

BASEL ABBAS AND RUANNE ABOU-RAHME, DAVID ADJAYE, NABIL AHMED, DOUG AITKEN, ATIF AKIN, JOHN AKOMFRAH, NEVIN ALADAĞ, ALLORA & CALZADILLA, LAURA ANDERSON BARBATA, JONATHAS DE ANDRADE, KUTLUĞ ATAMAN, NEİL BELOUFA, CECILIA BENGOLEA, JOHN BOCK, MONICA BONVICINI, CANDICE BREITZ, JANET CARDIFF AND GEORGE BURES MILLER, JULIAN CHARRIÈRE, ANETTA MONA CHIŞA AND LUCIA TKÁČOVÁ, TYLER COBURN, PHIL COLLINS, CLAUDIA COMTE, ABRAHAM CRUZVILLEGAS, EMANUEL DANESCH AND DAVID RYCH, DARK MORPH, JEREMY DELLER, OLAFUR ELIASSON, NOA ESHKOL, OMER FAST, MARIO GARCÍA TORRES, GELITIN, ISA GENZKEN, LIAM GILLICK, DOMINIQUE GONZALEZ-FOERSTER, DAN GRAHAM, ARIEL GUZIK, CARL MICHAEL VON HAUSSWOLFF AND THOMAS NORDANSTAD, FLORIAN HECKER, NIKOLAUS HIRSCH / MICHEL MÜLLER AND CYBERMOHALLA ENSEMBLE, CARSTEN HÖLLER, MARINE HUGONNIER, PIERRE HUYGHE, INHABITANTS, SANJA IVEKOVIĆ, RASHID JOHNSON, JOAN JONAS, BRAD KAHLHAMER, AMAR KANWAR, RAGNAR KJARTANSSON, ARMIN LINKE, SHARON LOCKHART, LOS CARPINTEROS, SARAH LUCAS, URSULA MAYER, JONATHAN MEESE, EDUARDO NAVARRO, ERNESTO NETO AND THE HUNI KUIN, RIVANE NEUENSCHWANDER, CARSTEN NICOLAI, OLAF NICOLAI, JORGE OTERO-PAILOS, MATHIAS POLEDNA, WALID RAAD, RAQS MEDIA COLLECTIVE, LISA RAVE, MATTHEW RITCHIE WITH ARANDA/LASCH AND ARUP AGU, TOMÁS SARACENO, RITU SARIN AND TENZING SONAM, HANS SCHABUS, CHRISTOPH SCHLINGENSIEF, ALLAN SEKULA, CHARLES STANKIEVECH, SIMON STARLING, SUPERFLEX, TERRITORIAL AGENCY, RIRKRIT TIRAVANIJA, SISSEL TOLAAS, SUZANNE TREISTER, JANAINA TSCHÄPE WITH DAVID GRÜBER, JANA WINDEREN, SUSANNE M. WINTERLING, CERITH WYN EVANS, ŽELIMIR ŽILNIK

Thyssen-Bornemisza Art Contemporary

STERNBERG PRESS

Making Bets While Knowing Nothing

Raqs Media Collective

Gyan chausar, mandi chauhatte, sarat paasa saar
ya duniya mein rachi baazi, jeet bhavai haar
sadhu, sant, mahant, gyani, chalat kat purkaar
lal girdhar, jeevana din chyar

Knowledge is a game, dice roll, players rise and fall
But the world declares, “all bets are off,” ’coz “victory is defeat”
Good lord, listen, be wise, your knowing days are numbered
—Mirabai, sixteenth-century princess, rebel, and mystic
(free translation)

1.

What would happen if one placed a bet on the idea that “knowing nothing,” the knowledge of nothingness, is the basis of wisdom?

This is actually not a very new idea, even though it remains a surprising and unsettling one. Recognition of nothingness, or emptiness, or *shunyata*, is at the very heart of an ancient way of knowing and acting in the world. It expresses a gentle skepticism about three complementary proposals, familiar to us from both the natural sciences and some forms of theological doctrine—namely, the assertion that the universe is either one, totally knowable thing, or that the self is coincident with the cosmos, such that to be self-aware is to know the universe (the *aham brahmasmi* principle in nondualist Vedanta) or that actually everything is just random, pointless, and chaotic.

There is a fourth way—and that consists in knowing the primacy of nothingness as a binding principle. That a sense of emptiness, an awareness of the absence of substance and form, is itself generative of substance, form, and knowledge. In some traditions of knowing and acting in the Indic world (including classical Madhyamika Buddhism and some common traditions of knowledge and spiritual questioning), this would be called *nirakar* (formless) awareness.

The insistence on the primacy of nothingness is not an admission of ontological failure or epistemic collapse; rather it is a recognition of the fact that what binds one thing to another cannot be easily named, marked, or numbered. Its existence is signaled not by its substantiveness but by the way in which its massive immateriality affects other things.

2. The Indian American theoretical physicist Subrahmanyan Chandrasekhar wrote about mysterious entities in his book *The Mathematical Theory of Black Holes*, published in 1983: "The black holes of nature are the most perfect macroscopic objects there are in the universe: the only elements in their construction are our concepts of space and time."¹

The business of *creating objects whose elements are concepts* is a terse but elegant way of talking about what it is that some contemporary artists do. It may well be said that the relationship between contemporary art practice and the generation of new knowledge is not just a way of rendering information into aesthetically pleasing or challenging objects and processes. It is not just a matter of translating "research," or even deep archival investigation, or processing an encounter between different fields of knowledge to produce an artwork. Ultimately it boils down to a question of giving form to things that might be unthinkable without the act of giving form to them. It is the making of art, in this instance, that makes it possible to think a new thought as well as the other way round. Sometimes this may mean attempting to think the unthinkable.

What might the unthinkable be?

When Albert Einstein said that God does not play dice with the universe, he might as well have been objecting to a joyously skeptical song attributed to the Mewari Rajput princess, rebel, and mystic known as Mirabai, who lived, ecstatically, in the sixteenth century of the common era, in what is now Rajasthan, in western India. The words she sang, or so it is said, which serve as the epigraph to this essay, would have offered no comfort to Einstein.

In some ways, understanding what a black hole might be represents both the victory and the defeat of knowledge. If at least one element of knowledge consists of information, then a black hole, by its very nature, is the defeat of information.

So what would we be saying if we said that she knew something about a black hole?

If knowledge is a stab at omniscience, a claiming, a carving out, or conquest of cognitive territory—from the continent of bleak nescience—then how many moves must one make in the course of these maneuvers before victory and defeat begin to mirror each other at every step?

Is it possible, like Mirabai, to celebrate the risk of losing one's sense of self, or coherence, in order to be able to find joy in this dance, or even a sliver of rapture, in the playing of this game?

And no, the wager is not simply on ignorance as the threshold and foundation of all acts of knowledge. Rather it is the conjecture, and the paradox, that insists that to know anything at all, one has to at least know of that which is categorically unknowable. It's like realizing that there is a zero, a nothing, and a something, a one, that is hidden in every number. A nothing that adds, multiplies, divides, and a one, a singularity, that accumulates, and mates with itself, to make any quantity at all possible.

What does it mean to know that nothing?

What does it look like?

What does it sound like?

What does it feel like?

What does it taste like?

Mirabai, the *Namak Haram*, the wanton, the breaker of conjugal promises, spills her salt, she who no longer listens to her master, her husband, her king. She goes back on her word. So that in the beginning there is no longer a word, no leg left for her to stand on, even as she dances, makes her moves in the game. No words left to catalog her books. No title to her claims, no quarter. But a little bit of nothing lingers in everything, a zero inside every number, a silence in everything said. "Your knowing days are numbered."

But Mirabai's songs are sung forever.

How to share nothing? Not how not to share, but how to share that fullness of hunger, that foreboding, that foresight that comes with knowing the taste of more salt in your tears than there are stars in the sky or silence in the library.

3.

On July 31, 1930, Subrahmanyan Chandrasekhar—Chandra, to his friends and family—set sail from Bombay Harbor on the steamship *Pilsna* of the Lloyd Triestino Shipping Company, via Aden, Port Said, and Alexandria, for Venice, on his way to the port of Southampton in England. From Southampton, the nineteen-year-old Chandra was going up to Cambridge with hopes of studying astrophysics. He had three books to keep him company on the monthlong voyage, one of

which was the celebrated British physicist Arthur Eddington's recent book *The Internal Constitution of the Stars*.

Eleven years prior to Chandra's voyage, on May 29, 1919, Eddington had found himself marooned on a ship anchored near the island of Principe, in the Gulf of Guinea, just off the west coast of the African continent. Eddington's mission was to scan the clear African sky in order to observe and measure the slight bending of starlight under the influence of the gravitational field of a massive object like the sun.

A total solar eclipse, clearly visible in the equatorial region of the Gulf of Guinea on May 29, 1919, constituted the perfect set of conditions for observing the very slight bending of starlight consequent to the approaching transit of the Hyades star cluster at the edge of the eclipsed, blacked-out disk of the sun.

Inspired by his quest, Eddington is thought to have joyously, and somewhat impishly, composed the following limerick,

Oh leave the wise our measures to collate
One thing at least is certain, light has weight
One thing is certain, and the rest debate—
Light-rays, when near the Sun, do not go straight.

If light did bend as it approached the sun, it would prove the empirical validity of the theoretical conjectures of the general theory of relativity, written up by the Bern patent clerk turned physicist Albert Einstein. On May 29, 1919, starlight bent as Einstein had said it should, measures were taken, and the hypothetical conditions laid down in the general theory of relativity calmly ascended to the pedestal of empirically verified truth. Then the world changed forever.

But there was a new problem. If the general theory of relativity, with its description of the bending and curving of space-time (which is what caused starlight to bend) under the gravitational pull and stretch of massive cosmic entities, was true, then it would also imply, as a corollary, the intensification of gravitational force to an extent that could tear holes in the fabric of space and time itself. Supermassive stars, no longer able to burn with their accustomed intensity, could collapse onto themselves under their own weight and become either dead, cold, frozen stars, called white dwarves, or even more strangely, turn into intensely dense singularities, capable of gravitational force so tremendous that they would swallow even light. The latter included

the possibility of entities into which light, information, and matter would fall, seemingly to be lost forever. Relativity seemed to describe the way things worked, but it also invoked the conceptual probability of entities that seemed to defy reason and stretch the imagination. The implications of Einstein's theory played havoc with his desire for order.

The nineteen-year-old Chandra whiled away his monthlong sea voyage on board the *Pilsna* on mathematical calculations that accompanied his reading of Eddington's book on stars. These calculations suggested that according to quantum mechanical principles at least, the remaining energy of the atomic particles within a dying star could still act against gravity to keep it going as a white dwarf. Chandra's conjecture held out an important qualification. It proposed that this defiance of gravity in an imploding star had a limit. Any star more than 1.4 times the mass of our sun would collapse into itself to form a "singularity"—something that no one quite understood at the time—which would be supermassive but would lose almost all its matter in the form of a gigantic explosion—what we now call a supernova burst—that would distribute matter and leave behind an enigmatic residue.

The 1.4-times-the-mass-of-the-sun limit is now called the Chandrasekhar limit, in honor of the then nineteen-year-old.

Chandrasekhar worked on those shipboard calculations for the next five or so years and then wrote a brief paper titled "The Highly Collapsed Configurations of a Stellar Mass."² The then twenty-five-year-old presented these conclusions at a meeting of the Royal Astronomical Society in London in January 1935. The paper contained the following tentative statement: "For all stars with a mass greater than M , the matter does not become degenerate. Great progress in the analysis of stellar structure is not possible unless we can answer the following fundamental question: what happens if we go on compressing the matter indefinitely?"

The answer to his question—"what happens if we go on compressing the matter indefinitely?"—would have to admit to the enigmatic possibility of black holes. Chandra's onetime hero Eddington, who was present at the meeting, was furious and put all his formidable rhetorical force into admonishing the young scholar, implying that Chandra's conclusion reduced the idea of relativistic degeneracy of stellar matter to an absurd level: "The star has to go on radiating and radiating and contracting and contracting until, I suppose, it gets down to a few km radius, when gravity becomes strong enough to hold in the radiation,

and the star can at last find peace. . . . Various accidents may intervene to save a star, but I want more protection than that. I think there should be a law of Nature to prevent a star from behaving in this absurd way!"

The ridicule and humiliation that Chandra faced came out of incomprehension but was not without an element of racial prejudice and imperial arrogance. He decided to stop being an astrophysicist and went into the more abstract discipline of theoretical physics, left Britain, and did not write anything about dying stars for the next thirty-odd years. Four years after Chandra's talk at the Royal Astronomical Society, J. Robert Oppenheimer and H. Snyder published a paper titled "On Continued Gravitational Contraction," in which they proposed the possibility of the continued collapse of a star into smaller and yet more supermassive entities.³ They were endorsing, at least in theory, what Chandra had implied.

Then in 1963 Roy Kerr, a New Zealander working at the University of Texas at Austin, published what he said was the result of observing an object rotating in a vacuum under conditions of general relativity. These mysterious results were given a name, *black hole*, following the banter after this result.

The name *black hole* stuck to the nothing that it sought to describe.

4.

Something strange began to happen in 2015. We began to hear black holes.

On September 14, 2015, a gravitational wave designated GW150914 was recorded, and then rendered as a faint, 0.2-second-long "whump" or "chirp." It is actually possible to hear this sound, and it doesn't sound very remarkable.⁴

This wave beached on the shores of human consciousness when two black holes, one thirty-six times denser than the mass of our sun and the other twenty-nine times denser than the mass of our sun, spun into each other and merged to form a supermassive black hole that is estimated to be both appreciably smaller than, as well as roughly sixty-two times denser than, the mass of our sun.

The gravitational radiation that these two black holes released in the final fraction of a second of their merger is thought to be at least sixty times the total output of energy of all the stars in the observable universe. The actual event of the collision took place roughly 1.3 billion years

ago, in the vicinity of the Magellanic Clouds (a pair of irregular dwarf galaxies) orbiting the Milky Way, in the southern celestial hemisphere.

The event (and ten others like it that followed, nine involving other black holes and one involving the collision of two neutron stars) was closely monitored by a network of one thousand scientists located in observatories spread across the world and by 440,000 lay enthusiasts, who were conducting observations from their personal computers, as a part of the Laser Interferometer Gravitational-Wave Observatory (LIGO)-VIRGO research process in the emerging field of gravitational wave astrophysics.

A black hole is a massive concentration of gravitational force, consisting of a mass condensed to such a great extent that it amounts to an "almost nothingness." Listening to the sound that we think two black holes make when they fall into each other is like being tuned in to the frequency of the biggest fragment of "nothingness" that we have come across so far. It is the biggest nothing we have ever heard or have imagined hearing. And we have heard nothing like it before.

Then, on April 10, 2019, another array of instruments, and another network of scientists and enthusiasts, were able to generate the first recorded image of a supermassive black hole located in the Messier 87 (M87) galaxy, in the constellation Virgo, approximately fifty-five million light-years away from our earth.

It is estimated that this black hole may have eaten matter and energy equivalent to six billion suns. Looking into its image is like looking into the abyss of nothingness magnified to an unthinkable dimension. It is the biggest nothing that we have ever seen. And again, we have seen nothing like it before.

5.

What does it really mean to know "nothing"?

The phenomenon of a black hole plays havoc with our ordinary sense of time. Should a human observer fall into a black hole, she may emerge (at the hypothetical other end) in a parallel universe in which time runs contrary to the way we know it. The threshold of an event in a very remote past may also be the gateway to an unknown future, because of the way in which space-time folds around a massively dense concentration of the nothing that marks the presence of the black hole.

The birth of the black hole as a concept marks an event in human consciousness coincident with thinking the unthinkable, and its continued career can be represented by the evolution of unthinkability.

This order of knowledge that apprehends realities in a way that is impossible to describe in language, that is pre- or translinguistic, borders on the ineffable. This order of knowing is also a form of not-knowing, or a form of knowing emptiness, because it cannot be translated into information.

The Madhyamika Buddhist philosopher Dharmakirti developed a model of two truths—*satyadvaya*—as a description of the world in his text *Madyhamakavatara* (*Introduction to the Middle Way*). The first truth, *paramartha* (ultimate meaning), consisted of things that one could be aware of but that were impossible to contain within language; they could be said to be non- or preconceptual, of an order of awareness designated as *pragna*, a kind of wisdom that is beyond knowledge. The second, *samvriti*, or concealment, were conventional truths, the mirrors of our linguistic forms, concealed within the names we give to things. It could be said then that our apprehension of how matter and time behave when a supermassive celestial body crashes into itself is a movement from intuition and awareness to naming and observation and then again to a higher-order awareness of the unthinkable.

Considering a black hole, as we have seen, means considering the eventual loss of information. Knowing a black hole means knowing that knowledge itself dissolves once it crosses the black hole's event horizon. And yet, with it, we heard the inaudible and saw the invisible, and now, once again, we are beginning to think the unthinkable, anew.

This spiraling and back-and-forth movement between two different kinds of knowing, from *paramartha* to *samvriti* and then back to *paramartha*, is one way in which to create an image for the evolution of our consciousness.

In his lecture "Shakespeare, Newton, and Beethoven, or Patterns of Creativity," Subrahmanyan Chandrasekhar comes to a remarkable conclusion:

In my entire scientific life, extending over forty-five years, the most shattering experience has been the realization that an exact solution of Einstein's equations of general relativity, discovered by the New Zealand mathematician, Roy Kerr, provides the *absolutely exact*

representation of untold numbers of massive black holes that populate the universe. This "shuddering before the beautiful," this incredible fact that a discovery motivated by a search after the beautiful in mathematics should find its exact replica in Nature, persuades me to say that beauty is that to which the human mind responds at its deepest and most profound.⁵

6.

One reason to make art is because it condenses what happens in our minds when we feel compelled to rethink everything that we know and take for granted. Sometimes this can begin with a meditation on a piece of sky. In a series called *Unfamiliar Jataka Tales*, we attempt something like that when we consider a patch of fallen sky. Being a lenticular text-image diptych, the image very appropriately takes advantage of the property of light to bend when refracted off a ridged surface chanced upon by a moving observer. In a moment of whimsy, it may well be regarded as a homespun, handheld embodiment of the principles of general relativity in action. The work, like the conventional Jataka tales, tells a brief story about the career of an enlightened being, a bodhisattva. It merits retelling.

How the most terrible solitude was overcome

Once, a small rectangular piece of the sky (a Bodhisattva unknown even to itself) landed on the earth. It rested, bewildered by the hardness of the surface it found itself on. Everything, everywhere, was arid. The sky-patch-Buddha-to-be felt very alone, especially as it had lost its playmates, the clouds. Many years passed. The patch of sky, out of unself-conscious yet boundless compassion, decided to be useful to the earth on which it had found itself. The skylet, after considerable meditation on being fluid and substantial at the same time, condensed itself into a pool of clear, cool water. Now, grasses began to grow around it in abundance for miles on end. The wind played ripples and laughed on its surface. It quenched the thirst of passing strangers, provided clear water to splash about in on hot days. And its lost playmates, the clouds, would often stop by and reflect themselves. Sometimes it was just the clear blue firmament that found itself recovered in the empty blueness of the fragment of sky that had strayed so far from home. And so, this humble patch of fallen sky was united again with the heavens above, even as it continued to sustain the earth below. Grass, wind, clouds, earth, thirst and the quenching of thirst, all found themselves intricately bound in a relationship of inter-dependence. Nothing seemed possible any longer without the active presence of everything else.

How the Most Terrible Solitude was Overcome

Once, a small piece of sky (a Bodhisattva unknown to itself) landed on the earth. It rested, bewildered by the hardness of the surface. Everything, everywhere, was arid. The sky-patch-Buddha-to-be felt



The desolation of the most terrible solitude was overcome, even as the most fulsome emptiness was attained.

Today, on rereading this story and looking again at the lenticular image of a patch of water on the earth that mirrors the sky, we are struck by a strange thought, a thought that conquers everything just as much as it is itself conquered by its own strangeness.

Could it be that this little patch of sky, or something like it, may have fallen into a supermassive black hole, and fallen out of it into a completely different universe, one like our own? Could it be that the making of a work of art is sometimes just an instance of information lost in one universe finding itself in another, and super-translating itself on the threshold of the event horizon of the consciousness of the artist? Even as one writes these words, their meaninglessness and utter absurdity become apparent. In the throw of the die of a concept, this is a move that means losing what one has, by way of reason, almost utterly. But then, nothing ventured, nothing lost, and nothing gained.

Is this what it might mean to shudder at the strange beauty of what it means to know, and know nothing, at the edge where art, science, philosophy, reason, and madness meet?

We could spend the rest of our lives trying to answer this question.

1 Subrahmanyan Chandrasekhar, *The Mathematical Theory of Black Holes* (New York: Oxford University Press, 1992), 1.

2 Subrahmanyan Chandrasekhar, "The Highly Collapsed Configurations of a Stellar Mass," *Monthly Notices of the Royal Astronomical Society* 95 (January 1935): 207-25.

3 Robert Oppenheimer and H. Snyder, "On Continued Gravitational Contraction," *Physical Review* 55 (1939): 455-59.

4 The audio is available at www.gw-openscience.org/audio/.

5 Subrahmanyan Chandrasekhar, "The Nora and Edward Ryerson Lecture: Shakespeare, Newton, and Beethoven, or Patterns of Creativity" (1975), in *Truth and Beauty: Aesthetics and Motivations in Science* (Chicago: University of Chicago Press, 1987), 54.

How the Long Wait for the Thaw was Endured

It was once an exceptionally genial bicycle that had accumulated enough merit in her youthful life to have almost arrived at the end of her journey. A few more revolutions of her pedals and she would have broken away from the cycle of existence and become a free wheel. She was friendly, reliable (her chains, brakes and gears for long gave way) and she cheerfully ferried anyone who touched her pedals with grace. Many people were thankful for the ride they took on her, hurrying to fetch a doctor to tend a sick friend, rushing to get supplies before the next day's curfew, or just out for a leisurely ride by the lake. Once, on a winter day, the bicycle was stopped by soldiers with guns and her frightened passenger was asked to dismount. Other bicycles on that street were also made to abandon their riders. The bicycles were lined up and left standing, and the men and women who rode them were taken away. The bicycles stayed where they were through the night, waiting for their riders. A snowstorm held them in thrall. Ever since that day, the bicycle has stood with its companions, waiting for a thaw. She does not know, as she stands in the cold, that she is only a pedal-push away from Buddhahood. She waits, neither with nor without hope.