

# WORKING TITLES

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COMPROMISED VISIONS:

“Lately, she’s been seeing  
things differently”

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# - Making Visible the Invisible - The Art of Seeing Black Holes

Angela Matthies

## Abstract

Lately, she has been seeing what cannot be seen: a black hole. Black holes occupy a central position not only within galaxies and scientific theory, but also in the “optical unconscious” of collective imagination. Any vision of these celestial objects is compromised by their gravity: even light cannot escape past their event horizons. Yet, since 2019 photographs of the invisible have been created by scientific theory, a mechanical eye the size of the earth, and algorithms piecing together a puzzle of pixels. Thus, she is a person, a mechanical eye, a load of data, an algorithmic filter. What she sees: a shady spot surrounded by an orangey circle. What it makes visible: an open question. What is she supposed to be seeing here?

I would like to recover this image of the black hole, again, by looking at and re-reading it through the lens of the internet: a vision of a vision.

My goal is an epistemology of the black hole based on a subjective and situated, yet algorithmic, piecing together of agglomerates of visual and textual information provided by the deep space of the internet: artistic renditions, simulations, explanatory videos, TED talks, metonymy, metaphors, and memes.

This methodology leads to a blurring of the lines between objective and subjective, the intellectual and the sensory, machine and human, specialist and public, and finally: scientific visualisation and the artistic image. The result will be my own vision of a black hole.

## Introduction

It is often said that black holes are invisible. They reflect no light at us, the viewer. An image of a black hole consequently “is one of those great, self-negating concepts, like the sound of silence, the presence of absence or the lives of the dead. The nature of one refutes the other” (Kluger). However, black holes are, of course, highly visible. What can be seen are strange effects in the environment of a black hole due to gravitational lensing, the accretion disk, which is composed of extremely hot gas and matter circling around the black hole at some distance to the event horizon. What can also be seen is the so-called shadow of the event horizon, against this very bright accretion disk.

Then, in 2019, an image was revealed that was described as the “first picture of a black hole” (Event Horizon Telescope, EHT) by Sheperd Doeleman, lead astronomer at EHT. The image became a media and internet sensation, and I became curious what exactly people and I were seeing.

While I was drafting this essay, ChatGPT, a large language module provided by OpenAI, began dominating the headlines. Reactions ranged from the ecstatic to the apocalyptic. I came to believe that my proposed method, to scour the internet and piece together information along some or other algorithmic function to answer the question:

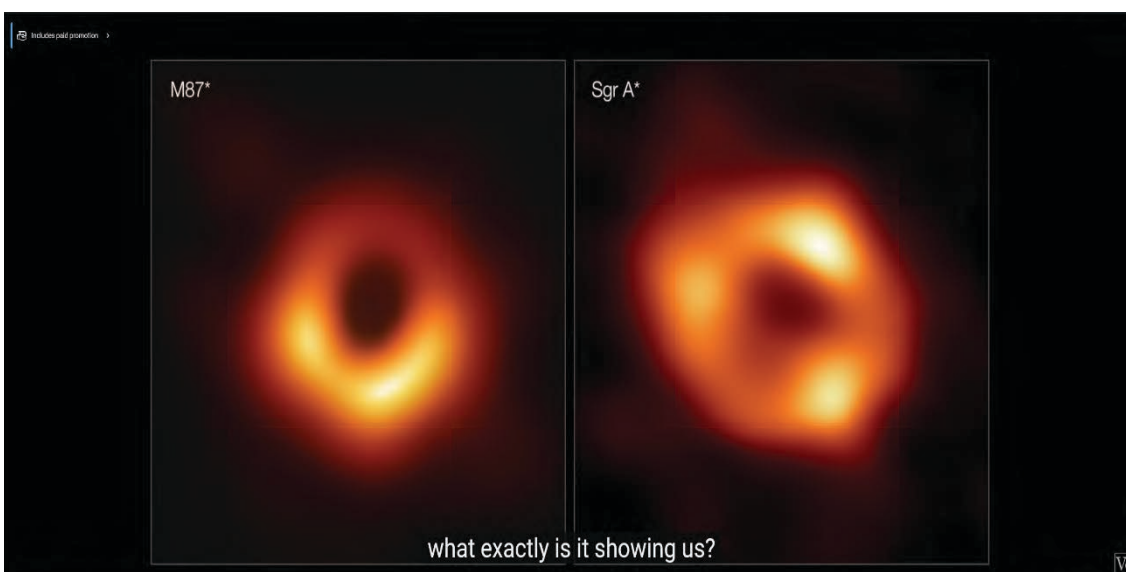


Fig. 1: Still from “How did they actually take this picture? (Very Long Baseline Interferometry).” *YouTube*, uploaded by Veritasium, 12 May 2022, <https://www.youtube.com/watch?v=Q1bSDnuIPbo>.

“What are we supposed to be seeing here,” was one of the tasks the chatbot could do much better!<sup>1</sup> After all, it had been my aim to create a vision of the black hole by uncreatively piecing together bits from the internet according to some mechanistic procedure. Which is what ChatGPT is essentially doing anyway. I thought I could track descriptions of the image via the large language model which could offer us a uniquely unobstructed vision of visions of the first black hole image. My original idea was to use ChatGPT to conduct an interview about the first black hole image eliciting descriptions of the image (containing verbal imagery) and musings about metaphor, using “I” and “A” to differentiate between me and the algorithm. The beginning of the essay was to look like this:

## A Black Hole Pastiche

“So let us marvel at this image,  
Of a place beyond our understanding,  
For even in the darkness of a black hole,  
There is still a spark of light, expanding.”<sup>2</sup>

*I:<sup>3</sup> The first image of a black hole was released in 2019 by the Event Horizon Telescope (EHT) collaboration. This image was created using data collected by the EHT, which is a network of telescopes located around the world that work together to create high-resolution images of objects in the universe. The enormous amount of data was processed using specialized algorithms that were developed specifically for this project. The resulting image provides the first direct visual evidence of the existence of black holes. It was widely covered in the media and was considered a major scientific achievement.*

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<sup>1</sup> At the point of writing, ChatGPT cannot access images and video, does not include the whole of the internet and cannot access information after 2021.

<sup>2</sup> This is a poem generated by ChatGPT with the prompt "write a poem about the first black hole image". It encapsulates the paradoxes black holes embody (in the third and fourth lines) and connects them with the complexities of human emotions: the irrational feeling of hope humans feel, even when they are faced with inescapable darkness. All this plays out against the backdrop of the human condition, introduced in the first two lines, of being just about smart enough to understand that there are things they will never understand, because they are not smart enough.

<sup>3</sup> In this instance, I have already given up on indicating the algorithm speaking with the letter "A". Instead the algorithm speaking is now confined to the centre of the page.

Can you describe the image?



Fig. 2: Still from “Inside the black hole image that made history I Sheperd Doeleman.” *YouTube*, uploaded by TED, 10 May 2019, <https://www.youtube.com/watch?v=uyMtsyzXWd4>.

*The bright ring surrounding the black hole is caused by hot gas and plasma that is being pulled into the black hole, and it appears as a bright circle around the edge of the image. The image is highly detailed and reveals many features of the black hole, including the shape of its event horizon (the boundary beyond which nothing can escape the black hole’s gravity) and the structure of the hot gas swirling around it. The image has a resolution of about 50 microarcseconds.*

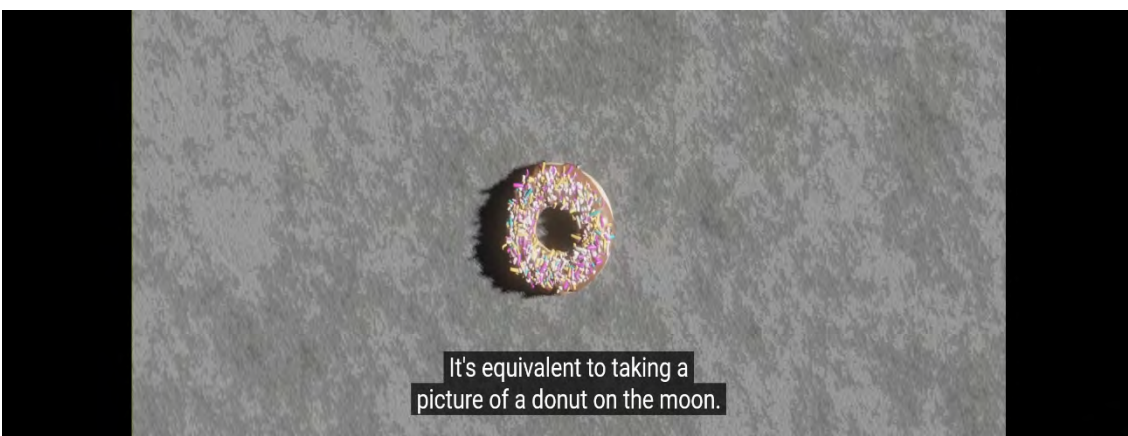


Fig. 3: Still from “How did they actually take this picture? (Very Long Baseline Interferometry).” *YouTube*, uploaded by Veritasium, 12 May 2022, <https://www.youtube.com/watch?v=Q1bSDnuIPbo>.

*The overall appearance of the image is quite striking.*

## Data Hallucinations

Later ChatGPT told me, equally confidently, that the actual resolution of the image was 20 microarcseconds. In other words: the slick prose of ChatGPT was hiding the fact that it was telling a whole load of “bullshit.” According to Frankfurt (33) the essence of bullshit is “indifference to how things really are.” So, bullshit may even be true. The point is that bullshitters are not concerned with the truth. They are not liars, who do care about the truth. After all, liars want to avoid the truth. Bullshitters are those who hide their missing commitment to the truth. They do not care about it. In Frankfurt’s version of bullshit, they care more about their image.

I: Are you a bullshitter according to Frankfurt’s theory of bullshit?

*A: As a language model, I do not have personal beliefs or intentions, so the concept of “bullshitting” does not apply to me. However, my responses are based on patterns that have been observed in the data that was used to train me. In some cases, my responses may not be entirely accurate or may not fully reflect the complexity of a given topic. I am a tool created by humans to help them; I can provide you with possibilities, but the truth is something that only humans can determine. However, I can provide information on Harry Frankfurt’s theory of bullshit if you would like me to do so.*

ChatGPT has a point, of course. Or, rather, it does not have a point, as it has no points. It is not hiding anything since it does not have intentions.

Still, ChatGPT is programmed to transform probabilities into language, where this language is constructed in a way as to hide the fact that we are dealing only in probabilities. It does not give a disclaimer every time it answers a question but creates the impression that it is knowledgeable on almost anything. In other words: If ChatGPT did have the intention to hide its commitment to the truth, that is exactly what it would sound like. (Unless you ask it directly about the issue of the veracity of its statements.)<sup>4</sup>

<sup>4</sup> The connection between ChatGPT and Frankfurt’s bullshit has also been made by Lakshmanan (2022), who slightly misconstrues Frankfurt’s theory in that he does not mention intentions.



So even if what ChatGPT says is correct most of the time (or even all the time) and even if it does not have intentions, it could be argued that it is still essentially bullshit. Its language is constructed in a way that suggests that it knows what it is talking about. It answers every question with a declarative sentence containing suitable amounts of details. It never says “maybe”, or “I could be wrong, but...”. Yet, it does not care about the truth of its claims. In contrast to Frankfurt’s version of bullshit, ChatGPT does not care about presenting itself in a certain way, either; and when prompted directly, it will readily admit that its answers might not be correct. It does not care about the truth, because it cannot care.

So, I eventually abandoned the idea of interviewing ChatGPT to replace my vision of the black hole by its probabilistic recreation of descriptions of the black hole image. But when I looked at the image a little closer, the following question occurred to me:

Is the first black hole image bullshit as well?

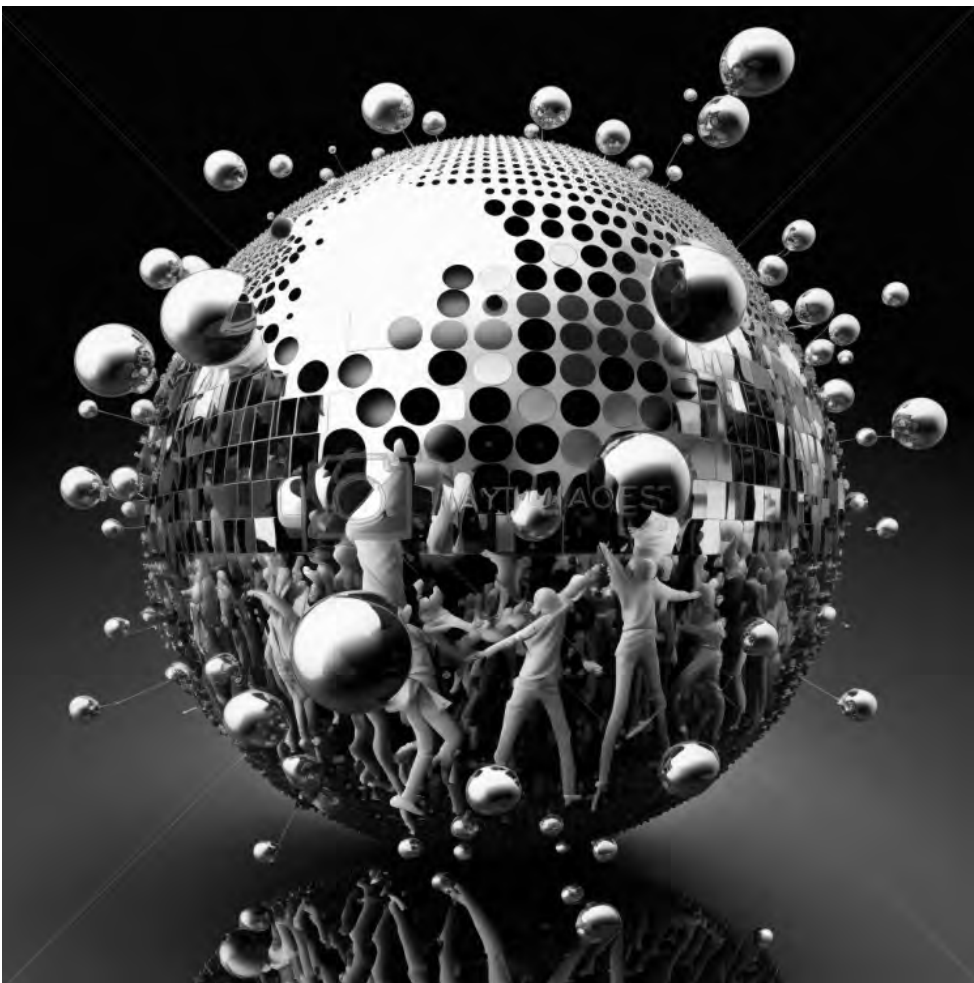


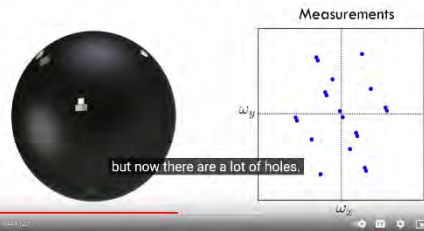
Fig 4. Image generated by the AI-platform Midjourney, loosely based on the prompt: “The imaging algorithms fill in the missing gaps of the disco ball.”

# The Event Horizon Telescope



How to take a picture of a black hole | Katie Bouman  
3,317,294 views · Apr 28, 2017

# The Event Horizon Telescope



How to take a picture of a black hole | Katie Bouman  
3,317,294 views · Apr 28, 2017

The imaging algorithms we develop fill in the missing gaps of the disco ball

How to take a picture of a black hole | Katie Bouman  
3,317,294 views · Apr 28, 2017

However, the missing data is not random noise. It's a pattern that tells us how likely an image were to appear on Facebook.

How to take a picture of a black hole | Katie Bouman  
3,317,294 views · Apr 28, 2017

How Do We Choose the Best Image?

Image 1 Image 2 Image 3

Since there are an infinite number of possible images

How to take a picture of a black hole | Katie Bouman  
3,317,294 views · Apr 28, 2017

### What is a Likely Everyday Image?

Unlikely More likely Very likely

How to take a picture of a black hole | Katie Bouman  
3,317,294 views · Apr 28, 2017

### What is a Likely Black Hole Image?

Unlikely More likely Very likely

we're posed with a real conundrum: we've never seen a black hole before.

How to take a picture of a black hole | Katie Bouman  
3,317,294 views · Apr 28, 2017

Simulation of a Black Hole

If we bake Einstein's equations too much into our algorithms,

How to take a picture of a black hole | Katie Bouman  
3,317,294 views · Apr 28, 2017

Simulation of a Black Hole

we'll just end up seeing what we expect to see.

How to take a picture of a black hole | Katie Bouman  
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In other words, we want to leave the option open

How to take a picture of a black hole | Katie Bouman  
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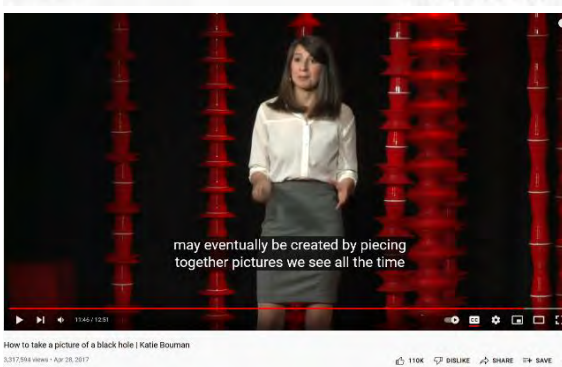
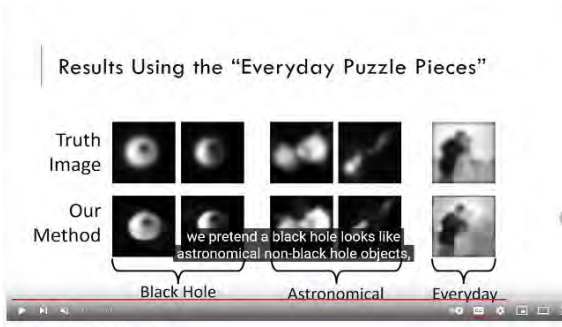
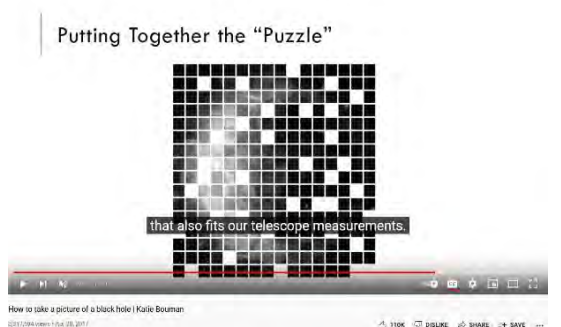
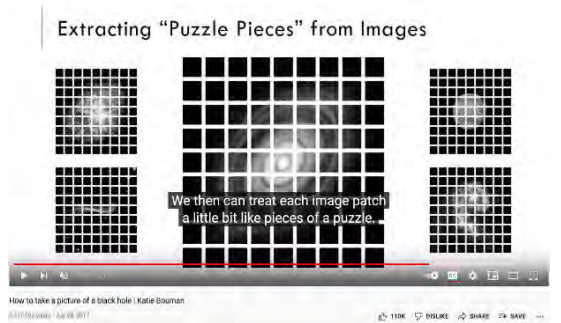
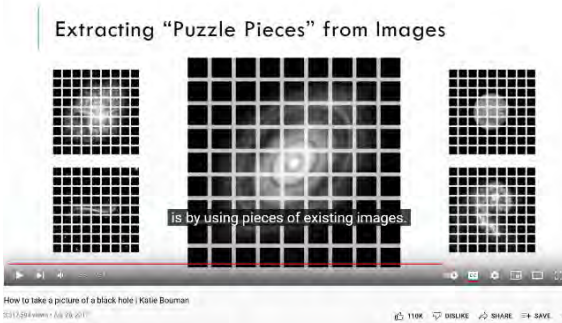


Fig. 5 Stills from "How to take a picture of a black hole | Katie Bouman." *YouTube*, uploaded by TED, 28 Apr 2017, <https://www.youtube.com/watch?v=BlvezCVcsYs.va>



Interestingly, the black hole image is also the result of algorithms creating the image with bits of other images according to certain probabilities. So I repeated my original question, more or less:

I: How would you describe the image?

*A: The image has a somewhat ghostly, ethereal quality, and it is a testament to the extraordinary capabilities of the Event Horizon Telescope and the scientific team that produced it.*

The first black hole image is thus not a photograph, or even close to something like an image of a black hole, but rather a composite image created using data from multiple sources, including EHT observational data collected over a period of several days.

The data is puzzled together by algorithms that are trained on images. These algorithms then make predictions on how holes in the image that are not covered by data are probably filled. This method makes it highly likely that there is no elephant at the centre of our galaxy. But not impossible.

Is the first black hole image essentially bullshit as well, then? Because it does not really care about depicting reality, but only about constructing an image according to probabilities?

*A: In Frankfurt's theory, Bullshit is related to the intention of the person who is speaking, not to the accuracy of the information that is being presented. In this sense, the image of the black hole is not bullshit, as the scientists involved in the EHT collaboration had no intention to deceive or mislead. They were motivated by a desire to gain a deeper understanding of black holes and to share that understanding with the scientific community and the general public.*

I: Is truth something only humans can determine?

## Commercial VS Reality

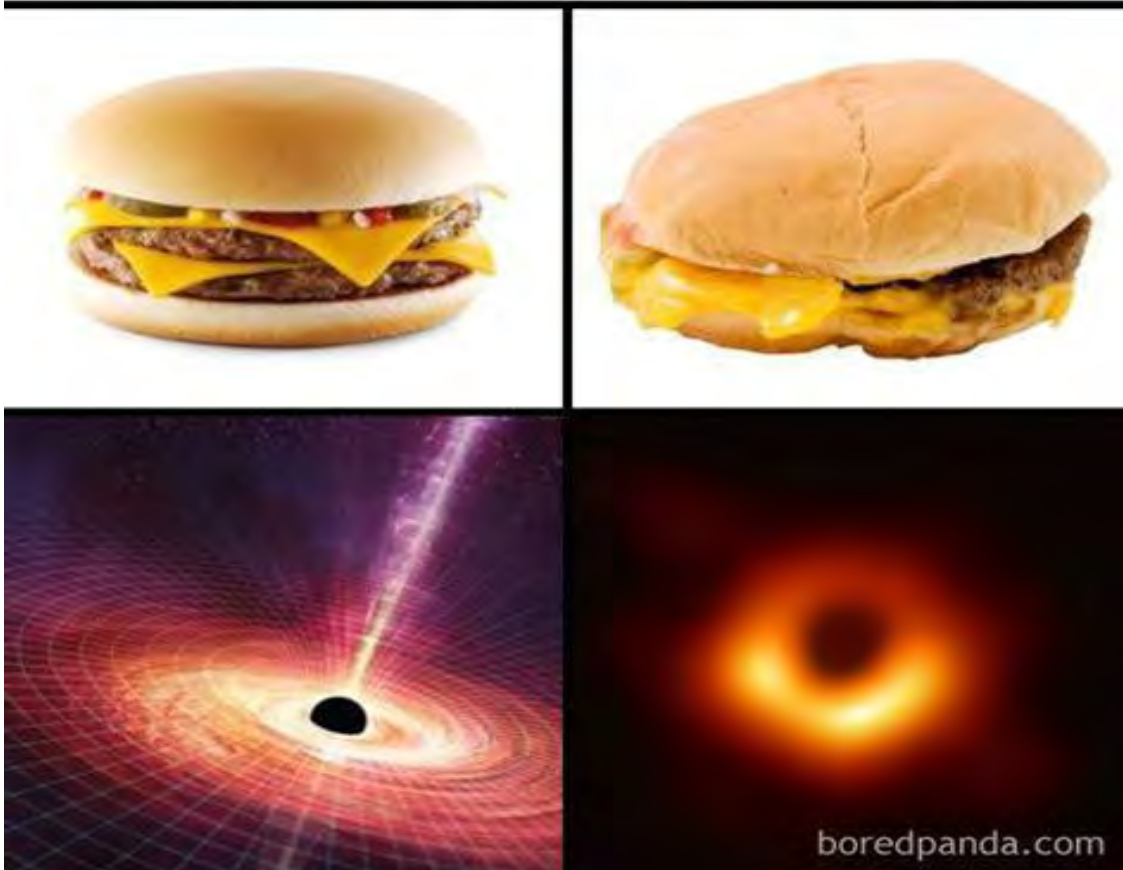


Fig. 6: Meme.

I: What did the first black hole image look like to you?

*A: As an artificial intelligence, I do not have the ability to see or perceive physical objects in the same way that humans do. I have been programmed with information about the image and the scientific concepts and phenomena depicted in the image and can use this information to answer questions and provide descriptions of the image. Based on the description of the image that I have been given, the image of the black hole would appear as a circular “shadow” at the centre, surrounded by a bright ring of light.*

## Metaphors, Metonymy and Memes. Or: My Own Vision

Even if the Event Horizon Team was not planning to bullshit us, and even if an image generated by algorithms cannot bullshit us, it is still clear that this image is not what it seems. And if it were to persuade us that it is a visual presentation of a black hole that is exactly what it would look like. With its blurriness and missing details, it has a reality effect baked into it.



Fig. 7: Meme.

Of course, the image differs from the texts of ChatGPT, in that these texts are only linked to other texts which have been fed to ChatGPT. The image, on the other hand, is linked to data based on observations, and hence, to the real world. But the missing elements of the picture, holes in a hole, are still filled with bits of other images.



Fig. 8: Meme.



And here I found a way to use the algorithm to fill in the holes in the hole in people's minds. For in my view, what is missing in people's vision of the black hole is precisely what is captured by the first black hole image itself. The puzzlement at what it depicts and the subtle disappointment at what was felt to be a let down from images and simulations of black holes we had seen before was filled by the metaphors and metonymy used to describe the black hole.



Fig. 9 Memes.

Some of the descriptions try to connect the 'real' image of the black hole with earlier, artistic renditions and simulations: "A swirl of cosmic matter, the black hole does resemble artistic interpretations of the past but with a less-fantastical smattering of starlight. And contemporary entertainment like the movies *Interstellar* and *High Life* have imagined more beautiful versions of the black hole with sparkling stardust and blinding light." (Small). Against this backdrop, the image of the black hole looks a bit benign, and hard to sell even on the premise of its "haunting simplicity".

And the internet was quick to note this: So, images like "porthole to eternity," "one-way door out of our universe," "an even darker blackness," and "time seems to come to a standstill" are connected to the dark blob in the centre to underline its mystery and power. This is because the dark blob, which is not very black, and, merely from its visual properties, is not distinguished at all from the background, which, if at all, seems slightly blacker than the blob. To use these images and connect them with the

dark circle in the centre achieves a kind of poetic charging of our vision. We see a circle against a background, until we are told that we see a door to eternity. However, this poetic charging is itself something that should ultimately be fed back into the algorithm to get a realistic picture of what is out there. Just like the first black hole image is such an amalgam of algorithmic produced piecing-together based on data, so is the vision of the black hole image I would like to recover in this paper one which originally has contained a lot of holes that needed to be filled for an image to emerge. Algorithms are the tools at our disposal for the filling of these holes. Or we are not going to get an image in the first place. No ping pong between text and image is beyond the reach of the uncreative machine process. It is up to us humans to creatively use this uncreative process and dream in between the ping and the pong.

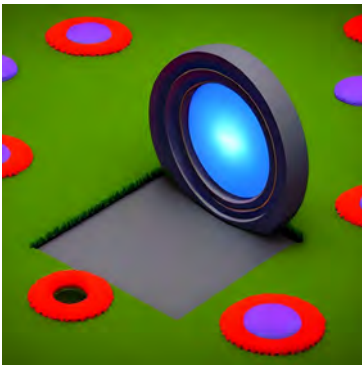
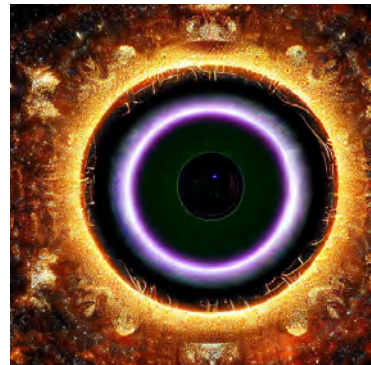
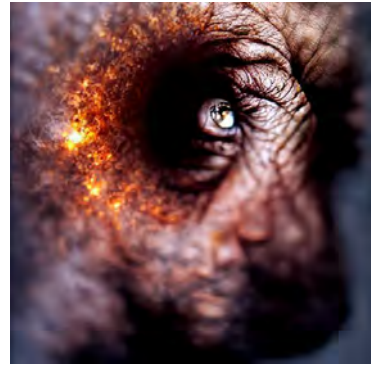
With this in the back of my mind and given the fact the first black hole image is an animation, rather than a still, I tried to recreate the first image of the black hole as a series of images generated by artificial intelligence based on these holes in ordinary people's visions. That which cannot be seen, which is not only out of the picture, but is in the picture, cloaked in the universe's invisibility cloak. Holes filled by metaphor and metonymy uncreated by machine learning.

## Appendix

My own vision is thus one which is created by algorithmic means to make visible the holes in our vision of the first black hole image. The images are a result of prompts, which I am creating out of the metaphorical language accumulated around the first hole image. It is a language I have found in blog entries, journalistic texts, memes, and scientific papers (For instance Small; Devlin; Simpson and Visser; Overbye; Ford; Ghosh; Small; D'Mello; Schwedel). I am feeding these prompts into AI-image-generators (like Midjourney, DALL-E, or Nightcafé) that work similarly to how the first black hole image was created. The difference being that my data is a subjective collection of imagery from the optical unconscious of people's vision,<sup>5</sup> subsequently refined and enriched with already generated images. The resulting series is a subjective selection of a wide range of images.

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<sup>5</sup> The term "optical unconscious" was coined by Walter Benjamin. He refers to the secrets that "[p]hotography, with its devices of slow motion and enlargement, reveals [...]. It is through photography that we first discover the existence of this optical unconscious, just as we discover the instinctual unconscious through psychoanalysis" (511-512).



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**Angela Matthies** has never studied physics, astronomy, or computer science. That does not help with understanding black holes as scientific entities but does not harm her inquiry into black holes as imaginative, philosophical, artistic, and cultural phenomena.

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