Museum-AI Assemblages

A Conceptual Framework for Ethnographic and Qualitative Research

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Artificial intelligence (AI) has rapidly become a mainstay of modern life. It has permeated many areas of our existence and is a significant driving force behind the sweeping digital transformation of society. Museums are no exception. On the contrary, they have proven particularly adept at adopting AI and used it to create conversational AI such as chatbots, robots, and interactive artworks; to observe and analyse visitor behaviour; to scan and automatically tag millions of images from digital archives, creating new forms of participation, learning, and aesthetic experience; to preserve material and intangible heritage; and to create new opportunities for heritage and museum-related research. Recent developments in the field of computer vision (CV), natural language processing (NLP), artificial neural networks (ANNs), and generative adversarial networks (GANs) are particularly central. In an exploratory assessment of AI projects in the museum and heritage sector in early 2021, we were able to compile a comprehensive list of 586 AI projects in 56 countries, more than 90 per cent of which were realized between 2016 and 2021.[1] These figures demonstrate the rapid spread of AI technologies in museums and the significant impact they will have on the field in the years to come. AI has the potential to transform curatorial practices and visitor experiences (including the way we learn and feel in the museum), the global circulation of data and images in digital museum archives, and the ways in which we recreate and preserve heritage for the future.

The field of digital museum and heritage studies—by which I mean the totality of interdisciplinary studies that address the role of digital technologies in museums and heritage—has made great strides in recent years (for instance, Giaccardi 2012; Drotner/Dziekan/Parry et al. 2018; Giannini/Bowen 2019; Lewi/Smith/vom Lehn et al. 2019; Arvanitis/Zuanni 2021; Geismar 2021; Stylianou-Lambert/Heraclidou/Bounia 2022), and the number of studies on the role of AI for museums is growing.

1 This list was generated mostly by my student assistant Julia Molin, with funding provided by the Humboldt Universität zu Berlin.

Oonagh Murphy, Elena Villaespesa, and Ariana French have surveyed the range of AI technologies in museums (French/Villaespesa 2019; Murphy/Villaespesa 2020). Luciana Bordoni et al. (2016) and Marco Fiorucci et al. (2020) have discussed possible uses of AI in the field of heritage studies. Others have conducted studies on topics such as museum chatbots and deepfakes (Gaia/Boiano/Borda 2019; Kidd/Rees 2022), the use of AI in digital archives and its ethical implications (Ciecko 2020; Villaespesa/Murphy 2021; Foka/Attemark/Wahlberg 2022), the changing working conditions in museums resulting from AI (Fang 2019), and concrete AI projects and their implementation (for example, Machidon/Tavčar/Gams 2020). These studies, however, focus almost exclusively on the applied dimensions of museum AI, namely its limitations and possibilities for museum use. By contrast, this chapter aims to contribute to the growing body of work on AI in museums by proposing a conceptual approach that can inform empirical studies and thus help us understand and critically reflect on the transformations of museums brought about by AI technologies.

What follows is not the result of a rigorous empirical analysis. It is based, rather, on exploratory work that includes informal conversations with experts, a study of the structures of the most significant AI projects mentioned above, and experimental methods such as testing the biases inherent in computer vision algorithms when applied to museum databases. My general approach is ethnographic in nature, and I believe that ethnographic and qualitative approaches are particularly well suited to studying AI in museums. Indeed, my preliminary findings are meant to show why a particular concept—the museum-AI assemblage—might be fruitful for future qualitative and ethnographic work in the digital museum and heritage studies.

Museum-AI Assemblages

To understand museum AI, it is helpful to consider the concept of 'assemblages' and to engage in what is now often called 'assemblage thinking' (Anderson/Kearnes/McFarlane et al. 2012, 172). This perspective considers 'the heterogeneous connections between objects, spaces, materials, machines, bodies, subjectivities, symbols, formulas and so on' and how they constitute 'sociomaterial and sociotechnical ensemble[s]' (Farías 2011, 14). Researchers have applied assemblage thinking across a diverse range of fields in the social and cultural sciences (Hansen/Koch 2022; Welz 2021). Two of these fields are particularly noteworthy for my own purpose in this paper.

The first consists of studies that apply assemblage thinking to museum and heritage research. The cultural anthropologist Sharon Macdonald, one of the first to use the term in this field, proposes that individual museums or heritage sites be understood not in terms of static structures, but instead of the 'processes and entan-

glements involved in their coming into being and continuation' (Macdonald 2009, 118). Others have used the concept for examining museum archives (Byrne/Clarke/Harrison et al. 2011), affective relationships in museums (Waterton/Dittmer 2014), the infrastructural and governmental entanglements of museums (Bennett 2015; Muller 2020), and the connections between museums and Indigenous communities (Schorch 2017).

The second area consists of studies that apply assemblage thinking to the analysis of digital technologies such as online blogs (Hopkins 2019), video games (Taylor 2009), or, more generally, algorithms (Rosenbaum 2020) and human-data relationships (Lupton 2016). Some scholars have already started to apply assemblage thinking in the field of AI research (Kim/Yun/Oh 2022; Tseng 2022). This is particularly helpful because AI is never simply a single technology used by a single person. Rather, AI always consists of complex sociotechnical ensembles constituted by relations between human actors (including their practices and experiences) and various nonhuman elements. The latter include, first and foremost, algorithms based on machine learning (or deep neural networks), as well as simpler algorithms, software, hardware, interfaces, and interface design. Physical spaces, material objects and infrastructures also play a role in AI settings. Thinking about AI in terms of assemblages also enables us to recognize the relevance of big data—itself a product of sociotechnical processes—in underpinning machine-learning algorithms (Kim/Yun/Oh 2022). Finally, assemblage thinking encourages us to consider the hopes, fears, and 'algorithmic imaginaries' (Bucher 2017; Schellewald 2022) associated with AI.

Following the aforementioned work in each of these fields, I propose the concept of museum-AI assemblages for exploring the ongoing transformations of museums brought about by AI technologies. Museum-AI assemblages are socio-technical ensembles that constitute, stabilize, and transform the constantly changing relations between AI technologies (computer vision, natural language processing, artificial neural networks, et cetera), human beings (museum staff, researchers, IT experts, visitors, users, artists), material objects (historical artefacts, artworks), and real or virtual environments (exhibition spaces, digital archives).

Assemblage thinking will help us to acknowledge the complexity of the sociotechnical ensembles constituted by museum AI. We, however, still need to specify what exactly we want to study when looking at such assemblages. In recent works that apply assemblage theory for empirical research in the social sciences and anthropology, there is no consensus about what exactly one is supposed to study when investigating assemblages. The original assemblage concept was proposed by Gilles Deleuze and Felix Guattari (1987), but it is contested whether they, in fact, provide a full-fledged theory (DeLanda 2006, 3; Nail 2017, 21). Many see the work of Manuel Delanda (DeLanda 2006; 2016), who builds on and extends the work of Deleuze and Guattari, as the first attempt to provide a comprehensive

theory of assemblage—even though some are highly critical of DeLanda's approach (Buchanan 2021). Other authors barely engage with the work of Deleuze, Guattari, and DeLanda, and instead follow assemblage thinking as used in actor-network theory (ANT) (Latour 2005). The latter does not provide a specific theory of assemblages; rather, it integrates the concept into its broader approach. What ANT adds to the original concept of assemblage as proposed by Deleuze/Guattari is therefore not so much a specific set of theoretical concepts—though some authors use ANT vocabulary to talk about assemblages in terms of actor networks—as an extension of assemblage thinking based on its analytical sensitivity to the entanglements and interrelationships of human and nonhuman actors (Bennett 2005). This includes a sensitivity to the fluid transitions between the material and the processual, between stability and transformation, between bodies and practices, and so on. In order to emphasize these fluid transitions, assemblage thinking uses the notion of 'components' to denote any actor or element within an assemblage (Deleuze/Guattari 1987, 347; DeLanda 2016, 1), and I will use this term in the following as well.

Each assemblage constitutes its own individual and dynamic constellation of components, what DeLanda calls the 'identity' of an assemblage (2006, 18–19, 28; 2016, 19–20). An assemblage usually includes other related (and often smaller) assemblages—'at all times we are dealing with assemblages of assemblages' (DeLanda 2016, 3). This means that any assemblage is usually included in larger populations of assemblages that share certain characteristics and similarities (DeLanda 2016, 20–21). A single museum is an individual assemblage, but it is also part of a population of similar assemblages (museums in general) that might or might not co-constitute one or several larger individual assemblages. For example, one could view ICOM as an organizational assemblage that is connected to many individual museum assemblages. Assemblages can be stable for periods of time while remaining in constant flux—which DeLanda, drawing on Deleuze and Guattari, describes as a tension between processes of 'territorialization' and 'deterritorialization' (2006, 22). Although I do not use the latter terms, they are influential for the style of assemblage thinking that I apply in this paper. Essentially, what assemblage thinking offers for my own purposes is that it enables me to consider how AI technologies set in motion a series of shifts in pre-established relations between the components of museum assemblages and to understand the impacts that result from those shifts. One aspect that is central for this purpose, and which is only discussed implicitly by DeLanda (2006, 54–65; 2016, 27, 28), is the constitutive role of routinized practices (Reckwitz 2002). The potential synergies between practice theory and assemblage theory have yet to be fully explored. In essence, routinized practices function as crucial components that stabilize, transform, and shape the relations within a sociotechnical assemblage. They are a binding force that connects other components and often shapes an assemblage's identity in crucial ways.

From Museum Assemblages to Museum-AI Assemblages: The Case of a Museum Chatbot

What constitutes a museum assemblage? The central components of a museum assemblage consist of museum staff, visitors, material spaces, material objects, and assisting technologies (audio guides et cetera). A museum assemblage also depends on further components such as legal guidelines, financing/economy, background infrastructures, and so forth. We can also say that any museum assemblage is constituted by meanings, interpretations, affects, aesthetic experiences, and forms of knowledge and learning. Many more components could be added, and within (human) groups such as 'museum staff' or 'visitors' it would certainly be possible to identify a broad range of subgroups, each with its own particular role to play within a museum assemblage. Specific practices are also key components. For example, the practices of collecting, curating, and visiting the museum belong to any museum assemblage's main routines.

What happens when such an assemblage is now transformed through AI? Here, I would like to focus on one particular example: the case of an AI-based museum chatbot that I came across during my exploratory research. Gaia/Boiano/Borda (2019) have already traced the historical emergence of museum chatbots back to the work of Alan Turing and to early chatbots such as Eliza, developed by Joseph Weizenbaum. Today, museum chatbots are emerging against the backdrop of increasingly sophisticated 'conversational interfaces' (Bunz 2019) such as the well-known Alexa (Amazon) or Siri (Apple). At the same time, they are part of a trend towards 'educational AI' (Krämer 2018).

The observations and analysis I present below are based on visits to the museum that introduced the AI chatbot and on ethnographic interviews with two people, the person in charge of the museum's staff, who helped shape the design of the chatbot, and the technical lead developer. Both interlocutors (who I treat anonymously) have read and commented on this paper and confirmed that my descriptions are an accurate reflection of their own experiences.

The introduction of the chatbot introduced a range of additional components into the museum assemblage. The chatbot itself was a smartphone app that allowed visitors to ask questions about various aspects of the artworks in a contemporary art exhibition. The chatbot responded with mostly accurate and seemingly creative answers, which provided context beyond the information contained in the texts displayed. Its conversational interface was based on natural language processing (NLP) technology, which enables the chatbot to 'understand' spontaneous questions from visitors and provide appropriate answers pre-curated by the museum staff. Around 80 to 90 pre-curated answers were available for each work of art. Some were very informative; others offered fodder for 'small talk', as the lead developer put it. To

develop the answers and the data, the museum hired additional curators with expertise in related fields, along with a team of technical developers.

The app relied on hardware (for instance, visitors' smartphones), the technological infrastructure required for the chatbot (internet, electricity, et cetera), and the data used to train the NLP system. The chatbot's developers worked with museum professionals to conduct test runs of the NLP system and assess what visitors are likely to want to know. The job of the museum staff was to imagine and conceptualize what the chatbot should do and to curate the chatbot's possible responses. The technical developers created and monitored the algorithms and adapted a pretrained NLP system from a large international software company to the purposes of the museum.

Another essential component in the museum-AI assemblage was visitors, the people whose experience the AI system focuses on. They provided some underlying data for the NLP system and feedback for the curators. They also introduced their own 'algorithmic imaginaries' (Bucher 2017; Schellewald 2022) into the assemblage. These imaginaries consist of the specific ways 'in which people imagine, perceive and experience algorithms and what these imaginations make possible' (Bucher 2017, 31).

The final crucial component in the assemblage was the physical space of the museum and the works in the exhibition. During the use of the chatbot, spaces, objects, visitors, and technology interacted to co-constitute an AI-enhanced museum experience.

With this brief description we see how the introduction of a new AI technology is accompanied by a range of new components being added to the museum assemblage. Generally, it is impossible to describe assemblages holistically because they are far too detailed (Macdonald 2009, 131). This is especially true for AI assemblages, which are always changing as AI rapidly evolves. When describing the particular transformations caused by museum AI, we therefore must look more closely at how AI causes concrete changes in individual relations between components. In other words: we need to 'zoom into' the assemblage and pay attention to specific parts.

Zooming into the Museum-AI Assemblage

A typical routine that functions as a constitutive component of any museum assemblage is the practice of visiting a museum space (Davidson 2015; Falk/Dierking 2016). People enter the museum building, encounter exhibits and information, have certain aesthetic and emotional experiences, often acquire knowledge, form opinions, and so on. How does the use of an AI-based chatbot change this fundamental practice?

On first consideration, it might seem that a chatbot would add nothing original or new to the museum experience. Indeed, its use combines different routines that have long been established in many museum spaces. In one respect, it is like an audio guide that provides supplemental information while giving visitors full control over which exhibits they would like to look at. In another, it acts as a kind of docent or well-informed friend to whom visitors can ask questions and receive seemingly personalized answers.

At the same time, I would argue, these established practices constitute, in their combination, a new kind of visiting routine. Ultimately, the aim of the AI chatbot is to provide a highly personalized and, in a sense, highly social visitor experience that does not involve additional costs or time constraints for visitors (provided they have a modern smartphone). The result is a form of visitor experience characterized by what I call AI-mediated sociality, a kind of sociality that emerges through dialogical interaction with a conversational interface.

A detailed understanding of this type of visitor experience would require extensive ethnographic and qualitative research, which I am unable to offer here. Still, the potential ability of an AI-mediated sociality to transform museum visits, and, by extension, the museum assemblage as a whole, should already be apparent on a cursory level. The social aspect of visiting a museum has long been acknowledged as a key motivation for many visitor groups (Davidson 2015, 516; Falk/Dierking 2016, 41). For most visitors, museum chatbots will probably not replace the social experience of visiting a museum with an actual friend or family member. Studies on interactions with conversational AI, such as the chatbot Replika (Skjuve/Følstad/Fostervold et al. 2021), however, show that users can have socially and emotionally meaningful interactions with an AI system. While museum chatbots are not designed to afford a complex, long-lasting social relationship with their users, they are certainly able to integrate aspects of such mediated social and emotional experiences into the museum visit. This raises questions such as: How does the kind of sociality afforded by AI feel for museum visitors? Will AI-mediated sociality make the museum—as argued by Gaia/Boiaono/Borda (2019, 325)—more attractive and engaging? Will human tour guides play less of a role in the future? Could AI-mediated sociality become a factor for professional curators who want to design exhibitions in a way that fosters engaging in dialogue with chatbots? And will AI-mediated sociality ultimately attract new visitor groups?

When talking to the museum expert in charge of my chatbot example, it became clear that the last question was a main motivator of the project. Knowing that many visitors are reluctant to ask questions or engage in conversation with a human tour guide—for fear that their questions or interests might be seen as inappropriate or 'stupid'—the museum's staff hoped that the AI chatbot would prompt visitors to engage more deeply with the exhibition by asking questions and being able to develop and pursue individual interests. In other words, AI-mediated sociality was imag-

ined as a way to circumvent the thresholds connected to human sociality (and human prejudice) and attract groups that would normally not visit the museum.

AI-mediated sociality is not the only transformation caused by the chatbot's introduction into the museum assemblage. As I previously noted, the chatbot does not create its own answers. The answers the chatbot is able to provide are pre-curated by the museum staff. They are intended to provide not only contextual information, but also, as one of my interlocutors in the museum put it, 'interpretation offers'. In analytical terms, these offers can be regarded as 'preferred readings' (Macdonald 2006, 128). Borrowing from Stuart Hall's media theory of encoding and decoding, the cultural anthropologist Sharon Macdonald uses 'preferred readings' to describe the outcome of efforts by human tour guides and curators to control (or at least attempt to control) how certain exhibits are understood by visitors and the meanings they attach to them. When it comes to 'preferred readings' in the context of AI, we might assume that the chatbot simply mediates the long-established relationship between curators and tour guides, who control potential meanings, and visitors, who are offered certain interpretations. But I would like to argue that the chatbot's influence is significant in another way. To understand why, we first need to delve briefly into the process of developing the chatbot.

In the example under consideration, the main purpose of the NLP system was to analyse visitors' textual input and identify what the development team calls visitor 'intents'. These 'intents' were based on a survey in which a diverse group of potential museum visitors were asked to indicate the questions they might have about various artworks in the exhibition for which the chatbot was to be used. The developers then employed this information to identify the intents behind each question. For example, if a visitor asked, 'What is the person in the artwork wearing?', it was assumed that the intent was to obtain a 'definition' of a particular object in the artwork. If a visitor asked, 'Why did the artist focus on the red dress?', it was assumed that the intent was to be given an 'interpretation' of this aspect of the artwork. 'Definition' and 'interpretation' were two of the most important intents. Others were more specific. These intents might be that visitors want to know more about the 'artist's biography', about 'influences from other artists and art forms', about 'other artistic techniques used by the artist', and so on. Intents were combined with a second category called 'entities'. These are usually clearly identifiable features within a painting. For example, in the question 'Why did the artist focus on the red dress?', 'interpretation' is the intent and 'red dress' is the entity. For classification purposes, intents were the more important category.

The technical development team manually mapped hundreds of visitor questions to such intents, creating a dataset to serve as the 'ground truth' for the AI system. The team then taught a commercially available pre-trained NLP system to 'understand' the connections between potential visitor questions and their intents, and to apply this understanding to new questions. The system could then associate a

broad range of questions with one or more intents, and provide a 'confidence score' for each of them. For example, the system might be 87 per cent confident that the question has the intent 'interpretation', and 54 per cent confident that it also contains the intent to discover 'other artistic techniques used by the artist'.

The system uses the list of intents (with confidence scores and the associated entities) to identify what the technical lead developer called the 'right answer' to each question. In technical terms, this is known as 'process flow'. Each process flow leads to a specific 'identifier'. Take, for example, the question, 'Why is the woman in the artwork wearing a red dress?' The system would likely identify the intent as 'interpretation' (with a high confidence score) and the entity as 'red dress'. This would lead directly to the identifier 'interpretation_red_dress'. The identifier then triggers a response from the chatbot. It provides a text, pre-curated by the museum staff, that elaborates on possible interpretations of the red dress.

In doing so, the developers, however, had to make normative decisions about what kinds of questions might be asked and successfully answered in the first place. This process was based on a collection of questions posed by actual visitors. But the crucial step was for the technical development team to assign 'intents' to each question, and to leave the further understanding of these intents to an AI-based system trained in a commercial environment that even the chatbot's technical developers could not fully control or understand. That is, the technical developers collaborated with a pre-trained AI system to decide what questions are desirable and 'normal' in the museum space, and they then inscribed those assumptions into the chatbot's algorithm. A question that fell within this expected range resulted in a successful experience, but any question that deviated from this range produced responses such as 'Your question is too long' and 'Please rephrase'. In some cases, deviant questions prompted a restart of the entire conversation. Visitors, therefore, had to comply with the chatbot's affordances if they were to have a successful experience with it in the exhibition.

Expanding now on Macdonald's conceptual approach, I argue that while the museum staff still controlled the preferred readings by means of the pre-curated answers, the chatbot's algorithm and the technical development team defined and controlled preferred intents. The relations between visitors, exhibits, contexts, and meanings were not simply enlarged on by the chatbot in the sense that the chatbot provided personalized information about the exhibits. Rather, to create a successful museum experience, visitors had to allow the algorithm to direct their intents within the museum space. Or, to put it more bluntly: visitors had to play along by developing the kind of intents that the chatbot wanted them to have. Again, we see how the introduction of AI technology shifted key routines and relations in the museum assemblage.

Such transformations ultimately affect the cultural orders established within a museum assemblage, which raises critical questions regarding power. Curatorial

control over a particular exhibition is usually held by museum directors, curators, tour guides, and so on—and it is often guided by explicit or implicit policies, for example, state guidelines and curatorial conventions (Macdonald 2006). In my example of the museum-AI assemblage emerging through the chatbot, there was suddenly a threat to this status quo. Museum staff decided against a version of the chatbot that could create its own answers, even though at the time the chatbot was programmed it was possible to experiment with AI-generated variations on pre-curated texts. The reason was, quite simply, that the director and staff needed to retain curatorial control over the visitor experience. This is not simply because they do not like relinquishing their curatorial authority, but also because of the potentially problematic ethical (and legal) implications of visitors having conversations with an 'uncontrolled' AI chatbot.

But does this actually mean that the balance of curatorial control did not change within the museum assemblage? Talking to the technical lead developer, who is an expert in optimizing commercially oriented chatbots, it became clear to me that the power relationships within the museum had indeed shifted significantly. As I explained above, the chatbot's algorithm constitutes preferred intents, and this part of the software was mainly controlled by the technical development team, while also depending on the infrastructures and affordances of the pre-trained AI system. The complexity of the resulting system left developers struggling to explain to museum staff (and at times to themselves) how exactly the algorithm works. Ultimately, the developers, who lacked formal training in curation, had to make their own decisions regarding the algorithm, directly influencing the visitor experience and shaping what kind of intents were normal and desirable.

For museums, this means that the emergence of museum-AI assemblages requires careful consideration of the shifts in curatorial power relations (see Kidd/Rees 2022, 226). Within these assemblages, developers are not merely technical practitioners who 'do the math'. They exert considerable curatorial authority. The same is true for the influence of the pre-trained AI system that forms the basis for the chatbot's ability to identify intents. At least a portion of curatorial control is transferred to the AI system itself. This is not to say that this development is problematic per se, but, given its implications for museums, it is worth exploring these shifts empirically to gain a better understanding of their consequences.

Conclusion

The aim of this paper was to suggest a conceptual approach that enables us to better understand the transformation of museums brought about by the emergence of AI. I wanted to show how thinking about AI in museums based on the notion of assemblages can raise important questions and guide empirical examinations. Using

the example of a museum chatbot, I considered several transformations within a specific museum-AI assemblage. Firstly, I argued that the museum chatbot affords a change in visitor practices by means of a new form of AI-mediated sociality, and showed that while the role of the chatbot was similar to that of a human tour guide or curator in that it offered preferred readings of exhibits, it also introduced what I call preferred intents. Both AI-mediated sociality and preferred intents are new components in the museum assemblage. Provided that visitors use the new technology, these components can affect the relations between other components—visitors, curators, tour guides, technical staff, exhibits, and the meanings attached to them—and in the process transform power dynamics, shifting significant curatorial control to the technical staff and the AI system.

All of these observations are based on a chatbot that is certainly sophisticated, but also far from exploiting the full potential of AI. With the rapid emergence of large language models (the best known being OpenAI's GPT), museum chatbots will improve significantly over the next few years and be able to provide truly individualized responses. Given the cost-effectiveness of such devices, it is likely that they will soon become a normal part of museum visits. The same is true of other AI technologies, such as systems that help visitors curate their own museum experience, interactive AI exhibits, or new forms of access to digital archives. The use of ethnographic and qualitative methods in investigating such examples could provide important insights into the transformations that museums are currently undergoing due to AI. The approach to museum-AI assemblages introduced in this paper is intended to support this kind of research.

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