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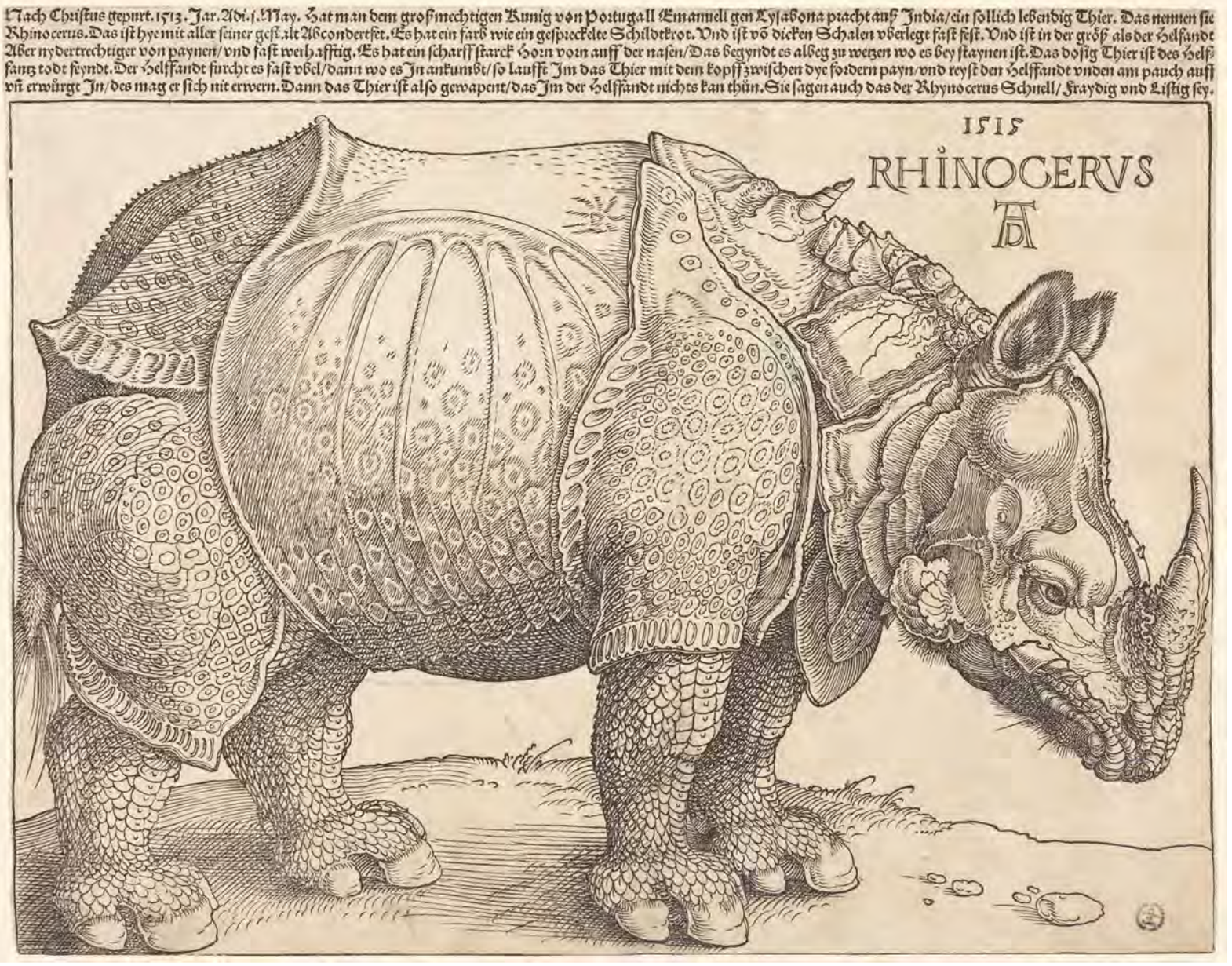

Figure 1.
Albrecht Dürer, *The Rhinoceros*, 1515, woodcut on laid paper. Courtesy National Gallery of Art, Washington (Rosenwald Collection).

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From Dürer's Rhinoceros to AI Image Diffusion Models

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Abstract: The article explores the intersection of artificial intelligence (AI) and image creation, comparing the advancements in AI image diffusion models like OpenAI's DALL-E 2 with Albrecht Dürer's iconic 1515 woodcut of a rhinoceros. It discusses how both Dürer's artwork and AI-generated images challenge traditional notions of knowledge production and representation. Dürer's rhinoceros, produced from textual descriptions without direct observation, is paralleled with modern AI's ability to generate images based on vast datasets. The article examines the historical significance of the rhinoceros as a symbol of early globalization and the Anthropocene, together with the societal, epistemological, and environmental dilemmas posed by AI's rapid development. By drawing such parallels, the complex relationship between technology, art, and the representation of the world is highlighted, emphasizing the implications of AI in reshaping our understanding and documentation of reality.

Keywords: AI, classification, Dürer, episteme, representation, rhinoceros.

Introduction

This article situates the present condition of an emerging infrastructure of artificial intelligence (AI) within wider considerations of archive, epistemology, and creative practice. Over the course of the twentieth century, AI research experienced many 'winters', whereby the lack of progress and seeming dead-ends led to the drying up of funds, prompting a precarious boom/bust cycle. At the time of writing, however, AI is widely acknowledged to be experiencing something of a boom, with many advances shifting into commercial domains. As Jack Clark, co-chair of Stanford University's annual A.I. Index Report, puts it: 'It feels like we're going from spring to summer. In spring, you have these vague suggestions of progress, and little green shoots everywhere. Now, everything's in bloom' (cited in Roose, 2022).

A particular focus here is the rapid development and deployment of large language models, notably OpenAI's GPT-3 and ChatGPT-3, which underlie the use of new AI 'image diffusion' models such as OpenAI's DALL-E 2, Google's IMAGEN and smaller scale/open access models including Midjourney, Nightcafe, Starryai and Dalle-mini (the list is growing all the time). To situate these technologies with respect to the longer-term conditions of the (re-)production of knowledge, we turn to historical precedents, specifically the case of an artwork known as Dürer's *Rhinoceros* (1515), which, not dissimilar to contemporary image diffusion models, was fashioned from text and image *prompts* (rather than a real, empirical rhinoceros). Dürer's woodcut was a by-product of a 'Golden Age' (from the late-fifteenth to the mid-sixteenth centuries) which saw the rise of Portugal as an ambitious, confident and economically strong seafaring and trading nation. Today, the surfeit of AI generated texts and images are another kind of by-product, which, while playful, pose significant epistemological, societal and environmental dilemmas.

Wretched Rhinoceros

The story of Dürer's famous woodcut *Rhinoceros* (1515) (Figure 1) is well-known: in May 1515, a live Indian rhinoceros arrived in Lisbon as a diplomatic gift to King Manuel I of Portugal, from Sultan Muzafar II of Gujarat. Reported to be the first rhinoceros to set foot on European soil since Roman times[1] , it was exhibited in Dom Manuel's menagerie, where it was diligently studied by scholars. The rhinoceros was then sent to Rome as a gift to Pope Leo X, but sadly perished when the ship carrying it sank off the coast of Northern Italy (Dackerman, 2011; Monson, 2004). Indian rhinoceros are good swimmers, but the animal was chained to the deck and had no chance of survival.

The arrival of the rhinoceros in Lisbon was symbolic of the growth of knowledge production, exploration and discovery. It happened at a time of significant and curious zoological discoveries and was a powerful symbol of the Early Modern, pre-Enlightenment period, which we can now define as an early period of globalisation, especially for the seafaring Portuguese nation. Lewis and Maslin perceive these early 'trans-oceanic exchanges', the transportation of crops and animals (and also the accidental movement of earthworms, for example, and pathogens), as 'a swift, ongoing, radical reorganization of life on Earth without geological precedent', perhaps marking the beginning of the Anthropocene in 1492, with what they call a 'collision of the old and new worlds' (2015, pp. 172-75). This period in Portuguese history was far from beneficial for the whole nation. A growth in population, deforestation of woodlands used for communal foraging, and the loss of marsh land for hydraulic projects, led to shortages of food and basic commodities, hitting the rural population hard (Disney, 2009, pp. 145-146).

Translation of Dürer's description accompanying his print: On 1 May 1513 [this should read 1515] was brought from India to the great and powerful king Emanuel of Portugal at Lisbon a live animal called a rhinoceros. His form is here represented. It has the colour of a speckled tortoise and it is covered with thick scales. It is like an elephant in size, but lower on its legs and almost invulnerable. It has a strong sharp horn on its nose which it sharpens on stones. The stupid animal is the elephant's deadly enemy. The elephant is very frightened of it as, when they meet, it runs with its head down between its front legs and gores the stomach of the elephant and throttles it, and the elephant cannot fend it off. Because the animal is so well armed, there is nothing that the elephant can do to it. It is also said that the rhinoceros is fast, lively and cunning. https://www.britishmuseum.org/collection/object/P_1895-0122-714 [Accessed 16 November 2022].

A newsletter containing a drawing and a description of the rhinoceros was sent from Lisbon to Nuremberg, where Dürer lived and worked, acting as a significant prompt for his woodcut. The original text is lost, although Dürer includes a text at the top of his print (Figure 1). Dürer was an exceptional draughtsman, successfully using orthographic techniques to transfer three-dimensional objects into flat space. His observational accuracy is apparent in his drawings of bats, hedgehogs, owls and squirrels, but since he could not observe the rhinoceros, he had to piece together the little information available. Nonetheless, *Rhinoceros* began as a detailed and precisely rendered drawing, if not anatomically correct (Figure 2). He depicted the animal as having overlapping, riveted sheets of what resembled armour plating, scaly skin, and a small horn at the top of the neck, 'which puzzled naturalists for centuries afterwards' (Monson, 2004, p. 51). The drawing also incorporated a text similar to the one on the woodcut. Jesse Feiman notes that the text, like the drawing, 'presented the animal as an aggregation of attributes' (2012, p. 23).

Virtual Animals

The drawing from the newsletter, though lacking in detail, had been done from life and would have had a significant effect on the way that Dürer depicted the animal. His woodcut has the recognisable shape of a rhinoceros that could not have otherwise been imagined and would have been hard to convey in language alone. Without the drawing, *Rhinoceros* might have been completely off the mark; more akin perhaps to the *virtual* animals created today by contemporary AI tools[2]. A blogpost by HungryMinded (2022), demonstrates how dictionary descriptions of animals fed into an AI image generator can produce wholly inaccurate results. A rendition of a hippo (using the prompt: 'A large African animal with a wide head and mouth and thick grey skin') (Figure 3) produces what which looks remarkably like an elephant, while the description of an elephant ('A very large wild animal that lives in Africa and Asia. It has thick grey skin and a very long nose called a trunk') resembles a hippo (Figure 4). Further experiments include a dog ('An animal kept as a pet, for guarding buildings, or for hunting') (Figure 5) that has a type of ammunition belt around its neck, echoing Rhinoceros' armour plating, as well as Pliny's description of the fight with the elephant.

The brief, modern dictionary descriptions used by HungryMinded have their root in the classification of animals and plants that reached its peak in the mid-eighteenth century, with publications such as Georges-Louis Leclerc de Buffon and Louis-Jean-Marie Daubenton's *Histoire naturelle, générale et particulière, avec la description du Cabinet du*

Figure 2.
Albrecht Dürer, *Rhinoceros in profile to left*, 1515, pen and brown ink.
© The Trustees of the British Museum.

Figure 3.
HungryMinded, AI-generated hippo, following the prompt 'A large African animal with a wide head and mouth and thick grey skin'.

Roy, 1758. It is noteworthy that while Daubenton uses concise, scientific description and actual measurement, Buffon embellishes his text, with details that anthropomorphise, adding personality and spirit. By the time *Histoire naturelle* was published, the boundaries between fact and 'literature' were beginning to be tightly controlled by expert voices of the time who demanded scientific rigour. Buffon's textual embellishments, however, undoubtedly added to the 'sense' of the creatures described and were defended by him as a way to boost the popularity and understanding of the natural sciences. (Stalnaker, 2016, pp 37-78).

Between Tragedy and Farce

In thinking of this arch from Dürer's *Rhinoceros* of 1515 to the present-day experiments of HungryMinded, there are deeply woven connections relating to the vast archival 'project' of centuries of collecting, sorting, sharing and storing data. To paraphrase Marx, we seek to make our own history, but never simply as we please; the prevailing circumstances are never fully of our own choosing. Present-day AI text and image generation tools are trained on masses of data produced under circumstances, to borrow Marx's (1977, p.300) words, 'that already exist, given and transmitted from the past. The tradition of all dead generations weighs like a nightmare on the brains of the living'. Marx reminds us of Hegel's remark, 'that all great world-historic facts and personages appear, so to speak, twice. He forgot to add: the first time as tragedy, the second time as farce'. In our current context, 'all great world-historic facts' not only appear twice, but 'infinitely' (through computational means), continually echoing through the massive, yet still narrow lens of a grand digitisation.

The story of the rhinoceros' passage (and ultimate death) might be viewed as tragedy – and as both metaphor and precedent for the globalised, technologically obsessed period we now term the Anthropocene – with the avoidable demise of the rhinoceros as a microcosm of the human destruction of natural resources and the decline in biodiversity. Hungryminded's swift renderings of idiosyncratic, amusing virtual animals – in isolation – might be read as mere farce. Yet, of course, what Marx meant by farce was not without historical weight. The incessant manufacture of today's digital imagery and virtual entities are inevitably 'a nightmare on the brains of the living'. The nightmare is the steady advance of the Anthropocene.

The recent gains in new computational models for AI, notably the rapid development in large language models, require training on terabytes of data, with hundreds of billions, even trillions of parameters, the demands of which keep growing as models seek ever more sophistication. The hidden resource of acres of server farms are required to house not only the plethora of image and video files that AI can now swiftly and automatically output, but also the massive training datasets and its 24/7 computation. Inevitably the resources required have raised serious environmental, economic and political concerns (Bender et al., 2021; Crawford, 2021). As is well-documented, all energies spent have real-world costs. Lewis and Maslin indicate the extent that human action affects non-human life today, with changes in land use and targeted hunting resulting in 'species extinctions some 100 to 1,000 times higher than background rates' (2015, p. 172). It can be noted, at the same time of accessing the imagery of HungryMinded for this article, and concurrent with world leaders attending COP27, harrowing images circulated the World Wide Web showing animal carcasses littering the Kenyan landscape 'as megadrought and climate change collide' (Marcus, 2022).

Total Encyclopaedia, World Brain

The suggestion, so far, is that the AI generation of text and image offers a parallel with Dürer's 'virtual' rendering of a rhinoceros. There are some direct connections with how text prompts the generation of an image, albeit with human and AI techniques operating at different scales. Dürer will have reflected upon his own personal learning and understanding to achieve his aims, whereas AI image generation applications – notably the newer image diffusion models such as DALL-E 2 – generate massive virtual neural patterns (using high dimensional maths to store a huge array of probabilities). From these patterns 'decisions' can be made as to what is the most 'likely' appropriate rendering. In both cases, there is an attempt to render the *most appropriate* image. Yet, for Dürer this is to *imagine* the look of something he has never seen, while for an AI tool it is to achieve an outcome that is *probabilistically* most accurate. Crucially, the latter works upon what is already available in an array of patterns, albeit a massive collection. It is also important to remember, Dürer's scale of working will have been anatomical and figurative.

He was thinking with units of meaning such as limbs, body, head, tail, shading and line, etc., utilising his seeing human's 'mind's eye' (Kleege, 2016, p. 93). The self-supervised AI model, by contrast, has no 'mind's eye' and will not work with any such categories, but instead, due to the enormity of information it can parse and retrieve, and the speed at which it can do so, will locate and operate with its

Figure 4.
HungryMinded, AI-generated elephant, following the prompt 'A very large wild animal that lives in Africa and Asia. It has thick grey skin and a very long nose called a trunk'.

Figure 5.
HungryMinded, AI-generated dog, following the prompt ‘An animal kept as a pet, for guarding buildings, or for hunting’.

own wholly different 'units of meaning', which may coalesce of mere 'clusters' of pixels that the human eye may never notice or be able to see.

At a methodological level different things are at play, yet outcomes can *appear* to be similar. It depends how much of an archive the person (consciously or unconsciously) or the computer is able to access. Dürer was hampered, historically, by the fact he had never seen a rhinoceros. Today, if a child is asked to draw a picture of the animal, they will likely have no qualms, knowing at least vicariously what the task involves (even if their technical ability will likely fall very short of that of Dürer). The images generated by HungryMinded may seem frivolous and wildly inaccurate, yet the text inputs, based on dictionary definitions (excluding any reference to the name of the animal), are extremely abstract (more so than the text Dürer worked from). In this regard, the fact the final images clearly show animal forms (with limbs, body, head, tail, etc.) is not insignificant. Methodologies aside, the key connection is that both AI creations and Durer's woodcut reverse the archival notion of image as data and description as metadata. Text is data, and the image is the metadata that 'describes' it, the 'data about data'. Image and description are always already entwined, and could be considered as equal, but generally the image is perceived as the core element to be considered, even if it comes second in temporal terms.

Regardless of the human or computer generation and operation of data, it is important to recognise that knowledge is *produced* by classification, with the gathering together of knowledge (often specialised) in encyclopaedias; or in the high-dimensional clusters of information of virtual neural networks. What is common to these *practices* of knowledge is the need to rely upon prior information and/or information beyond immediate grasp. Umberto Eco evokes the idea of the 'Total Encyclopedia' to suggest the notion of a 'totality of knowledge' that is always *productive* and in operation:

> I've learned that for a lot of things, I've been used to putting my faith in other people's knowledge. I confine my doubts to some specialized sector of knowledge, and for the rest I put my trust in the Encyclopaedia. By 'Encyclopedia' I mean the totality of knowledge, with which I'm only partly acquainted but to which I can refer because it is like an enormous library composed of all books and encyclopedias - all the papers and manuscript documents of all centuries, including the hieroglyphics of the ancient Egyptians and inscriptions in cuneiform. (Eco 1994, p. 90)

Eco places himself in the 'trust' of the Encyclopedia (with the first letter capitalised to denote its totality), which is not the same thing as it being fully trustworthy. How knowledge (and its discontents) accrues varies and is structured in less than partial ways (more on which below). Nonetheless, the pursuit of a reservoir of knowledge is the connective element at stake here. In a remarkable article in *Science News-Letter*, from 1937, an entity called the 'world brain' (borrowed from H.G. Wells) is discussed, with 'Librarians, scientists and editors, and others who marshal and create the written record of civilisation' bringing together 'the intellectual resources of this planet into a unified system'. In a statement predictive of the World Wide Web, they outline the problem (the answer to which they see as residing in the new technology of microfilm): 'The nuclei of this world brain exist in the various great intellectual centers – the libraries, journals and indices of recorded knowledge – and the task considered is how to exchange and distribute more effectively the past, current and future accumulations in all fields of human endeavor.' It is precisely this 'brain' or network of information that has made possible the massive training of data for AI. Typically, given the media stories that prevail, it might be said AI technology marks a 'break', or, to use Michel Foucault's (2002a) term, a new episteme (i.e., a new way of thinking). To watch the speed and adeptness of an AI application producing highly credible text (even a summary of Foucault's work!), can seem, on the surface, almost 'magical'. Yet, at root, its operation is drawn *through the network* of knowledge, the 'world brain'; through both a temporal and material set of connections.

AI/Episteme

The passage of time marked from Dürer's *Rhinoceros* (itself now a firm fixture of the network) to the contemporary, spans the historical periods recounted in Michel Foucault's 'archaeology' of the human sciences, *The Order of Things* (2002b), in which he charts across three distinct 'epistemes' or ways of organising knowledge throughout history: the Renaissance, the Classical, and the Modern, where every historical period has its own episteme (discourse; ways of thinking), giving order and accounting for shared 'truths' about the world, materially, politically, and philosophically. Thus, he describes the shift from the Renaissance through to the Modern as marked by a series of breaks, from a philosophy (and methodology) of *resemblance*, through the development of mathesis and *classification* (of the Classical period), through to modern systems of representation, whereby 'European culture [invented] for itself a depth in which what matters is no longer identities, distinctive characters, permanent tables with all their possible paths and routes, but great hidden forces developed

on the basis of their primitive and inaccessible nucleus, origin, causality, and history' (Foucault, 2002, p. 274). Our own period is defined by a change to knowledge itself, 'as an anterior and indivisible mode of being between the knowing subject and the object of knowledge' (Foucault, 2002, p. 274).

Criticisms of Foucault aside, not least the contention that historical periods 'break' as the epistemic account suggestions (Merquior. 1991, pp. 62-69), the underlying hypothesis of this article is that the present formation of AI applications *encompass* (and potentially are recursive of) the *long durée* of knowledge production, i.e., *through* its various episteme, through the systems of resemblance, classification, and contemporary metadata. For example, when AI image diffusion models detune (to noise) a wealth of text and image data in order to then generate a whole new image, it is an act of resemblance, albeit one drawn through a massive database and accruing of classifications and dynamic (neural) patterns.

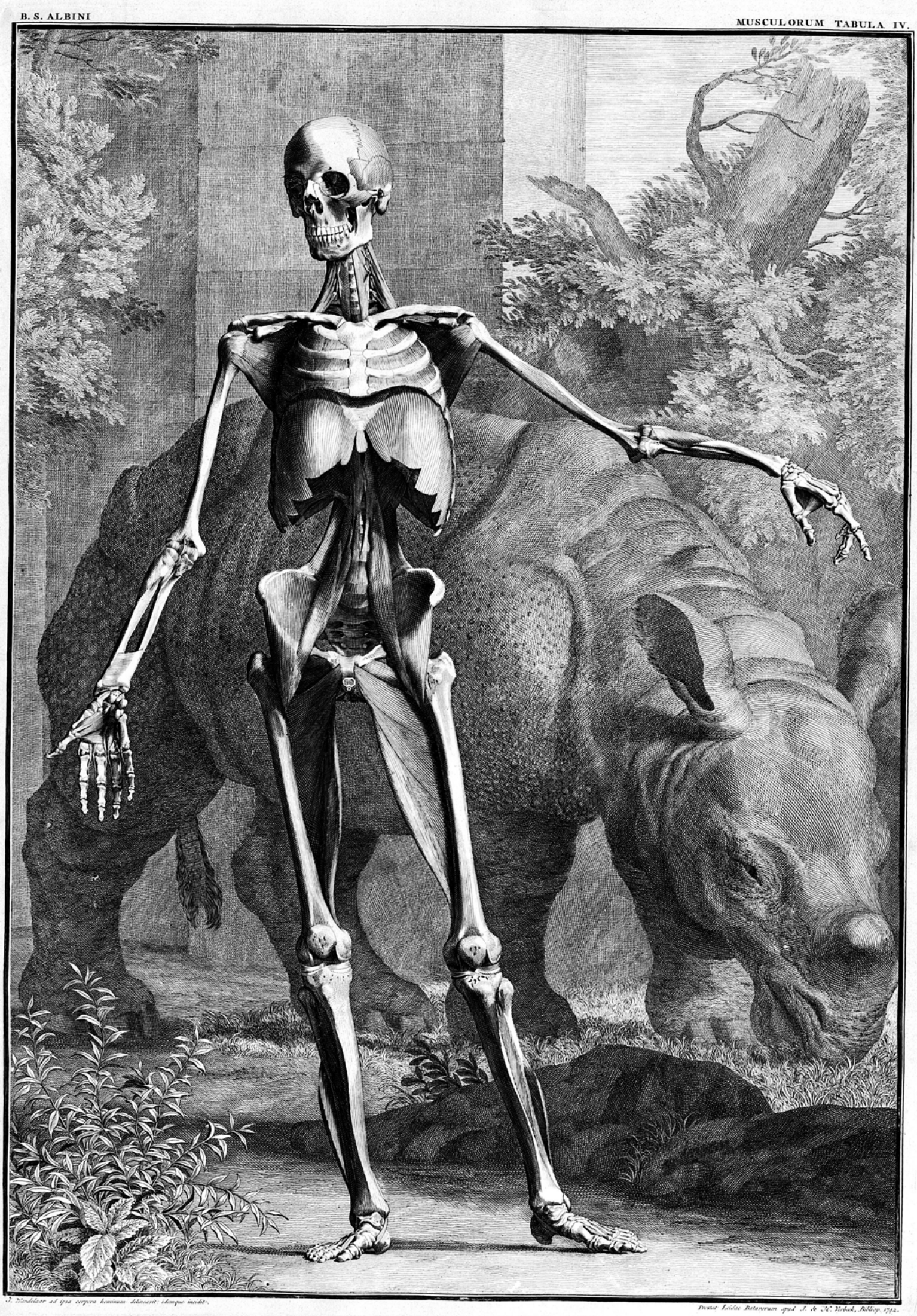
Reports are beginning to emerge that the current stock of language data used to train AI tools 'could run out by 2026, because AIs consume it faster than we produce it' (Stokel-Walker, 2023), which only begs the question: what happens as we now *add* AI generated information to centuries of human and natural history information? As Mirzoeff (2015, p. 17) reminds us, the last European 'who was thought to have read all available printed books was the sixteenth-century reformer Erasmus (1466-1536)', and the explosion of text and image production in recent years is fast outpacing whole centuries' worth of 'data'; '[e]very two minutes, Americans alone take more photographs than were made in the entire nineteenth century' (6). We now need to consider as much the weird and wonderful animals of HungryMinded, as they slink back into the database (not least through articles such as this), further informing our World Brain and Encyclopedia.

At the core of Foucault's *The Order of Things* is a question of both the persistence and fragmentation of knowledge. Every historical period has its own set of underlying epistemic assumptions, which, as noted in Foucault's account, includes the medieval period being dominated by a system of 'resemblance', whereby things were classified based on their perceived similarities and connections to each other. In the modern period, there emerges a system of 'representation', in which things were classified based on their relationship to a pre-existing set of concepts and categories. While much has been debated as to how these different systems emerge rather than 'break', the relatively long periods of time suggest sustained, *dominant* knowledge systems that are formed through and persist as discourse, as regimes of thought. Equally, however, in the modern period, the shift leads to new disciplines and fields of knowledge, such as the natural sciences and the humanities. Arguably, it is the compartmentalising of knowledge through specialisms, which enables significant advances in key areas, including, for example, computer science, leading to our contemporary advances in AI. Yet, as already suggested, with the metaphor of the world brain, recent gains in AI technology are based on the fact that they draw upon the massive corpus of data of centuries (irrespective of epistemic regimes). Operationally, AI could be said to act according to systems of representation *and* resemblance (the latter in terms of matching complex patterns, so seeking out similarities and connections).

Exactitude vs. 'Common' Sense

Returning to the case of Dürer's *Rhinoceros*, it is worth reminding ourselves of its site of production, of its epistemic context. Nuremberg was a significant centre of the nascent printing industry, and the drawing was quickly translated into the more familiar woodcut (Feiman, 2012). The relatively new technology of printing was critical to the notoriety of Dürer's *Rhinoceros*, and to the availability of the newsletter that first prompted the work. The image has persisted over the centuries. Illustrators borrowed from it even after they had seen a live animal and had therefore witnessed the discrepancies in the image. Leanne Ogasawara notes that school textbooks in Germany used Dürer's image to illustrate the rhinoceros until the 1930's (2021, p. 141).

A living rhinoceros ('Clara') came to Amsterdam Zoo in 1741 as part of a European tour. It was drawn from life by artist Jan Wandelaar, using his own orthographical system, for inclusion in Bernhard Albinus' *Tables of the Skeleton and Muscles of the Human Body* (1749) (Figure 6). Unlike Dürer, Wandelaar remains relatively unknown, and we can reasonably conclude that, as well as its wide distribution by print, it is Dürer's reputation that caused his image to endure, carrying more authority than the exactitude of scientific study and zoological actuality that Wandelaar presented. These two factors are undoubtedly contributors to the persistence of Dürer's *Rhinoceros*, but something else is happening that puts aside the conventional desire for accuracy and instead foregrounds the speculative and sensational aspects of the image of this unfamiliar animal: Fieman argues: 'The visual and tactile sensations it evokes are informational, not mimetic' (2012, p. 23). Ogasawara also points out



J. Wandelaar ad ipsa corpora hominum delineavit: idemque incidit.

Prostat Lugduni Batavorum apud J. & H. Verbeek, Bibliop. 1742.

Figure 6.
Bernhard Siegfried Albinus, *Tabulae sceleti et musculorum corporis humani*, 1747. Credit: Wellcome Collection. Attribution 4.0 International (CC BY 4.0).

Figure 7.
Salvador Dali, *Rinoceronte vestido con puntillas*, 1956, bronze, Marbella, Spain. Photograph by Manuel González Olaechea y Franco. This file is licensed under the Creative Commons Attribution 3.0 Unported license.

that 'somehow Dürer's rhinoceros is not only clearly recognizable as an Indian rhinoceros, but it captures much of the spirit of the animal' (2021, p. 141).

Umberto Eco unpicks this further when he identifies what he sees as the *sense* of a rhinoceros in Dürer's work and puts this forward as a reason why the depiction endures. Arguably, the armour and the rivets describe the tough, rough skin better than more recent drawings, or even photographs, which tend to make the skin appear smoother and softer. Eco writes:

> Dürer's graphic exaggeration, which pays excessive and stylized attention to that roughness, would be rather more realistic than the image in the photograph which by convention portrays only the great masses of color and makes the opaque surfaces uniform, distinguishing them by differences of tone. Thus, one could say that Dürer's rhinoceros is more successful in portraying, if not actual rhinoceroses, at best our cultural conception of a rhinoceros. Maybe it does not portray our visual experience, but it certainly does portray our semantic knowledge or at any rate that shared by its addressees. (Eco, 1976, p. 205).

As well as the newsletter from Lisbon, Dürer had sight of a text by Pliny, describing how the rhinoceros could battle an elephant:

> In the same solemnities of *Pompey*, as many times else, was shewed a Rhinoceros, with one horne and no more, and the same in his snout or muzzle. This is a second enemie by nature to an Elephant. He fileth that horne of his against hard stones, and maketh it sharpe against he should fight; and in his conflict with the Elephant, he layeth principally at his bellie, which he knoweth to be more tender than the rest. He is full as long as he, his legges are much shorter, and of the boxe colour. (Philemon (trans), 1601).

The Pliny text does not contain much in the way of *actual* description, rather it is a narrative (echoing Buffon's meanderings) that would add to Dürer's sense of the rhinoceros (and is the source of the phrase on the woodcut, 'The stupid animal is the elephant's deadly enemy'), resulting in 'certain perceptual conditions that photographic reproduction does not convey' (Eco 1976, p. 205). The ancient text could be responsible for the armour that *Rhinoceros* carried, although Dürer lived next door to an armoury and perhaps took inspiration from this as well. We now know what a rhinoceros looks like from photography and film, we can even visit a zoo and see for ourselves. Surprisingly, the list of '7 Images of Dürer's Animals That Are Better Than Trip to a Zoo,' (Stanska, 2022) indeed includes *Rhinoceros*, so it seems that even in the age of internet 'listicles' the image still conveys something that a live animal does not.

The 'sense' of Dürer's *Rhinoceros*, to use Eco's reading, is a cautionary tale. A question arises as to whether we might consider the images of HungryMinded to similarly offer some 'sense' (in both senses of the word). Do these strange and playful images, while far from accurate by any stetch of the imagination, nonetheless relate to underlying cultural conceptions of animal forms? Even if the specific images of HungryMinded do not possess a 'common' sense, they at least stand as a reminder that such sense making is precisely what is at stake in the operation of AI image generation, which is premised upon a vast archive of data and its veritable 'narratives'.

Coda: DALL-E's Rhinoceros

In the preface to *The Order of Things*, Foucault describes how the book 'first arose out of a passage in Borges, out of the laughter that shattered'. This laughter arises from a passage he reads in which:

> […] all the familiar landmarks of my thought – our thought, the thought that bears the stamp of our age and our geography – breaking up all the ordered surfaces and all the planes with which we are accustomed to tame the wild profusion of existing things, and continuing long afterwards to disturb and threaten with collapse our age-old distinction between the Same and Other. (2002, p. xvi).

In keeping with the animal theme of this article, the passage in question quotes from a Chinese Encyclopedia, which offers a rather idiosyncratic taxonomy of animals (including '(a) belonging to the Emperor, (b) embalmed, (c) tame … (k) drawn with a very fine camelhair brush … (n) that from a long way off look like flies'). 'In the wonderment of this taxomony', Foucault writes, 'is demonstrated as the exotic charm of another system of thought, is the limitation of our own, the stark impossibility of thinking *that*'. Today, we must contend with the fact that AI presents us with yet *another* system of thought, which similarly reminds us of our own limitations; that in finding patterns in data that humans would rarely find, it might feasibly locate animals 'that from a long way off look like flies'. What is difficult to determine is what elements of information are persistent, which offer invariance, and what else falls away.

It is well documented that contemporary AI knowledge systems are being produced by classifications that rely

on flawed image identification procedures, built, for example, on pervasive datasets such as WordNet, and subsequently ImageNet. We cannot spirit away the layered quandaries that arise from the labour of unskilled, low paid workers, that underlie the early work in image recognition and image generation, which continue to impact on how images are described, situated, discovered and now produced (Crawford, 2021). Note, however, such flaws and anxieties, whilst complex enough, relate to supervised AI learning. What is even harder to unravel are the flaws, affordances and other patterns that increasingly inform *self*-supervised deep learning systems.

Suggestion has been made here as to why Dürer's *Rhinoceros* persists in our 'matrix' of knowledge, yet this in itself remains only one, brief interpretation. The complexities increase exponentially as we consider the massive datasets and their meanderings (meanderings that, for example, lead to the creations of HungryMinded). The recursivity of AI generation tools seems set to only obfuscate our place in the knowledge:

> When we *make* images, we bring references. When we *look* at images, we make sense of them through references. Those references orient us toward or away from certain understandings. An AI has no conscious mind (and therefore no unconscious mind), but it still produces images that reference collective myths and unstated assumptions. Rather than being encoded into the unconscious minds of the viewer or artist, they are inscribed into data. (Salvaggio, 2022).

Of course, when thinking of knowledge production as a gathering together of documents, there lies the question of whether the rhinoceros – the live animal – can be classed as a document in its own right. It was placed in a menagerie, a forerunner to a zoo (Robovský et al, 2020, p. 452), which is, in common with an encyclopaedia or a 'world brain', a place where knowledge of the world is brought together. Documentalist Suzanne Briet (1951), famously defines the animal when it is brought into a zoo to be a 'document', from which many secondary documents can be produced:

> The living animal is placed in a cage and cataloged (zoological garden). Once it is dead, it will be stuffed and preserved (in the Museum). It is loaned to an Exposition. It is played on a soundtrack at the cinema. Its voice is recorded on a disk. The first monograph serves to establish part of a treatise with plates, then a special encyclopedia (zoological), then a general encyclopedia. The works are cataloged in a library, after being announced at publication (publisher catalogues and Bibliography of France). The documents are recopied (drawings, watercolours, paintings, statues, photos, films, microfilms), then selected, analysed, described, translated (documentary productions). (1951, pp. 10-11).

Based on this logic we perhaps tend to view Dürer's *Rhinoceros* as a secondary document, but, arguably, because it is so far removed from the live animal, we can equally call it a first level document, from which various documents are produced, some of which have been considered here (and which includes this article itself). Whether or not Dürer's image or the AI representations discussed contribute to the production of knowledge in its pure form, they demand thought on how knowledge production works and how knowledge can even be defined.

It is important to remind ourselves of the productive, generative forces aways already inscribed in our interface with knowledge, and which will not always take us in directions we might predict (whether we find ourselves considering animals 'from a long way off [that] look like flies', or appear in new, virtual forms as presented by HungryMinded). The name of OpenAI's DALL-E plays on the name of the artist Salvador Dalí, and in part reflects the surrealist nature of some of the images created, especially early on in its development. But in the case of our rhinoceros, there is a further connection: a reproduction of Dürer's woodcut hung in Dalí's childhood home. He became obsessed by the animal and incorporated it into many of his works, including several paintings and sculptures (Figure 7), and a film (never completed), *The Prodigious Adventure of the Lacemaker and the Rhinoceros*, which Dalí worked on between 1951-62. In 1955, in support of the film, he took a copy of Vermeer's painting *The Lacemaker* (another obsession) to the Vincennes Zoo in Paris, where he painted the horn of a rhinoceros named François, while sitting on a wheelbarrow and balancing a crust of bread on his head. Dalí wanted François to charge at the completed painting and skewer it with his horn, but the rhinoceros would not comply, and the artist had to finish the job himself with a lance (Arbuckle, n.d.). A film of the strange event is available at https://youtu.be/lyPtU8WZD3M [Accessed 22 January 2023].

Dalí was himself an accomplished draughtsman; his images may appear bizarre but his technical skills are never in question. He also had a great interest in science and mathematics, and the geometry of the rhino horn fascinated him, as it grew in a logarithmic spiral. Intriguingly, the phenomenon of the logarithmic spiral, which frequently appears in the natural world, was first described by Dürer in 1525. Today, of course, Dali is himself deeply woven into our cultural logarithms, which then themselves

Figure 8.
DALL-E 2 image, following the prompt: 'Dürer's rhinoceros in the style of a Salvador Dali sculpture'.

perpetuate new texts and images. History, first as tragedy, then as farce, repeats itself, ad *infinitum* (only today, with the advent of supercomputers the near insurmountable calculations are of an increasingly *ordinary* scale).

Notes

[1]In his 1950 essay 'The Classical Rhinoceros', William Gowers explains how the rhinoceros was known to the Greek and Roman world between 300BC and AD250. He argues that it would very likely have been the African rhinoceros, coming to the Roman Empire through Egypt. His hypothesis is backed up by discoveries of early representations of the rhinoceros in Egypt and Sudan, including a rock drawing, situated on a cliff to the west of the Nile.

[2]There are ancient coins depicting the Indian rhinoceros, such as one held in the British museum, minted in India, c. AD 319/20-535 https://www.britishmuseum.org/collection/object/C_1955-0407-1. It is unlikely that Dürer would have seen this or the coins that William Gowers describes (1950, p 69), which circulated in Egypt and then in Rome as early as AD 91.

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Front cover image
HungryMinded, AI-generated dog, following the prompt 'An animal kept as a pet, for guarding buildings, or for hunting'..

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