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Operative Image Spaces. Navigating Virtual Museum Collections

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Abstract: The mass digitization of museum collections has created global spaces of image aggregation. Transformed into weightless data floating in virtual space, musealized artifacts can now be arranged into navigable landscapes intended to make visible latent relationships of statistical similarity. Thanks to generative AI, datasets of archival images have become a valuable resource for generating new, synthetic images. The paper explores the implications of this operationalization of virtual image archives and asks for possible alternatives.

Keywords: Operative images, museum collections, interfaces, machine learning, generative AI

Espaces d'images opératives. Naviguer dans les collections de musées virtuels

Résumé : La numérisation en masse des collections de musées a créé des espaces d'agrégation d'images à l'échelle mondiale : les objets des musées deviennent des points de données flottants dans l'espace virtuel, qui peuvent être transformés en paysages navigables afin de révéler des similitudes. Grâce à l'IA générative, les corpus d'images d'archives sont devenus une ressource précieuse pour la création de nouvelles images synthétiques. L'article examine les implications de cette opérationnalisation des archives visuelles et s'interroge sur les alternatives possibles.

Mots-clés : Images opératives, collections de musée, interfaces, apprentissage automatique, IA générative

Operative Bildräume. Zur Navigation in virtuellen Museumssammlungen

Zusammenfassung: Die Massendigitalisierung von Museumssammlungen hat Räume der Bildaggregation im globalem Massstab geschaffen: Musealisierte Artefakte werden zu schwerelos im virtuellen Raum schwebenden Datenpunkten, die sich zu navigierbaren Landschaften formen und latente Beziehungen sichtbar machen sollen. Dank generativer KI sind Archivdaten zur wertvollen Ressource für die Erzeugung neuer, synthetischer Bildwelten geworden. Der Beitrag untersucht die Implikationen dieser Operationalisierung virtueller Bildarchive und fragt nach möglichen Alternativen.

Schlüsselwörter: Operative Bilder, Museumssammlungen, Interfaces, Machine Learning, Generative KI

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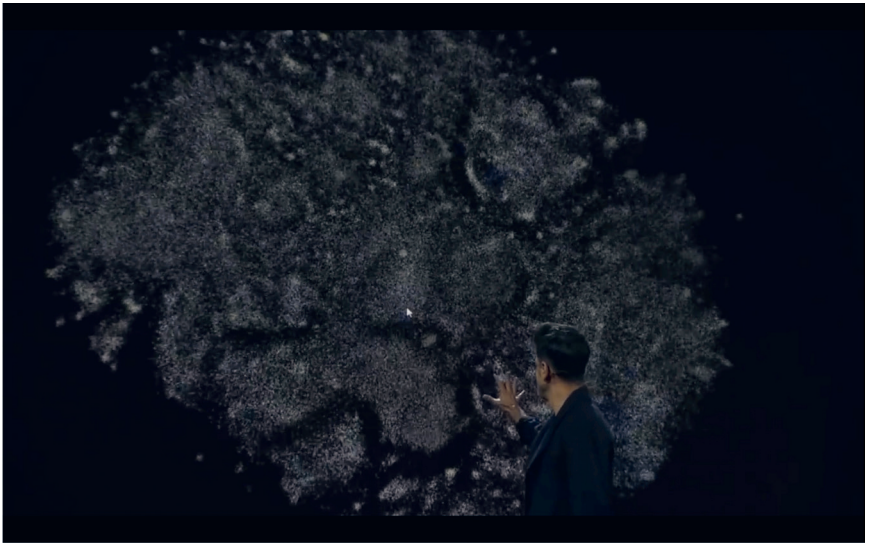
1 Galaxies of Big Visual Data

"[L]et's strip all the meta data" – with this laconic formula, Amit Sood (2016), Head of the *Google Cultural Institute*, introduced one of the most interesting sections of his highly acclaimed TED Talk from 2016. Beforehand, Sood had not only rattled off the impressive figures of Google's global *Art Project* – around 1 000 participating institutions in 68 countries, more than six million digitized artifacts – but also staged what he called a *Cultural Big Bang*: Millions of digital reproductions of artworks from all over the world, starting with the 200 000-year-old so-called *Venus* of Berekhat Ram, filled the vast projection screens behind his back within seconds and formed a galaxy of tiny rectangles in a boundless black expanse (fig. 1). Turned into a galaxy of big visual data, they now could be sorted by year, country of origin, and artist name and arranged into ever new clusters and formations. However, all of this still depended on metadata, the non-visual information added to the digital image files by the collecting institutions in order to describe, classify, and make them retrievable (Rubinstein & Sluis, 2013). But what remained once on got rid of all this metadata? What other possibilities were there for navigating these endless expanses of images?

Sood's answer was, unsurprisingly, machine learning: "[…] let's look at what machine learning can do based purely on visual recognition of this entire collec-

Figure 1 Scene from Amit Sood's TED Talk "Every piece of art you've ever wanted to see – up close and searchable", 2016



Source: Sood 2016, Screenshot 10:05.

tion" (Sood, 2016). Of course, nothing about this is purely *visual*, as computers cannot *see* but are merely trained to compare data sets and calculate probabilities of matches between patterns (From a practical research perspective, see Frischknecht in this special issue). Soods announcement thus aimed at what is known as similarity-based image search: the image information itself, not the textual metadata, should be the key to sorting and arranging large collections of visual data. Once trained, the algorithms could assemble entire image clusters from portraits or depictions of horses alone, regardless of whether this such designations had already been added to the image data. New forms of navigating big visual data, seemingly independent from language, now seemed possible. Sood enthusiastically demonstrated how even one's face could become a search command, as for every facial expression, Google's *Portrait Matcher* would find a fitting counterpart from the digital collection in real time so even the youngest could get excited about portrait collections: "[s]omething fun for kids" (Sood, 2016).

All this is more than a mere gimmick. Instead, Sood's Ted Talk vividly demonstrates how machine learning and pattern recognition are used to design new operative spaces for interacting with virtual museum collections (Pfisterer, 2018). As digitally mobilized, "virtually unlimited populations of images" (Joselit, 2013, p. 13), expansive masses of museum collection objects, largely independent of their specific materiality and mediality, original cultural context, and collection history, coexist here in an otherwise empty, seemingly neutral space of comparison, in which they can be arbitrarily related to one another. This virtual space is presented as a homogeneous, continuous, and navigable space and potentially encompasses the entire history of art as collected and represented in the museums of the – predominantly Western – world. Paintings and sculptures, graphics and photographs, ceramics and design objects, masks and ritual objects are all made equally accessible and controllable to a free-floating gaze, for which they constantly form new clusters, clouds, and networks. Musealized artifacts can now be arranged into navigable landscapes to make visible latent relationships between them. Moreover, they do so in the form of images: rectangular surfaces that can be isolated, mobilized, reassembled, and made operative.

Thus, Sood's presentation also demonstrated how, today, any image could become, or even in a way, *already is* an *operative* or *operational image*.[1] When Harun Farocki (2004) coined this term more than twenty years ago, he had particular examples and social spheres in mind: images of control and surveillance that served defined purposes in limited functional contexts such as the factory, the prison, or the battlefield (see also Pantenburg, 2017). Today, however, as Trevor Paglen (2016),

1 Farocki's German term "operative Bilder" has been translated as both "operative" and "operational images". I have chosen to use the term "operative" in this essay to emphasize that such images, image ensembles, and image spaces are not only part of operations, but actively facilitate and perform various operations.

Hito Steyerl (2017), Jussi Parikka (2023), as well as myself (Meyer, 2021) and others have noted, operative images have become ubiquitous. Any image circulating in digital networks can – and most likely will – become "part of an operation" (Farocki, 2004, p. 7), an element in automated operational chains of data processing. And that includes more and more images of the past: The mass digitization of museum collections has created global virtual spaces of image aggregation and comparison, enabling new forms of image processing and even production. Virtual image archives have turned into what, drawing on Farocki, I would like to call *operative image spaces*: virtual spaces visualized through digital interfaces, in which images are mobilized, arranged, and re-arranged, and facilitate image operations such as analyzing, searching, and comparing. What interests me in the following essay, however, are less these image operations themselves and rather what Laliv Melamed (2021) has called "operative imaginaries" – in this case, the ideas of overview, access, and control, of availability, searchability, and even exploitability that manifest themselves in such interfaces.

Operative imaginaries are inseparable from image operations, in some respects even emerge from them, but at the same time go far beyond them. They are the totalizing ideological fantasies generated by technological possibilities, fantasies that often ignore the all-too-real limits of actual technologies while simultaneously drawing on culturally well-established metaphors and reactualizing much older cultural phantasms. These fantasies are not simply the product of already existing technologies, but guide and steer technological development in a certain direction. Image search, for example, is a very specific image operation that can be performed with different means and results depending on technical possibilities, infrastructural conditions, and specific needs (Thürlemann, 2024). However, Sood's idea of a boundless space in which every image ever made becomes searchable and comparable transforms searchability into a spectacle and creates the image of a total archive that resonates with a long Western tradition of thinking about archives and archiving.

The archive, being both a concrete institution and a general cultural function, seems to be an eminent site for operative imaginaries to emerge. In a very concrete sense, as Derrida famously analyzed, every archive is subject to "the principle of consignation, that is, of gathering together", which "coordinate a single corpus, in a system or a synchrony in which all the elements articulate the unity of an ideal configuration" (Derrida, 1996, p. 3). In this sense, the archive is both a concrete place where a specific corpus of elements is collected and ordered, and a series of operations that enable the collection, classification, and cataloguing of these elements. Beyond all individual, localizable and limited institutionalized archives in the plural, however, the idea of the archive in the singular also refers to a structural condition of cultural memory as a whole, most famously developed by Michel Foucault, for whom the archive is not a physical place, but a historically contingent system of knowledge that determines what can and cannot be said (Foucault, 1972). More

recent theories of the cultural archive, such as those of Aleida Assmann (2008) or Boris Groys (2021), move between the institutional and structural senses of the term, describing the archive as a kind of totality of all that a particular culture has chosen to actively remember – or at least not to forget. Thus, while archiving is rooted in concrete practices and operations and tied to specific places and social spaces, the idea of the archive always transcends the limits of the institution, generating all kinds of archival fantasies and, ultimately, operative imaginaries.

Furthermore, archives, like museums, libraries, and other institutions of cultural memory, are spaces whose everyday operation depends on spatialized addressing and retrieval systems maintained by indexes, catalogues, and databases – in a sense, they have always been datafied spaces (Krajewski, 2011). While in traditional archive spaces every addressing system ultimately referred to the physical location of the stored elements and collection objects, the mass digitization of collections and the emergence of cross-collection platforms such as *Google Arts & Culture* has fostered a virtualization of the archive in which the retrievability of collection objects as data objects has largely detached itself from their physical location (Henning, 2011). As the introductory example has shown, these new virtual collections, which are composed of data objects originating from physical collections scattered around the world, are nevertheless imagined in spatial terms – their forms of organization are represented as virtual topologies, and the operations made possible by them are visualized as explorations and journeys navigating through virtual landscapes. This raises the question of what these virtual spaces represent, what implicit values, ideologies, and cultural fantasies are inscribed in these forms of representation and, ultimately what alternatives seem possible. If operative image spaces manifest the dominant cultural fantasies of what big visual data is and what it means, could it be possible to image different ways of dealing with large, digitally mobilized collections of visual data?

In the following essay, I will discuss some examples of experimental interfaces that show how operative images have become prominent in visualizing and making accessible large virtual museum collections. In each case, I will not only emphasize the technical conditions of these interfaces, but also ask about the metaphorical spaces they open up, the ideological promises they make, and the perspective on collections they manifest. In the first part, I will focus on new forms of search and retrieval based on machine learning and pattern recognition, drawing on the idea of a *latent space* that aggregates all possible images and cultural artifacts in an abstract, statistical space comparison. In the second part, I will try to show how this idea of a latent space connects contemporary collection interfaces with the ideas behind current generative AI – and how both model collections of large visual data as repositories and resources to be appropriated, mined, and exploited. In the third and final part, I will discuss a recent example of a cross-collection database that I think can give us some clues as to how we can move beyond this extractive logic of the operational image spaces discussed earlier.

2 Models of Latent Space

Operative image spaces that assemble seemingly weightless and placeless museum artifacts in the form of decontextualized image data have become almost a standard interface for visualizing extensive collections. One current example of this trend is the *bauhaus infinity archive*, an interactive installation that promises virtual access to around 15 000 collection objects during the temporary closure of the Bauhaus Archive Berlin. Again, this vast collection is visualized as a galaxy of digital images floating in an endless black universe: an explorable, navigable, immersive three-dimensional image space made up of seemingly immaterial objects, waiting to be sorted and rearranged into clusters following the user's commands. Designed by the renowned Berlin Art+Com studios, the installation allows users to navigate the collection by drawing lines on a pad or selecting colors from a menu, making visible new, supposedly before unseen connections between collection objects based on pattern recognition.

As the designers explain in an interview, the precondition for this is a specific form of virtual spatialization that goes beyond the mere interface:

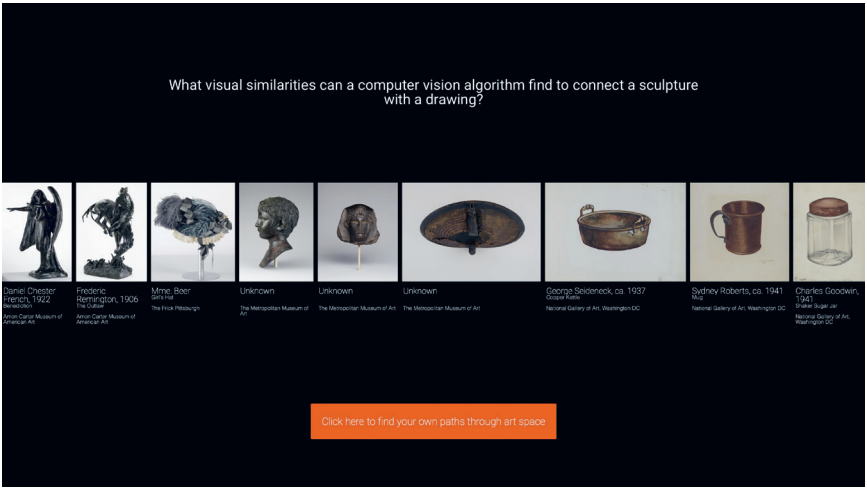
> *The images are initially vectorised using a convolutional neural network, i. e. translated into sequenced group of numbers – a so-called vector. After the images are vectorised, an algorithm called UMAP processes the dataset. This ensures that each vector, and with it, each picture is assigned a position in three-dimensional space. The result is a spatial depiction of the images, arranged in visually similar groups which the visitors can experience live in the bauhaus infinity archive.* (Brafa, 2022)

As this statement makes clear, the spatial visualization the users explore via the interface is a three-dimensional representation of the high-dimensional vector space by which these images are internally processed. Virtual spatialization is thus not merely a form of representation of big visual data intended for human eyes but also lies at the conceptual core of how contemporary forms of machine learning and pattern recognition make similarities within large data sets operative. When deep learning algorithms are trained on vast quantities of digital objects such as images, the features abstracted from these objects are encoded in a so-called latent space, a multidimensional vector space in which similarities between two images, be it in form, style, color, or any other aspect, are represented as quantifiable proximities (Somaini, 2023, p. 77).

While such latent spaces themselves are abstract, purely mathematical, multi-dimensional, and therefore not only invisible but ultimately impossible to visualize, three-dimensional interface visualizations such as the *bauhaus infinity archive* function as models of latent space as a symbolic form. Radically reduced

in their dimensions and made accessible to the human eye in ultimately diagrammatic form (Hunger, 2023), such visualizations of mathematical relationships and statistical distributions as spatial patterns nevertheless convey essential aspects of latent spaces: homogeneity, quantifiability, and continuity. Firstly, by staging the virtual image archive as a homogeneous space of universal comparison, in which all differences of media, genre, dimension, format, and cultural context are erased, these operative image spaces reflect the technical requirements of machine learning algorithms, which reduce all realized objects to a matrix of pixels, ultimately a series of numbers indicating color values. Converted into a table of discrete values, each digital image can be described as a vector in high-dimensional coordinate space, and its relative position in this space provides information about its relationship to other image vectors. Therefore, and secondly, such relationships between digital images, be it formal similarities, or, at least in some cases, iconographic references, can also be represented spatially as quantifiable proximities and distances. The closer two images appear in these spaces, at least in a certain dimension, the more similar they are said to be. Similarity, once an elusive category, thus seems to become measurable (see Hoggenmüller and Klinke in this special issue for more details). Thirdly and finally, these spaces are not only discretely addressable but also designed to be (almost) continuously navigable – from one image to another, there is always a path to follow, and each image is connected to every other image by a chain of similarities.

Figure 2 Mario Klingemann and Simon Doury (Google Cultural Institute), X Degrees of Separation, 2017 (Screenshot)



Source: artsexperiments.withgoogle.com/xdegrees/.

The idea that every existing image is just one link in a chain of similarities is maybe best illustrated by *X Degrees of Separation* (2016), an experimental collection interface designed by artist Mario Klingemann in collaboration with the Google Cultural Institute. Its stated aim was to playfully explore similarities in a collection of over 250 000 image data objects. From each object, a path of visual similarities to every other object was to be found or constructed. All these paths, it is suggested, coexist in a common "art space".[2] In contrast to the previous examples, this space is not visualized as a three-dimensional, perspective space but nevertheless forms the conceptual basis of the entire undertaking. Imagining a path leading from one object to the next only becomes plausible by spatializing similarities and differences between entirely different and physically unrelated objects. However, the supposed similarities that are traced here, for example, between a bronze sculpture and a watercolor drawing (fig. 2), are primarily those between digital image data, not between the actual objects themselves. Thus, a light background can sometimes be part of an artistic concept, as in the case of a watercolor drawing, in other cases it can simply be an arbitrary feature of the standardized photographic format of museum collection documentation. Similarity, abstracted from any context and reduced to a mere statistical proximity between flattened, standardized, pre-formatted digital representations, threatens to become an almost meaningless category (Wasielewski, 2023). Nevertheless, it is also becoming a productive category, as latent spaces are not only used to compare, sort and classify big visual data using discriminative AI such as pattern recognition algorithms, but also form the core of what is now known as generative AI.

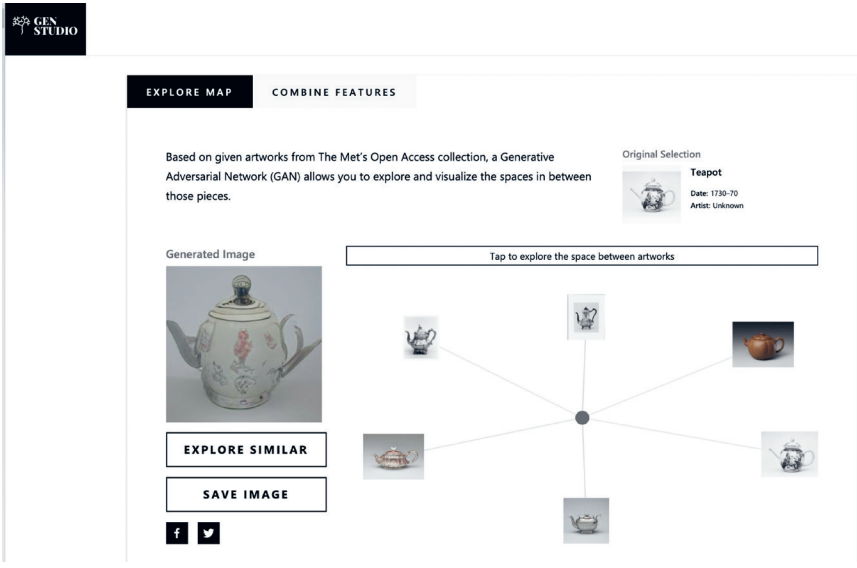
3 Generative Spaces

Ultimately, the idea that all images coexist in a homogeneous, quantifiable, and continuously navigable space of universal comparison also blurs the difference between the actual and the virtual. If every possible image occupies a specific position in latent space and there are always countless other images to be found between two actual images, what seems more tempting than trying to visualize these latent, potential, only virtually existing images? This was the idea behind *GenStudio*, an experimental interface launched in 2019 by the Metropolitan Museum in collaboration with Microsoft and MIT. This interface goes beyond simply navigating existing collections. It uses an early form of generative AI to create purely synthetic images from the collection data that do not resemble any pre-existing artifacts. However, this synthesis is understood as an exploration of a new, previously unexplored space: "Based on given artworks from the Met's Open Access collection, a Generative Ad-

2 https://artsexperiments.withgoogle.com/xdegrees/ (19. 12. 2024).

versarial Network (GAN) allows you to explore and visualize the spaces in between those pieces" (Fenstermaker, 2019). However, this space *in between* is not a space between physical objects in the collection, for example, between different historical teapots (fig. 3), but an imaginary space of mere statistical possibilities. The old universal museum's imperial claim to all-encompassing representation thus becomes a technical utopia, the empirical space of the collectible expands into a statistical space of endless possibilities, and digital representations of collection artifacts become a resource for generating ever-new variants of images.

Figure 3 Metropolitan Museum and Microsoft, GenStudio, 2019



Source: https://microsoft.github.io/GenStudio/.

Since OpenAI's Dall-E 2 in 2022, a wave of new generative AI models for image and even video synthesis has emerged, making GANs like the one used in the example above look old-fashioned by comparison (Wilde, 2023). While GANs have typically been trained on limited databases of thousands or tens of thousands of pre-selected images, so-called foundation models such as Dall-E, Stable Diffusion, or Midjourney are trained on billions of image-text pairs harvested from all over the web. Moreover, while GANs only reproduce and synthesize recurring visual patterns found in the training data, these models learn relationships between images and their surrounding text to transform written prompts into visual images. Despite these and other fundamental differences, all these forms of generative AI are based

on similar conceptual premises: the spatialization of similarities and the creation of a homogenized, quantifiable, and continuously navigable operative space of possible images, in which all images, regardless of format, style, origin, and materiality, virtually coexist. From the perspective of these models, every image they are able generate – which is, of course, not every possible image, as these models are highly biased and ultimately limited by the boundaries of their training data – already exists as a potential image within these latent spaces, as do all the images, albeit in a compressed and abstracted form, with which they have been trained. In other words, for these models, any imaginable image – and again, the realm of the imaginable may seem endless but is, in fact, limited, incomplete, and distorted – is just one more or less probable variant in an endless chain of variations (Meyer, 2023).

Figure 4 OpenAI, Dall-E 2, 2023

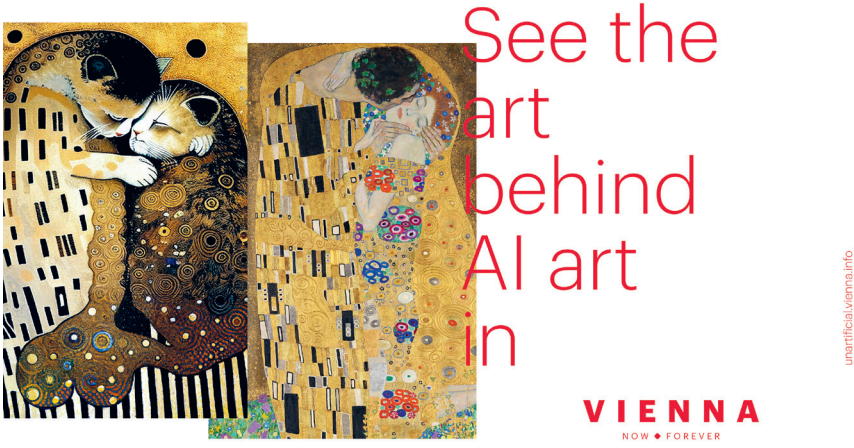
DALL·E 2 can take an image and create different variations of it inspired by the original.

Source: https://openai.com/dall-e-2.

In fact, variations *inspired* by the original was one of the first features announced when Dall-E went public in 2022. On its website, Open AI showed a series of variations of George Seurat's famous pointillist painting *Un dimanche après-midi à l'Île de la Grande Jatte* (1884–86) as a demonstration (fig. 4). These pictures are not simply collages or remixes. Rather, they are interpolations in which the virtual image archive of existing images is used as a source of data points and machine learning is supposed to fill the gaps between them. Such AI-generated variations

are already used by museums as a form of marketing. In 2023, the Vienna Tourist Board presented an advertising campaign entitled *UnArtificial Art*, which featured AI variations of famous artworks by Gustav Klimt, Egon Schiele, and others, all now turned into cat content in their respective styles (fig. 5). As they stated on their website, "AI mines vast repositories of existing artworks for data before replicating their substance and style. So, you could say it was era-defining artists like Klimt (a huge cat fan, by the way) and Schiele that made AI artworks possible in the first place" (Vienna Tourist Board, 2023). The "value of the archive" (Meyer, 2023) is fundamentally redefined here – the art of the past becomes a resource of styles to be mined and fuel the production of ever new variants. But before Klimt and Schiele could "teach artificial intelligence a thing or two" (Vienna Tourist Board, 2023), their paintings first had to be digitally reproduced and converted into training data, transformed from individual masterpieces into vectors and data points in a huge latent space of billions of images. In these latent spaces, virtual and actual Klimts or Schieles, what they actually painted and what they could have painted potentially, coexist as equally possible variations of patterns, and what makes them images *in the style of* Klimt or Schiele is that their relative proximity in the latent space.

Figure 5 Campaign UnArtificial Art, 2023 © ViennaTouristBoard



Source: https://b2b.wien.info/de/see-the-art-behind-ai-art-klimt-sujet-451836?view=asDownload.

As already stated, the invisible, multidimensional latent spaces of generative AI should not be confused with the three-dimensional galaxies of images spaces visualized in interfaces such as *bauhaus infinity archive.* But despite their differences in complex-

ity and function, all examples discussed so far ultimately share the same operative imaginary of seemingly unlimited access and control. Thus, it is no wonder that in a video Open AI produced to explain how Dall-E 2 was trained, they used almost exactly the same kind of imagery: a boundless black galaxy of free-floating images arranged into clusters and forming networks of relations.[3]

Models such as Dall-E, Midjourney and Stable Diffusion are a manifestation of a very specific, contemporary understanding of virtual image archives as both navigable spaces and exploitable resources. In this respect, they are more than just another tool for image production. Rather, they are the medium through which we negotiate what it possibly means to produce new images when almost every conceivable future image already seems to exist as a statistical possibility in a latent image space spanned by images of the past. In some ways, image generation by generative AI is indistinguishable from image search. When you enter a prompt into Dall-E, Midjourney, or Stable Diffusion, the software treats it less as an instruction to be executed and more as a search command that guides the model to a particular result – not unlike searching a database or catalogue, although you are not searching a collection of pre-existing images, but a latent space of possible images (Meyer, 2023).

This latent space of possible images is, however, completely defined and determined by images already existing: the billions of training images scraped from the web and used for training these models. The underlying archival fantasy of generative AI is that there is no outside of the archive: Everything can be created, can be interpolated from what is already stored and made accessible. This totalizing fantasy of an archive without outside, in some way or the other, connects all examples mentioned so far, from Sood's *Cultural Big Bang* to the generative spaces of today's AI models. It builds on and ties in with a second fantasy: that the virtual collection objects do not represent physical objects in specific institutions with their own concrete history but stand for themselves as the main object of interest. Only as data objects can all these diverse pictures and artifacts become the object of operations of comparing, ordering, interpolating, and synthesizing – operations that would be impossible with physical collections. Far from being a mere double of physical collections, a deficient copy, or mere add-on, virtual image archives have become, as big visual data, a valuable resource to be mined, mobilized, and monetized (Allert & Richter, 2018).

4 Beyond Extraction

With the progressive transformation of virtual image archives into an exploitable data resource, image operations tend to focus less and less on the individual image

3 https://openai.com/dall-e-2 (19. 12. 2024).

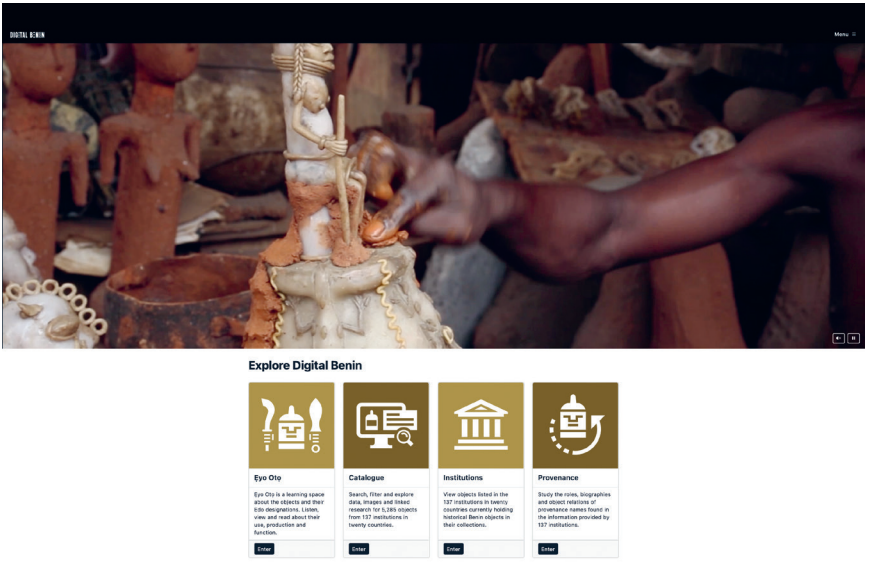
and more and more on the modulation of visual patterns extracted from big visual data. Adrian MacKenzie and Anna Munster (2019) have described this new visual regime as "platform seeing", a form of distributed visuality that emerges from the mass acquisition, accumulation, and operationalization of "image ensembles" through online digital platforms. Experimental museum interfaces serve as a playful introduction to this explorative and exploitative form of access to the virtual image archives aggregated by actors such as Google or Microsoft. Visualized as floating image populations in infinite space, images of the past become a seemingly natural resource that can be appropriated, varied, and transformed at will. Such an operative imaginary of a statistically controllable and sovereignly explorable space of all possible images is by no means harmless. Rather, in these interfaces, a highly ideological dream of overview and control manifests itself, perpetuating the imperial, colonial, and extractivist logic that has already driven the emergence of Western museum collections.

Since the 1980s, Tony Bennett (1988) and many other representatives of critical museology have analyzed how museums, as part of a larger "exhibitionary complex", establish a particular order of visibility, an order in which the world in its entirety is metonymically made present and subjected to a classifying gaze through isolated objects torn from their context of origin and production. Museums, as Ariella Aisha Azoulay (2019, p. 109) has put it, are "worldless depositories" – they destroy the living networks of relationships in which cultural objects were once integrated, reduce them to their collectability and displayability, and replace complex and diverse cultural practices with standardized bureaucratic procedures that are equally applicable to any and all objects (Azoulay, 2019, p. 96). Perhaps there is no better image for these worldless depositories than the endless galaxies of free-floating image clusters offered by Google, Microsoft, and OpenAI: placeless spaces that can be navigated by a disembodied gaze, digital universal museums in the age of data extractivism.

As artist Nora Al-Badri (2021) reminds us, "We live in a post-digital world as much as a post-colonial one", and both perspectives cannot be separated. Thus, regarding the examples presented in this essay, the question arises: What could be possible alternatives to their imperialist, ultimately neocolonial logic? Are there alternative spaces that make virtual museum collections navigable without imagining them as exploitable resources? One potential model could be found in *Digital Benin*, an online project launched in 2022 (Agbontaen-Eghafona et. al., 2022). On the surface, *Digital Benin* looks like a straightforward digital online catalog: via the website digitalbenin.org information on more than 5 000 objects from 131 museums is available for the first time in a common database (fig. 6). And thus, for the first time, the full extent of the looting becomes visible, which the often-used term *Benin bronzes* tends to obscure. Clicking through the catalog, one quickly comes across hundreds of musical instruments, spoons and combs, boxes, containers, and other household objects, in addition to the world-famous bronze heads, relief plates, and

ivory masks. Bringing together information on all these objects, which until now had been difficult or almost impossible to access, was the focus of the project funded by the Ernst von Siemens Foundation, on which a fourteen-member international project team, supplemented by five scientific advisors in Nigeria, Kenya, and the United States, worked for two years. The desire for such a cross-collection overview is decades old (Savoy, 2021, p. 150). Still, the fact that over one hundred museums and institutions from twenty countries cooperated and shared their data would only have been conceivable after the current restitution debate.

Figure 6 Digital Benin, 2023 (starting page)



Source: https://digitalbenin.org.

But *Digital Benin* is much more than just a cataloging project; it is perhaps the most ambitious attempt to date to think about virtual collections in an explicitly non-Eurocentric, or in this case consciously "Edo-centric" way (Agbontaen-Eghafona et al., 2022). In addition to the catalog, the website offers seven additional sections called spaces, which go far beyond the usual logic of museum databases. The space "Ẹyo Otọ", for example, groups the objects along categories that correspond to their original Edo designations. Here, one can not only hear the names of the various object categories read aloud in the language of the Kingdom of Benin, one learns, above all, something about the concrete ways in which the artifacts were used – a contextual knowledge that had been lost with the looting and musealization of the artifacts. In

order to reconstruct this knowledge, the project team not only conducted archival research in Nigeria, but also spoke with a variety of Nigerian experts, curators, historians, and linguists, as well as with craftsmen and artists who continue to produce and use similar objects today. So instead of making publicly available only the incomplete object data that the apparatus of the Western museum deemed worthy of recording, *Digital Benin* lays the foundations for a new, polyphonic, networked, and living knowledge of these objects and their cultural references.

While projects like *Google Arts & Culture* stage an operative imaginary as a spectacle of automated access to resources, *Digital Benin* uses modest technical means to show an alternative way of visualizing virtual museum collections: Instead of projecting isolated data points into a virtual space devoid of context and history, it opens up a multitude of situated and contextualized spaces for interpretation. And instead of nourishing the idea of a totalizing, all-encompassing virtual archive that is seemingly beyond all spatial and temporal limitations and detached from its history of origin, as was the focus of all the examples mentioned so far, *Digital Benin* offers access to historically located collections and the stories hidden within them. Rather than presenting us with an archive without an outside, in which what has already been stored, collected and classified marks the horizon of what can be represented, it strives to map the diverse, dynamic, and constantly growing networks of relationships that connect archived objects with historical events, physical places, and living practices.

When thinking about alternatives to the prevalent representations of big visual data, we have to acknowledge how deeply our operative imaginaries of how to handle, access, and navigate virtual collections owe to the specific presuppositions of Western image cultures. That it is possible to imagine that highly diverse museum objects share the same homogenized virtual *art space* is not least due to the standardized image format that is typical for the photographic recording of museum collection objects: physicality is reduced to a surface, materiality becomes a visual texture, and differences in dimensions, formats, and media disappear. The mass digitization of museum artefacts thus ultimately reduces the diversity of cultural heritage to a set of visual data, a two-dimensional pixel matrix that can be calculated with, and thus establishes a Eurocentric understanding of images as the basis for the supposedly universal comparison of visual similarities (Schröter, 2022).

In order to think beyond operative image spaces, therefore, we need a politics of digitization that does not simply extend the imperial and colonial logic of the universal museum to virtual space but radically breaks with its underlying ideological premises and operative imaginaries. Instead of sustaining the illusion of a universal, free-floating, disembodied gaze, we need to build interfaces suited to specific needs and interests, reflecting the diversity of subject positions and personal as well as collective histories. Instead of imagining new, seemingly neutral spaces of universal comparison, we need situated, specific and diverse spaces in which we can confront

virtual objects in all their complexity and levels of meaning. Instead of reducing any artifact to its standardized digital representation, we need forms of digitization that acknowledge that any representation is already an interpretation. Instead of mere technical standards, we need an awareness that data is always political, that its production is the result of historically situated decisions, and that it reflects power structures and should be, in principle, open to discussion and revision. Instead of homogeneous, quantifiable, and continuous operative spaces, we need to open up diverse and contradictory discursive spaces for debate and dissent and say goodbye to false promises of complete overview and universal access.

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