functionality, but also its specific user group, which needs to be taken into account and which differs from country to country.

Slowly but surely social media get more widely adopted in the museum world.[343] There are first social media specific forms of mediation emerging, which go beyond information. Some platforms, preferably those where users can comment on visuals, are suitable for "Caption Contests" to engage users with the visuals themselves, to get them to look closer onto the images. Dana Allen-Greil names the examples of mystery objects that involve the user in solving a challenge, for example asking people to date images or to recognize people or places of photographs. But also the dialogic capabilities of social media can be used, for example by making experts available to answer questions via social media or to involve them in thematic discussion. Any synchronous communication medium will do for this, from chatrooms over group-video chats, or Twitter, which allows to run a discussion such as in form of synchronous "Tweetups", channeling content into a coherent discussion via hashtags. A prime example is the initiative "Ask a Curator"[344], a website that allows users to ask a question to be answered by a curator in whose expertise the topic falls in a short video, which is made available on the site and is archived. Where this process is asynchronous, once a year some museums participate in an "Ask a Curator"-day where mediated live-conversations are facilitated.

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[342] Jasper Visser actually co-authored the "Digital Engagement Framework", a tool which should help institutions to plan their digital activities around their key assets, in order to engage their audience.

[343] However they are often used as just another information channel for exhibitions, exhibition previews, public programs or events. Or museums share information around the topics the exhibitions are dealing with, the exhibited artists, or communicate important dates and observations. "Behind the Scenes" content lets the followers take part in every day work at a museum and keeps the audience in the know what is going on at the institution behind the gallery walls (see Allen-Greil, 2013, p. 8 ff). For all of this informational content visuals are very important, as the Web as medium is inherently visual.

[344] http://www.askacurator.com

By bringing Social Media users into an exhibition and giving them a possibility to exclusively post and comment on it is another way to not only use social media as a marketing channel, but also to invite the expression of different perspectives on a physical exhibition in an online environment. An initiative of the Smithsonian Institute organized a special preview guided tour with the curator for their exhibition "Souvenir Nation" in August 2013 and invited active Twitter users to join the tour and live-tweet, to already get a social media conversation started before the official opening. The tweets consisted of quotes from the curator, personal thoughts about the exhibition or tweets describing the "weirdest artifact" or the tweeters' "favorite object", two challenges the museum apparently asked the tweeters to complete. The Twitter posts did also contain images taken with smartphone cameras from objects, the curator or the group taking the tour as well as short videos. On the one hand this action documents the physical exhibition and the official narrative presented by the institution and therewith transfers the exhibition in word and image into an online environment to be seen by users that are not able to visit the exhibition on site. On the other hand the twitter users were also able to express their subjective points of view and interpretation of the exhibition and the items shown. They were able to present their personal highlights and thoughts going along with them and were therewith opening up a discursive space in the realm of social media in order to discuss with other on-site visitors but also with the wider interested online-community. Therewith a potential diversification of insights and interpretation through virtual discussions becomes possible.[345]

Thus the hope for the use of social media is to stir an active engagement with a topic, with (digitized) assets from the collection or with an exhibition on site and to foster conversations and exchange, which ideally lead to own interpretation of the user. But of course another goal is to increase the visibility of the collection and the work of an institution, and therewith its impact. Through social media users and visitors can act as ambassadors for content they like and appreciate for example by commenting on or sharing the content and therewith attributing value and meaning to it as well as widening its reach. This increases the likelihood that new audiences encounter and discover the content (see Sanderhoff, 2014b, p. 50).

[345] A similar feature in form of a forum-like discussion structure was built into a mobile guide for the exhibition „Eat, Pray, Weave" at Nasher Museum. For a discussion of this project see Wiencek (2014).

Figure 86: Image compilation documenting the „tweetable tour“ posted on Twitter at 08.08.2013 by Erin Blasco (@erinblasco), Education Specialist at the Smithsonian National Museum of American History. Source: twitter.com; image courtesy of Erin Blasco.

Social media channels and specifically campaigns employing these channels can also be used to build digital communities around a collection and to foster engagement with art and culture. An example for such a social media campaign that builds up a community around arts in general while at the same time in raising awareness for a museum and its collection, is the marketing campaign #PlayArtfully[346] by the San Francisco Museum of Modern Art (SFMOMA) in 2014. Launched during a period of closure of the museum the campaign aimed to engage users through "accessible, fun, shareable games that inspire creativity. Rather than specifically advertising the museum's exhibitions and programs, #PlayArtfully works to garner general interest in

[346] https://www.sfmoma.org/playartfully/ (offline). A description of the project can be found at http://willakoerner.com/portfolio/sfmoma-campaigns/.

and curiosity about the arts" (Köerner, 2014). It provided the users with challenges that prompted them oftentimes to share their photos and ideas on their social media channels identifying it with specific hashtags. In these challenges they are "encouraged to see their life from a more creative perspective, and see the museum as an enabler of play and creativity" (Köerner, 2014).

To give an example, game 36 read "Look for the most colorful scence you can find. You win if you take a photo with all the colors of the rainbow (red, organe, yellow, green, blue, indigo, and violet" (Köerner, 2014). Willa Körner, one of the people that worked on the strategy and production of the campaign, named this the most popular game in the campaign, which generated a lot of user-generated content. The content moreover was very shareable, since the outcomes of the game were often bright and colorful photos, which are popular on social media (see Figure 88). During the campaign the museum highlighted a mix of tiny games together with the user-generated content the games resulted in, as well as related exhibition- and collection content under one umbrella. Examples therefore are challenge prompts on social media highlighting collection items as inspiration (see Figure 89).

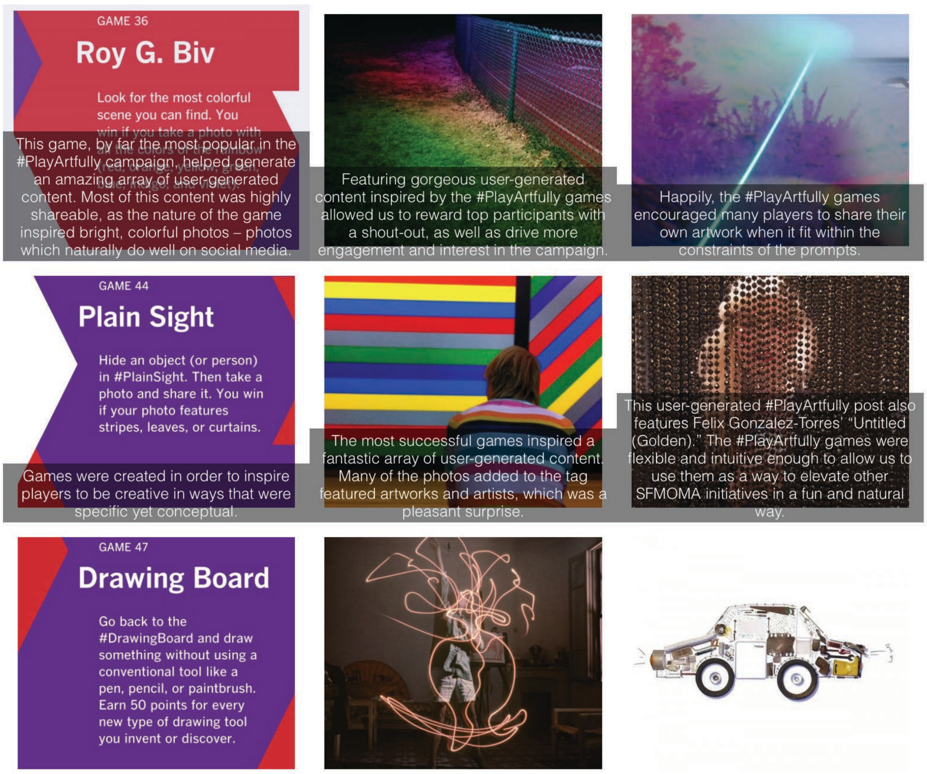

Figure 87: A collection of prompts together with examples of user-generated content they inspired. Source: Screenshot of Köerner (2014).

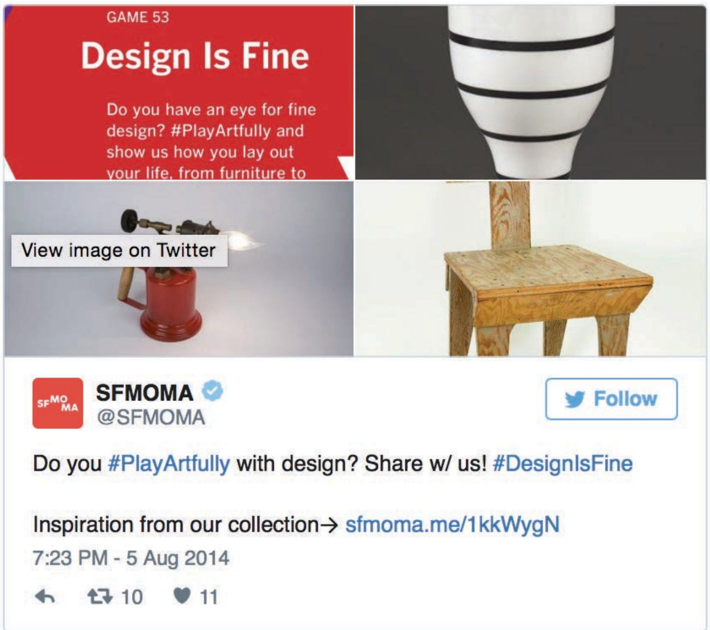

Figure 88: Challenge posted by SFMOMA on Twitter, containing inspirational objects from the SFMOMA collection. Source: Screenshot of Köerner (2014).

2.4.4. Algorithmic Meaningmaking and Collaboration

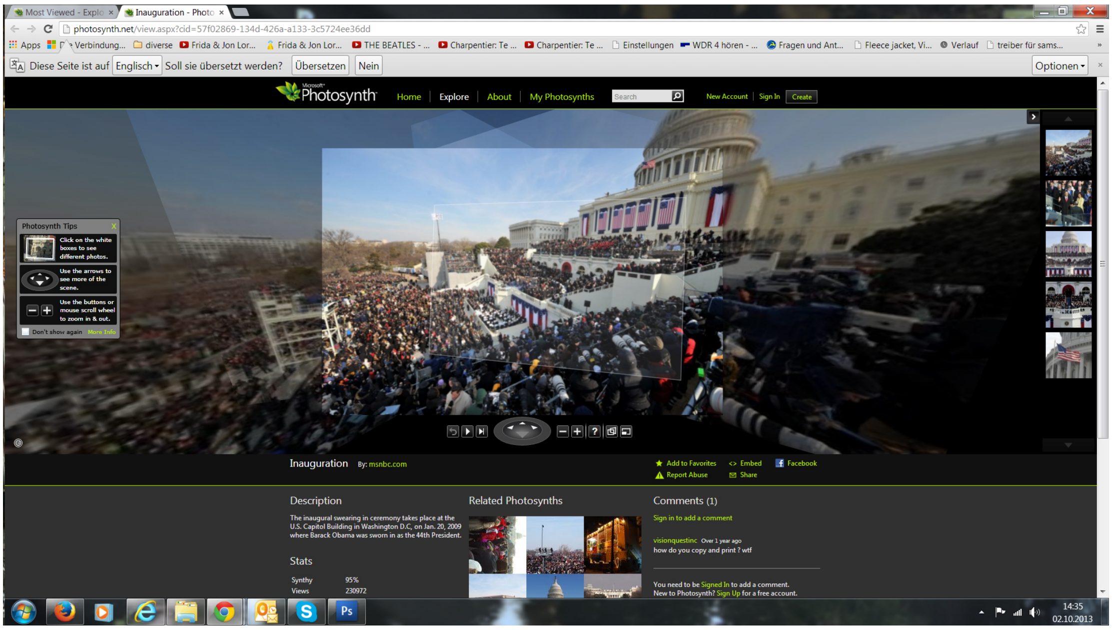

Figure 89: Screenshot of the collaborative Photosynth from Barack Obama's inauguration ceremony, January 20, 2009, Washington, DC, USA. Screenshot from 02.10.2013.

The third form of participation or collaboration can be called algorithmic collaboration. Where all participative and collaborative actions are mediated and made possible in their digital form by software, this last form is purely facilitated by data processing and algorithms. A prime example for such an indirect, algorithmic collaboration is an iconic image of President Barack Obama's inauguration in 2009 generated on "Microsoft Photosynth"[347]. Photosynth amongst others creates a navigable 3D space or network of multiple photographs placed in 3D space, which reconstructs an expanded moment in time out of multiple snapshots of the same "moment". But one can also document a specific place over time from multiple points of view and merge these photographs together into one compressed image space. The viewer-software enables the user to navigate and explore the image space interactively. Thus the meaning and value of this specific dispositive lies in the interaction with the many points of view and time-layers represented in one navigable image space, not within the single image. As William Uricchio argues, the "reader must take a more active role in making sense of the ensuing composite of anonymous voices, in assessing it, in moving across its links to pursue additional information. The work of individuals […] is theoretically traceable, but the larger mix supersedes and largely effaces those traces, enabling something like a collective point of view in which the user's agency and actions are paramount" (Uricchio, 2011, p. 30). Thus in this case the algorithm and the software create a novel way of interacting with and experiencing the visual material and according to Uricchio the technology intervenes between the viewing subject and the object on display (see Uricchio, 2011, p. 25).

For this specific collaborative capture of the historic moment of Barack Obama's inauguration CNN asked visitors at the inauguration ceremony at the Capitol in Washington, DC to submit their photographs from the moment, when the President Elect raises the hand to take the Oath (see CNN, 2009). The photos of the submitters were then combined with the professional material shot by CNN into one large collaborative photosynth, where this software tool and data processing made the collaboration possible and adds value to the individual images, by adding the interactive possibilities. It allows to visualize the "bigger picture" of a moment, incorporating different points of view (literally and metaphorically), making them explorable, and creating a new product which goes beyond the sum of its parts. With

[347] http://photosynth.net

todays technology one could even imagine to omit the step of submission, but making the material freely available and maybe tag it accordingly could be enough for the material to be scraped and incorporated into such an "algorithmic collaboration".

VII. Conclusion

1. Concluding Remarks

After looking at so many examples and related media theory, what are the take-away points of this massive undertaking?

The thesis created a map: of forms of cultural repositories and sources of cultural data; of mechanisms of meaningmaking within digital repositories and databases; of several re-use practices and ways of contextualizing cultural data in web-based environments. As its main part it introduced digital technology as a non-human agent in the mediation process, as mediator in its own right. It stands next to other agents in the process such as human gallery educators, cultural institutions, exhibition displays, visitors or the society at large. But since technology builds up and codifies rules for access and findability of information within its system, that is widely used by today's society and becoming the main information source, digital technology as agent has the power to influence what can be known at a certain time or place, what can be found in specific contexts. And it has the power to learn from, about and adapt to individual users. This accumulated data and its algorithmic interpretation about the users is brought into the mediation process in addition to the computational interpretation and understanding of the cultural data.

The database is presented as a nexus point in the mediation process, playing a central role. It is the central data provider and therefore source for many stories and interactive, non-linear narratives. It offers ways of structuring data and therewith is a mode of "meta-narrative" based on metadata and categorization as well as other means of contextualization. A database is a basis for further mediation and contextualization of art and culture through active reuse and engagement with the cultural items made possible in mediated form through interfaces and services. In a wider sense as data-based applications provide a display for cultural data through their various interfaces, which are determining also the in-between between user and cultural data as well as the possible interactions and manipulations of the data. And last but not least a database is networking data from different sources to open up new hyperconnected contexts. As Lev Manovich described it: the database is a cultural form in itself, an own way of structuring data and creating new possible versions of the inscribed realities through engagement with the data as well as an own way of expression through data. Data-driven storytelling is therefore an important concept for digital mediation of art, as are the ideas of the network and the platform as discussed in Part III, chapter 2, which form a common thread throughout data-based mediation practices. Thus one can say that the practice of digital mediation – or one could extend that also to digital curation – has first and foremost become the act of designing a platform, as in curating, filtering and networking data to be made available on the platform. It is mainly designing a process for users to engage with the data rather than a specific, pre-defined experience, which would be mere streams of content or variable narratives that are displayed in an online-specific form.

The thesis focused on mediation as process of co-creative knowledge generation. Therfore the process of meaning making within databases was one of the main foci of the analysis. The respective analysis discussed four major aspects of meaning making within a database of cultural data: 1) categorization and information architecture, 2) contextualization through retrieval, 3) database interfaces as modes of (re-)presentation of data as well as shaping interactive processes and 4) modes of participation and collaboration in meaning-making. These modes build up on and represent central functions of databases. They include amongst others the accessibility of data and the categorization bringing order through human intervention or computational analysis. Moreover search as well as browsing are still prevalent entrypoints to cultural data in databases especially in research oriented repositories, but are also methods of recall, contextualization and activation of cultural data. Database-interfaces are forms of display and enable different mechanisms of meaning-making and contextualization as discussed in Part VI. But these functions are merely the beginning. Or as Frank Frischmuth from the German Digital Library (DDB) said in a recent interview: the digitization of data and practices is not enough. The important task is the development of formats for the reuse and therewith activation of the newly digitized data and possibilities for the application of the cultural data in new contexts, its transformation and manipulation (see Lerche & Frischmuth, 2017). Thus the task of a contemporary cultural repository goes beyond accessibility and retrieval, but they are – as hinted at in the previous argument – rather a framework for storytelling, for co-creative knowledge generation with the data they hold, a basis for diverse possible experiences through re-contextualizing the data within or outside the gallery and depending on the visitor interaction. It provides a scenario where users can contribute something bigger than the sum of its parts. A framework that connects and networks multiple sources to widen the scope and allow multiple voices to be heard. Opening cultural data enables cultural institutions to reclaim their role as trusted source in the light of other information providers on the subject of art and culture – fulfilling the definition of digital mediations practice. And this in turn requires the institutions that provide the data and hold the cultural items to open up, to become an open platform that lets go of the full control over interpretation as well as re-use of data, embracing the uncertainty of the experience as well as the resulting cultural expressions, as I argued in a previous essay (Wiencek, 2014). But it also needs intuitive interfaces going beyond search-driven expert tools to create a digital experience on the basis of cultural data, that users really like to spend time with in their spare time. First examples leading down this road were discussed in this thesis and this is the direction where mediation of art and culture is headed in the future.

The thesis showed a close relation between the digital media characteristics as well as media theory especially of web-based media forms and the digital mediation practices that are employing web-based media. The characteristics of the medium are not separable from practices performed employing a specific medium. Thus forms of digital cultural learning naturally employ the digital media characteristic, which oftentimes leads to a transformation or adaption of an analogue practice by taking into account the arising needs and use-patterns or values of digital media users as outlined in Part III, chapter 2. At the same time discussions in mediation theory about participatory mediation forms in museums or co-creative knowledge generation as critical practice correlate closely with media-usage-patterns on the web and in social media applications as well as theories of "participatory culture" arising at the same time in media theory. Thus the digital mediation is in a way a natural extension of contemporary analogue practices.

As the examples show, several of the "curated contexts" take up forms of predecessors in the analogue world of mediation and transforming them into digital forms: from the virtual museum over online exhibitions or online collections to guided tours or hypermediated book-like long-form narratives, which are all inspired by analog media forms. The acts of pairing analogue mediation concepts and forms with online-specific mediation and publication forms, redressing classical forms of hanging in online-exhibitions or transforming art-historical methods such as the mnemosyne atlas into a digital interface, are all examples of re-mediation, which is central to digital media and a typical step in the very beginning of a media form or particular uses of it (see Part III, chapter 1.2). Other examples discussed are in contrast coming from the "other side" to a digital mediation tool, namely by appropriating or re-creating prevalent forms of digital media for the mediation of art: such as social media platforms, media sharing platforms or wikis with mechanisms like collaborative tagging, liking, reconfiguration, revision, commenting or the like.

Digital media proved to be an own mode of mediation, a display for cultural data in their own right, providing digital modes of displaying, discussing, learning and therewith influencing the reflection and thinking about art and culture (see Figure 9 for the basic areas of mediation of art and culture). The digital mediation moves from the remediation of physical displays as well as documentation to a room for experience: a specific online experience of cultural data. Like a physical exhibition, a digital display offers room for interaction with cultural data as well as other users and therewith constitutes a social space. It is merging and including other existing digital social spaces such as prevalent social media platforms with individual developments specific for cultural institutions that are used as standalone software products outside of the museum or in conjunction with a museum visit.

Thus it is important, however, not to look at the physical and digital museum as dichotomy, the same way as it is important not to look at digital and analogue means of cultural learning and mediation of art and culture as something separated. They are two sides of a coin when it comes to the museum experience with their own affordances. What especially web-based digital media gains in accessibility, retrievability, machine-readability, shareability or manipulation value, it lacks in materiality, haptic, immediacy or loss of information through digitization. Digital media thus also have to be seen as an additional way of interpretation to the human and personal gallery education, not as mere replacement of the human educators. Humans still also learn from humans. However their role changes with the technological availability of information at the fingertips of the users, the automated contextualization. They become mentors through the jungle of information. Being able to tell a trustworthy source from a source not to be trusted. Being able to interpret and make sense of the data. Being able to add knowledge- and interpretation-based relations to the purely semantic ones, which can be algorithmically detected. And also the machine learning needed for the latter can only be achieved by learning from humans and through human usage of data and applications. Humans are not outruled by technology, in the contrary. They are empowered to focus on tasks where they excel: the co-creative data-based knowledge generation.

Following the aforementioned argument, digital and analogue mediation practices should be regarded as unity when it comes to mediation offers of a museum and not as competitors. Each method and mediality has its own strength, oftentimes its own and different target group and its own place in the value chain of offerings for cultural learning with common goals. Both, digital and analogue mediation and putting cultural data on display as well as opening it up for interaction are not about merely showing the artifacts, but about facilitating a conversation and engagement with the cultural items, changing the way people think, forming social connections, eliciting multiple meanings. The philosophy of what mediation of art and culture should be able to accomplish changes over time with the general philosophy of learning and didactic, the changing circumstances and challenges in society, its point of view regarding cultural heritage and its contemporary role. The changes affect digital as well as analogue practices of mediation. But surely the “digital mindset” has influenced employees of museums and gallery educators over time, as it changed the society as a whole and hence also forces the museum as institution to come to terms with it. There is no option for the museum to not deal with digitization and the expectations of digital natives, if they do not want to loose entire target groups. Thus in that way digital mediation and especially the web-based practices discussed in this thesis are an important first step towards serving the target groups of digital natives and digitally affine people. But the practices are also important to gain and keep relevance and a trusted source[348] within the prevalent digital information infrastructure and inspire actions in the physical world through reuse, reimagination, re-display and sharing of cultural heritage data, as several examples showed. However sound cultural learning

[348] Staying a trusted source and go-to for information about their own collection is all the more important for a cultural institution, as players in the cultural heritage sector do not only come from the public sphere but especially in distribution are commercial entities such as galleries, software as service providers or commercial platforms that in parts provide services also for the public institutions or commercial services for the end customers or users. Thus besides the idealistic value of art and culture the commercial value of cultural data and metadata is not to be underestimated with all its political implications.

concepts geared specifically to digital media and its ever changing affordances as well as the inclusion with other learning modes within a museum are still needed and are a big field of development for the future. Technology has become an important agent in that process, but it is also only one of several agents. How to employ the currently available technological agents for meaningful and efficient mediation that fosters co-creative knowledge generation with the visitors, their own interpretation, that leads their gaze and provides a way into cultural heritage? This is a question that needs to be continuously answered anew.

2. Limitations and Future Research

This leads over to what this thesis does not cover and where its limitations are. It is in the nature of such a research undertaking that it is not all-encompassing. One very obvious limitation lies in the sampling of the examples and research data.

The sample-method and the qualitative approach of research employed in this thesis result in the fact that it cannot guarantee an all-inclusive overview of the field, nor can it give quantitative insights into the effectiveness of the mediation approaches, their usability, actual usage or impact onto the users. It therefore rather a theoretical account, embedding the examples and their functionality in a media-theoretical framework. The analysis of the functionality and the interpretation of the examples is, due to the qualitative methodology, also more subjective and not quantifiable. For a deeper understanding of the examples, the effect of their inner workings for cultural learning, the users and institutions further empirical studies are needed.

Moreover the data collection is dating back to the years 2009 to mainly 2013 with few additions of later projects during the editing process, which is a considerable age given the fast paced nature of digital media and therefore each project conducted within digital technologies and within web-based frameworks and platforms. Therefore the examples are rather “media historic” or “current” at the time of the data-collection or the time of their go-live. Some projects of the sample are even offline by now and therefore not available to the public anymore, transforming parts of the thesis nearly into “media archaeology”. The digital media principle of variability is massively at play, resulting in short lived projects and changing contexts and thus making the subject difficult to research.

Another limitation of the thesis is its focus on digital archives and collections and mainly web-based practices. This focus leaves out other important fields of digital mediation, such as location-based services, mobile applications, in-gallery interactives, or augmented reality applications. This on the one hand limits the discussed digital media characteristics to characteristics of computational media in general, which are of course inherent to the examples, as well as characteristics of the web and hypermedia. On the other hand, since database-building, contextualization and reuse of cultural data is the very basic step into a digital mediation, most disruptive innovations happen in these other areas by now. In that way it is also a rather "historic view" on digital mediation, leaving a lot of research to be done in the other areas in order to map practices and understand the effect of the left out digital modalities on cultural learning as well as developing sustainable digital mediation practices in an ever-changing media environment.

With the latest developments in hardware, Augmented Reality and Virtual Reality are current trends also in museum mediation and especially interesting for future research. These media-forms enable the employment of explicit mediation, preferring experiences, dialogic structures and actions over conventional, implicit or narrative information mediation that is geared towards mere recall of information. Through addressing the visitor also on an emotional and experiential level, explicit mediation improves the understanding of situations and complex processes (Moesgaard et al., 2015). These forms of mediation therefore allow to transform the experience of historic or museal spaces directly: starting from location-based contextualization through informationlayers, leading of the gaze, immersive meta-experiences of historic events as well as future or fictional scenarios, to inserting research data from Digital Humanities directly into mediation of art and culture. These mediation scenarios are going beyond the web-based virtual reality applications discussed in this thesis, especially in terms of immediate virtual co-presence in physical spatial environments. As stated in the NMC Horizon Report 2016 – Museum Edition (Freeman, A., Adams Becker, S., Cummins, M., McKelroy, E., Giesinger, C., Yuhnke, 2016), Virtual Reality has a time to adoption in museums of maximum three years. And in the area of Augmented Reality the technological development of AR-devices for the massmarket beyond applications on smartphones is ongoing, with the example of Microsoft Hololens being one of the most advanced devices at the time of writing, even though still too expensive for mass deployment in the cultural sector. There is an expected breakthrough of more affordable AR-devices into the mass market in the coming years. Therefore this becomes also very interesting for practical applications in the mediation of art and culture beyond the mobile or smart devices, which are currently prevalent in the in-gallery as well as on-location mediation practices. What is still lacking though are scientifically and didactically sound learning concepts that employ these media forms with its characteristics and affordances. This will be a promising area of research for the future.

Another upcoming and important aspect for future research in digital mediation of art and culture is the aspect of inclusion and "design for all". Digital media have the ability to provide a gateway to art and culture inside and outside of the gallery space to visitors, who otherwise experience barriers in access. The field ranges from services for vision or hearing impaired visitors with talk back, voice over and the on-the-spot interpretation with sign language to "understandable communication" as well as "design for all", that is accepted and understood by the widest possible range of people. Immersive experiences and virtual co-presence can include immobile or far-away visitors into a location-based experience that cannot reach the location physically, and even allow the exchange between the remote visitor and visitors on site. A great example for a first prototype in this direction is a robot that is employed in the mediation of the van Abbe Museum in Eindhoven (The Netherlands), which provides a telematic museum experience as part of their "Special Guests" program[349]. Remote visitors can steer the robot through the museum with an application on a smart device or on a desktop computer in order to walk through the museum accompanied by a guide. The robot enables the interaction with other visitors or experts on location as well. Augmented and Virtual Reality technology can offer ways to go beyond the hardware constraints of a robot in the future. Inclusive design can also ease access to digital offers for elderly people through the reduction of complexity in interaction design and by moving away from the focus on a device or screen for digital mediation to embedding the digital experience naturally into the spatial experience and the

[349] see https://vanabbemuseum.nl/en/mediation/special-guests/museum-visit-with-robot/ for more information.

engagement with physical cultural objects.. This target group is nowadays oftentimes still excluded from digital mediation by design, since digital mediation experiences are more often than not rather designed with a younger generation in mind.

Inclusive mediation offers are in the works in museums and research projects worldwide. And politics for example in Germany demand museums to become more inclusive in their offerings in the coming years. Therefore the demand for more research in this area is high. Design for all needs a deep understanding of the special needs of different visitor groups as well as the affordances of technology, their interfaces and content modalities. How can these components serve the various needs of different visitor groups while being accepted and understood by people with a wide range of literacy levels? How can experiences with and around cultural objects and cultural data that are based on interaction design, visual, audio and content design be open and inclusive for the widest possible range of visitors? And how can these offers include them in the learning process and even into a co-creative meaning making process that is at the core of mediation of art and culture? How can these experiences be a crucial part of community building, bringing groups of people together that are sometimes not meeting on the same level due to the lack of inclusive infrastructure?

To answer these questions, the basic understanding of the characteristics of digital media for cultural learning and the role of technological agents in mediation of art, analyzed amongst others in this thesis, can serve as a basis. Much more work is needed in the future in order to employ the ever-changing digital technology in a useful and effective way for the experience of art and cultural heritage.

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