

The Mirror

Reflections and revelations

Le miroir

Réflexions et révélations

Ruth Scheps¹

¹ Ph.D. in molecular genetics (The Weizmann Institute of Science, Rehovot, Israel); producer at France Culture and journalist at Radio Suisse Romande until 2009; editor-in-chief of the journal Mikhtav Hadash / La Nouvelle Lettre until 2019. rscheps@hotmail.com

ABSTRACT. The mirror's history, spanning thousands of years, has led people to view it as an aesthetic object, an optical instrument, a source of knowledge or illusion, and even a metaphor for the soul. The first part of this article explores the various manifestations of mirror consciousness, as it appears in certain animals and in the foundational myth of Narcissus. The following section discusses the technical evolution of mirrors, the diversity of their uses, and the ways in which artists have begun to appropriate them. Next, the article addresses the spiritual dimension of the mirror, followed by its persistent presence in contemporary art, where it reflects the uncertainties and fragmentations associated with postmodernity. Stepping through the mirror (in the wake of literary adventures such as Alice's) thus proves to be an endeavor as desirable as it is perilous. And while nowadays, the deep universe reveals itself more and more to giant telescopes, the question of infinity raised by the mirror continues to resurface, in contemporary art as well as in philosophy and literature.

RÉSUMÉ. L'histoire plurimillénaire du miroir a permis de voir en lui un objet esthétique, un instrument d'optique, un générateur de connaissance ou d'illusion, et jusqu'à une métaphore de l'âme. La première partie de cet article explore les diverses manifestations de la conscience spéculaire, telle qu'elle apparaît chez certains animaux et dans le mythe princeps de Narcisse. La section suivante évoque l'évolution technique des miroirs, la diversité de leurs usages et la manière dont les artistes ont commencé à s'en emparer. Sont ensuite abordées, la dimension spirituelle du miroir, puis sa présence insistante dans l'art contemporain où il reflète les incertitudes et les morcellements liés à la postmodernité. Traverser le miroir (dans le sillage d'aventures littéraires comme celle d'Alice) se révèle alors une entreprise aussi désirable que périlleuse. Et tandis que de nos jours, l'univers profond se dévoile de plus en plus aux télescopes géants, la question de l'infini suscitée par le miroir n'en finit pas de ressurgir, en art contemporain comme en philosophie et en littérature.

KEYWORDS. Mirror, reflections, mimeticism, telescopes, Narcissus, visual arts, contemporary art, metaphysics, infinity.

MOTS-CLÉS. Miroir, reflets, réflexions, mimésis, télescopes, Narcisse, arts visuels, art contemporain, métaphysique, infini.

1. Introduction

Beyond its physical reality, the mirror evokes, stimulates, and even provokes the mind. Throughout history, it has been viewed—sometimes even simultaneously—as an aesthetic object, an optical instrument, a metaphor for the soul, and a path to infinity.

We will first discuss the gradual emergence of mirror consciousness throughout evolution, from its partial manifestations in certain animals to its human embodiment, as evoked by the founding myth of Narcissus. Next, examining the classical mirror as a singular object that reflects (faithfully or not) everything facing it, we will describe its many variations (flat, concave, or convex mirrors) and its earliest appropriations by painters. Moving on to mirrors in contemporary art, we will see them shattered or arranged in networks, reflecting back fragmented images that disorient us to the point of dizziness and seem to blur the line between the real and the virtual; blind or positioned facing the sky, thus reflecting emptiness, they are no longer conceived in terms of truth or fidelity, but of uncertainties and paradoxes. Nowadays the mirror telescopes continue to extend the visibility of the cosmos. Potentially, they gather and reflect the light of the entire world, whether as a whole or in fragments: a world of beings, things, or

nothingness, which conceals an infinity upon which the mind—having itself become a mirror—has cause to reflect and speculate.

2. Toward Specular Consciousness

2.1. *Animals Facing the Mirror*

In the 1970s, psychologist Gordon G. Gallup developed the Mirror Test (or Gallup Test): after placing a visible, odorless mark on an animal's body, it is placed in front of a mirror; if it examines the mark on its body (rather than its reflection) or attempts to remove it, it is inferred that it recognizes its body—a capacity that has often been interpreted as evidence of self-awareness. This mirror-based awareness, specific to animals with dominant visual senses, is, however, only one of many forms of self-awareness¹, which is not necessarily invalidated by failure in this test, as such failure can have various causes; moreover, humans themselves do not pass it until around eighteen months of age. On the other hand, this test may only be partially passed, as in the case of crows and jays, whose complex behaviors in front of a mirror do not indicate full self-recognition; pigs, for their part, use a mirror to find hidden food, which suggests advanced spatial understanding but not necessarily self-awareness; finally, rabbits, dogs, and cats believe they see another individual in the glass, at whom they tend to lunge... How can one not think of the mythical Narcissus, deceived by his own reflection, which he initially mistakes for another individual?

Currently, the animals that clearly pass the mirror test are: great apes (chimpanzees, bonobos, orangutans, and some gorillas), dolphins and orcas, Asian elephants, the Eurasian magpie, the African grey parrot, the manta ray, and the cleaner wrasse. Among them, the bottlenose dolphin, once accustomed to the mirror, not only recognizes its own reflection but also begins to make faces or inspect parts of its body that are normally invisible, such as the inside of its mouth. This self-exploration in front of a mirror is also found in Asian elephants, which nod their heads, swing their trunks, or flap their ears in insistent back-and-forth movements; furthermore, the fact that they often play in front of mirrors suggests that they represent more to them than a simple reflective surface.

The publication of *On the Origin of Species* by Darwin in 1859 sparked a flood of caricatures, particularly those featuring the “great ape” in front of a mirror. The one by F. Betbeder in 1874 (fig. 1) is particularly scathing: under the authority of two Shakespearean quotations, “Prof. Darwin,” naked and hairy, holds up a mirror to a monkey whose hair stands on end at the sight of his resemblance to Man... Also in the late 19th century, the theme of the monkey in the mirror inspired numerous advertisements; the Brooke soap brand (founded around 1886 in Philadelphia) was particularly notable in this regard, with advertisements that sometimes bordered on surrealism, going so far as to proclaim itself “the missing link in household cleanliness”! In the *Monkey Brand* advertisement (fig. 2), a monkey dressed as a gentleman gazes at his smiling reflection in a spotlessly scrubbed frying pan.

¹ Self-awareness takes various forms: *sentience*, the ability to experience internal states (hunger, pain, fear, etc.); *body awareness*, the perception of one's physical limits and the distinction between oneself and one's environment; *episodic memory*, the ability to recall a past event within its spatio-temporal context; *self-recognition*, the ability to recognize oneself as an individual; *planning*, the ability to act now in pursuit of a future goal, without immediate gratification; *metacognition*, the ability to reflect on one's own thoughts; *narrative consciousness*, likely unique to humans.

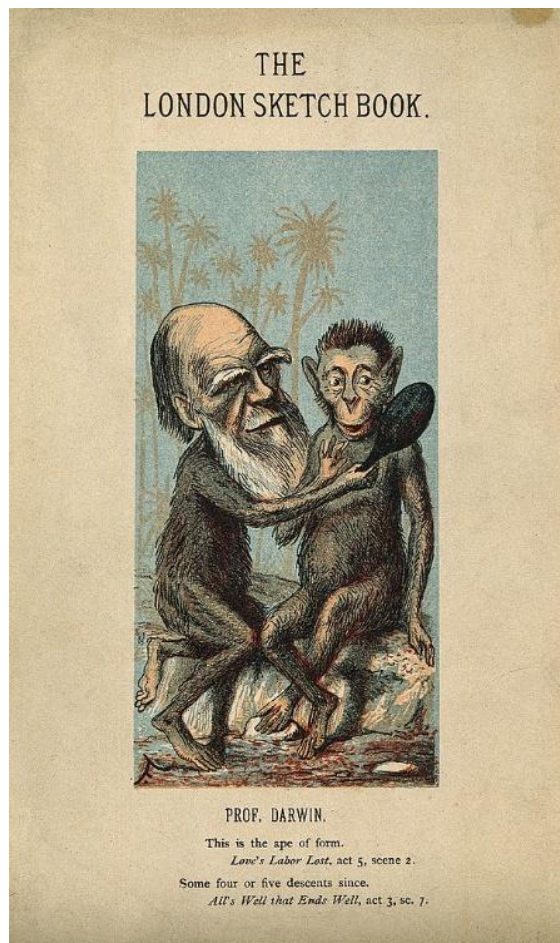


Figure 1. Faustin Betbeder, Prof. Darwin, 'The London Sketch Book', Lithography, 1874; Wikimedia Commons.



Figure 2. Antique advertising poster Soap Monkey Brand, Brooke's Lever Mirror, 19 May 1900; Wikimedia Commons.

2.2. The Illusion of Narcissus

In non-human animals, the mirror self-awareness we have just discussed manifests itself in various forms and to varying degrees. Among *Homo sapiens*—and in the West even before the advent of philosophy—myths have continually questioned human uniqueness and have long inspired both philosophers and artists. With regard to mirror consciousness, it is the myth of Narcissus² that has prevailed and continues to fascinate us. The story of the young man drawn to his own reflection explores the relationship between the self and the other (Narcissus and his reflection, Narcissus and Echo)—hence numerous psychological and psychoanalytic interpretations, but also the visual perception of a reflective surface, a theme extensively depicted by artists³ and which concerns us here.

The founding narrative featuring Narcissus at the edge of the spring essentially comprises two moments, aptly identified by art historian Henri de Riedmatten⁴ as “two stages of Narcissus’s reception of his own image on the water’s surface, which we will refer to here as the stage of the other (A) and the stage of the mirror (B)”⁵: at first, the hero, surprised by what he sees (he had come to the spring “to drink, not to look”⁶), mistakes his own reflection for a very real body: “in his ignorance, he desires himself.” No matter how much the author insists on the illusory nature of this image, Narcissus persists in seeing in it the figure of another and not his mirror double (A). A little further on, however, he begins to doubt: “He does not know what he sees, but what he sees inflames him”; to the point that seeing is no longer enough for him and he attempts to touch this virtual double. In the second half of the text, in despair, Narcissus speaks up, beginning to understand that he has deluded himself—“so great is the error that mocks my love!”—yet he remains torn between his doubting reason—“Ah! Whoever you may be”—and his overwhelming passion—“Come forth from this wave!”—before the cruel truth dawns on him: “But I am within you; I finally recognize it.” (B). He then sees the water’s surface for what it is: the

² Here we use the most detailed version of the myth, as recounted by Ovid in *Metamorphoses*, Book III (text edited by Désiré Nisard, 1850). Narcissus, a young man of irresistible beauty, spurns his many suitors, both male and female, including the nymph Echo. One of his victims calls upon Nemesis, the goddess of Revenge: “May he, in turn, fall in love, yet never possess the object of his affection!” Her wish is granted: after a hard day’s hunt, Narcissus comes to drink from a spring and falls madly in love with his reflection in the clear water, a passion that will ultimately kill him. But even then, he continues to search for his reflection in the waters of the Styx. In place of his body, one will find only “a yellow flower, crowned with white petals in the center of its stem”—the narcissus.

³ In the visual arts: *Narcissus*, a wall fresco from Pompeii; *Narcissus*, a painting attributed to Caravaggio (1597–1599); *Narcissus Gazing at His Reflection in a Fountain*, oil on wood by an anonymous artist (c. 1660); *Narcissus*, a fresco by Domenichino (1603–1604); *Echo and Narcissus*, a painting by Nicolas Poussin (1629–1630); *Narcissus Gazing at his Reflection in the Water of a Fountain*, an oil on panel by an anonymous decorator (circa 1660); *Narcissus*, a painting by Gyula Benczúr (1881); *Pink Narcissus*, film by James Bidgood (1971); *Narcissus*, painting by Pierre and Gilles (2012). In literature: Jean-Jacques Rousseau, “Narcissus, or the Lover of Himself” (1752); Rainer Maria Rilke, “Narcissus”, *Poèmes épars*, edited by Paul Hartmann (1935), *Poèmes français* (p. 171); Paul Valéry, “Narcissus Speaks” (1891), “Fragments of Narcissus” (1919–1922), “Cantata of Narcissus” (1938), *Œuvres de Paul Valéry*, Éditions de la N.R.F., 1933; regarding Mallarmé, see Laurent Matiussi, “Mallarmé and the Process of Impersonification: Narcissus Stares at Himself,” *Romantisme*, 1998, no. 99, *Écritures secondes*, pp. 105–116, DOI: <https://doi.org/10.3406/roman.1998.3376>.

⁴ De Riedmatten, H., « Narcisse au miroir trouble. De Caravage à Bill Viola » (Narcissus in the Troubled Mirror: From Caravaggio to Bill Viola), *A Century of Narcissism—Collective Work—Revue de psychanalyse*, © PUF, 2014. This article includes excerpts from *Narcisse en eaux troubles. Francis Bacon, Bill Viola, Jeff Wall (Narcissus in Troubled Waters: Francis Bacon, Bill Viola, Jeff Wall)*, “L’Erma” by Bretschneider, 2011.

⁵ De Riedmatten, H., *ibid.*

⁶ De Riedmatten, H., *ibid.* It is worth noting that the same alliteration appears in Valéry’s *Fragments du Narcisse*: “I greet you, child of my soul and of the wave, / Dear treasure of a mirror that shares the world! / My tenderness comes to drink from it, and is intoxicated by the sight / Of a desire testing its power upon itself!” (Je vous salue, enfant de mon âme et de l’onde, / Cher trésor d’un miroir qui partage le monde ! / Ma tendresse y vient boire, et s’enivre de voir / Un désir sur soi-même essayer son pouvoir !).

“medium of a representational space that is to be understood as an image—and, moreover, in this specific case, as a self-image.”⁷

Of all the paintings devoted to this scene, Caravaggio’s (fig. 3) is the most striking. Kneeling at the edge of a pond, one hand skimming the water, his face in profile, Narcissus is lost in amorous contemplation; his mouth is slightly parted, and his left eye, in shadow, seems to cast a melancholy gaze at his reflection. But in this powerful chiaroscuro against a black background, our attention is first drawn to a violently lit central mass: Narcissus’s right knee, almost phallic. In the upper half of the painting, bathed in light, is Narcissus’s body; in the lower half, his fragile reflection, drowned in darkness... Clear reality set against dark illusion.



Figure 3. Michelangelo Merisi da Caravaggio (Caravaggio), *Narcissus*, painting, oil on canvas, 110 cm x 92 cm, 1598-1599. Rome, National Gallery of Ancient Art, Barberini Palace; Wikimedia Commons.

The significance of the myth of Narcissus in the history of Western art and literature is immense. In the 15th century, Alberti effectively declared him the inventor of painting⁸, and as a cultural archetype, he gradually became the model for all thinking about the encounter between the individual and his image—in the mirror, but also on other planes within the visual arts (canvas, screen, photographic surface...). So true is it that, for Western aesthetics, “painting must be reflexive, that is to say, a repetition, a doubling of reality.”⁹

⁷ De Riedmatten, H., *ibid.*

⁸ Alberti, L. B., *Treatise on Painting*, Book II, 26, p. 135: “That is why I am in the habit of telling my friends that the inventor of painting, in the words of the poets, must have been that Narcissus who was turned into a flower; for if it is true that painting is the flower of all the arts, then the fable of Narcissus fits painting perfectly. Is painting anything other than the art of embracing the surface of a fountain in this way?”, (1435 in Latin, 1436 in Italian), 1992.

⁹ Phay, S., *Le vertige du miroir dans l’art contemporain (The Vertigo of the Mirror in Contemporary Art)*, Les Presses du réel, 2016 (with a foreword by Pascal Bonafous), p. 29.

3. Reflectors and Reflections

3.1. Reflective Surfaces

A source of reflection, a rigid surface without which things would be absorbed into oblivion, it invites us to reflect¹⁰.

Guy Michaud

The rich polysemy of terms associated with the mirror (psyche, reflection, revelation) immediately establishes it as an object that is both spiritual and material. Hence its widespread use far beyond the scientific realm that defines its characteristics.

As a technical and cultural adventure, the history of the mirror is as old as humanity itself. Originating around 6,000 B.C. in Anatolia, it was initially created by polishing a glassy volcanic rock, obsidian. More reflective mirrors with polished metal surfaces were subsequently produced: copper, starting around 4,000 B.C. in Mesopotamia and around 3,000 B.C. in Egypt; bronze¹¹ by the Hebrews, according to biblical accounts¹²; and polished bronze starting around 2,000 B.C. in China. The Romans primarily used mirrors made of an alloy of tin and copper, and later of silver (sometimes also glass mirrors coated with gold or molten lead). Legend has it that during the Second Punic War, to resist the Roman troops during the siege of Syracuse (213 B.C.), Archimedes, who had invented several war machines, developed giant “burning mirrors” to reflect the sun’s rays and concentrate them on the sails of the Roman ships, which are said to have caught fire as a result. At the turn of the 16th and 17th centuries, these spectacular events inspired the Florentine painter Giulio Parigi (fig. 4), but today the scientific community considers them unlikely¹³.



Figure 4. Giulio Parigi, *The Mirror of Archimedes*, 1599-1600, wall painting. Florence, Uffizi Gallery, Mathematics Cabinet; Wikimedia Commons.

In China, in the 5th century CE, amalgams of silver and mercury were used. Since all these metal-alloy mirrors were highly susceptible to oxidation, a sponge and a pumice stone were attached to them

¹⁰ Michaud, G., « Le thème du miroir dans le symbolisme français » (The Theme of the Mirror in French Symbolism), *Cahiers de l’AIEF*, 1959, p. 199-216.

¹¹ Bronze: an alloy consisting mainly of copper and, in varying amounts, zinc, tin, or other metals; more commonly known as bronze.

¹² Exodus 38:8: “He [Moses] made the bronze basin and its bronze stand from the bronze mirrors of the women who gathered at the entrance to the Tent of Meeting.”

¹³ For a more detailed discussion of the controversies surrounding Archimedes’ burning mirrors, see https://fr.wikipedia.org/wiki/Miroir_ardent

for cleaning and repolishing. The manufacture of glass mirrors represented a major advance in this regard. It is not clear exactly when this process emerged, and its existence during Antiquity is still debated. Pliny the Elder mentions the “glassmakers” of Sidon (modern-day Lebanon) in the 1st century, but the earliest archaeological examples date back only to the 3rd century (Egypt, Asia Minor, Germania, Gaul), and their quality is poor (as a result, metal mirrors would continue to be used for several more centuries).

During the 14th century, a superior manufacturing process was introduced in Europe: the back of a glass surface was coated with a tin amalgam (hence the “tain”¹⁴ in mirror). By the 16th century, Venice was renowned for its glassmakers on the island of Murano, who used this new technique (they kept it a secret for a century).

The modern history of the mirror began in 1835 when the German chemist Justus von Liebig invented the silvered glass mirror, which replaced the toxic tin-mercury amalgam. But while silver is highly reflective, it oxidizes quickly... In 1887, this flaw was overcome thanks to the first vacuum deposition process, which enabled the manufacture of glass-aluminum mirrors. However, for mirrors in optical devices, a more conductive metal, such as gold, is sometimes preferred because it reflects light more effectively.

Generally speaking, metallic coatings (gold, silver, aluminum) have a high reflectivity across a broad wavelength range, whereas dielectric¹⁵ coatings are highly reflective at specific wavelengths and also have the advantage of not absorbing light and being scratch-resistant.

Whether used for domestic, scientific, or artistic purposes, mirrors are equally notable for the diversity of their shapes and uses.

The surface of a mirror can be flat, concave, convex, parabolic, or spherical. A flat surface produces a virtual image that is symmetrical with respect to the mirror. A concave surface causes light rays to converge, while a convex surface causes them to diverge. The “witch's mirror” is a special type of convex mirror: its generally round shape allows it to reflect the image of an entire room, which is why it is used for surveillance in stores and hospitals, as well as for decorative purposes.

The first use of a mirror as an optical element rather than a simple reflector likely dates back to Newton’s telescope, built in 1685. Today, mirrors are ubiquitous in our societies and have become highly diversified: dielectric mirrors for short-wavelength, high-power lasers; cold mirrors to protect an illuminated element from thermal radiation; UV mirrors that reflect ultraviolet light¹⁶. As for semi-

¹⁴ Tain: a blackening layer of copper or lead applied to the back of the mirror’s glass panel, over a reflective layer of aluminum or silver. However, there are also one-way mirrors: some of the light that hits the glass surface is reflected, while the rest passes through it; in other words, a person standing on the reflective side (mirror) sees their own reflection, but standing on the other side (transparent), they see through the mirror. The well-known applications of one-way mirrors (voyeurism, criminology) may soon be joined by smart systems incorporating one-way mirrors for new augmented reality experiences.

¹⁵ Dielectric: A substance that does not contain free electrons capable of conducting an electric current, but which can be polarized by an electric field.

¹⁶ Applications of UV mirrors: UV laser systems; medical imaging (UV fluorescence microscopy enhances the visualization of certain biological markers and facilitates disease diagnosis); UV sterilization of medical equipment; curing of dental materials; semiconductor manufacturing (photolithography and precise patterning of silicon chips).

reflective¹⁷ mirrors, they are used in optical instruments (magnifying glasses, microscopes, telescopes, cameras, etc.) and in laser¹⁸ or lighting systems.

Finally, with the emergence of adaptive optics came segmented mirrors, which made it possible to further increase the size of telescope mirrors. We will return to this topic in Section 5.1, “Mirror Telescopes.”

Not all mirrors are optical. In geophysics, for example, some mirrors are discontinuity surfaces that separate terrains or bodies of water of different densities, and on which sound waves are reflected (echo); others are called fault mirrors; they constitute the visible surface portion of a fault plane, often smoothed by friction, and when the fault is active, they are associated with earthquakes. Finally, there are various magnetic mirrors, including the nuclear magnetic mirror, which allows for the reflection of a charged particle and the confinement of plasma¹⁹, necessary for the production of energy through thermonuclear fusion.

3.2. From Object to Work of Art

*The mirror is a void filled with images*²⁰.
Michelangelo Pistoletto

The act of making a mirror has always been an expression of a desire for knowledge (libido sciendi)—both of oneself (body and soul) and of reality, whether visible or invisible. As an object, the mirror fulfills this desire in multiple ways: through its surface, which reflects images (whether or not they correspond to the reality reflected in them), but also through its shape, size, frame, and even the place where it is placed.

While we can easily distinguish today between the scientific or medical uses of mirrors and their use for artistic purposes, this has not always been the case, and whatever the intended purpose of ancient mirror makers, aesthetic and/or symbolic concerns were never foreign to them. This is evidenced by this Egyptian statuette from the 15th or 14th century B.C. (fig. 5): a slender woman holds an oval bronze mirror at arm’s length, its handle resting on her head like a tiara; a metaphor for the universe?

¹⁷ Semi-reflective mirror: splits incident light into two identical light beams, one reflected and the other transmitted.

¹⁸ Laser: an acronym for Light Amplification by Stimulated Emission of Radiation. A device that amplifies light and focuses it into a narrow beam, known as a coherent beam, in which the waves and associated photons propagate in phase. A device that produces directional, nearly monochromatic light radiation through stimulated emission of radiation.

¹⁹ Plasma: the fourth state of matter, distinct from the solid, liquid, or gaseous states. An ionized gas in which atoms have lost or gained electrons, creating a mixture of positive ions and free electrons. In a broader sense, plasma can consist of charged particles (negative ions, electrons, ionized atoms, or molecules).

²⁰ In Coulibœuf, P., *Pistoletto - L’Homme noir (Pistoletto. The Black Man)*, Arles, Actes Sud, 2004, p. 107.



Figure 5. *Bronze mirror, 18th dynasty, 15th-14th BC, Hermitage hall 100 – Egyptian hall 38; Wikimedia Commons.*

As a decorative object, the mirror has embraced every style that has emerged from antiquity to the present day. The novelist Percy Kemp offers a charming glimpse of this in *The Devil's True Ass*²¹, the story of a woman and her reflection in a strange mirror, which turns her life upside down and, at first, prompt her to acquire, “among other things, a late-eighteenth-century Baroque mirror with a pediment, an oval English Chippendale mirror, a Louis XV mirror adorned with rocaille and chicory motifs, a pair of Louis XIV mirrors with gilded wood arabesques, a Regency mirror with a double frame, and a 1900s mirror featuring umbelliferous motifs in fruitwood.”²²

What distinguishes the decorative mirror from the artistic mirror in the full sense of the term is its representation in the visual arts. But while this representation dates back to antiquity, its significance was then primarily symbolic or mystical²³, and this remained the case until the very beginning of the Renaissance. However, its function as a model for self-portraits was recognized as early as the Middle Ages.

²¹ A medieval proverb says that a mirror is “the devil's true ass.”

²² Kemp, P., *Le vrai cul du diable*, Le Cherche Midi, 2009, pp. 60-61.

²³ In the Middle Ages, the mirror was regarded both as a diabolical instrument (deceptive, a tool of narcissism and vanity) and as a reflection of the divine (true knowledge).

In 1435, an event occurred that would transform the entire history of art: in his book *De Pictura*²⁴, Leon Battista Alberti²⁵ assigned to the painter the duty of copying reality; for Alberti, the painting is like the image in the mirror (both obey the laws of perspective, invented and demonstrated by the architect Filippo Brunelleschi in 1415): Narcissus is thus established as the inventor of painting, of which the mirror becomes the emblem. In fact, the mirror thereby acquired an undisputed pictorial status, which has persisted to this day, though it has evolved in response to the technical and later technological innovations of photography, which would challenge painting's role as an imitator of reality.

Nevertheless, from the 15th century onward, painters would explore to their heart's content within their paintings the mirror motif's capacity to reflect and provoke reflection. Notably through *mise en abyme*, which creates the illusion of depth by revealing a space outside the frame, as in the famous painting *The Arnolfini Portrait* (1434) by Jan van Eyck, the first artist to depict a mirror in an oil painting (figs. 6a and 6b): in the center, a convex mirror ("witch's mirror"), placed behind the couple at the back of the room, reflects the scene in reverse and distorts it; it depicts not only the couple from behind, but also what they themselves are seeing: two figures observing the scene, the one in blue likely being Van Eyck himself.



Figure 6. Jan van Eyck, *The Arnolfini couple*, 1434, oil on wood, 82 cm x 59.5 cm. London, National Gallery; Wikimedia Commons.

²⁴ Alberti, L. B., *De Pictura*, 1435–1436. Recent translation: Danielle Sonnier, Allia, 2019. Includes, notably, the first scientific study of perspective.

²⁵ Leon Battista Alberti (1404–1472): writer, philosopher, painter, mathematician, and theorist of painting and sculpture. A leading humanist of the Quattrocento, he produced three major works: *De Pictura* (1435–1436), *The Art of Building* (1450), and *De Statua* (1464).

Van Eyck's successors²⁶ would each, in their own way, continue these visual explorations of reality and illusion, but during the Renaissance, painters who turned to the imitation of nature abandoned convex mirrors in favor of rectangular flat mirrors that exactly duplicated the painted images. Leonardo da Vinci (1452–1519), who theorized about mirrors as an artist, scientist, and engineer, and who, as is well known, practiced mirror writing, made the mirror—along with the window—an absolute model of painting, which had itself become a “cosa mentale.” Toward the end of the Renaissance, Mannerist painters (1520–early 17th century) associated the mirror with the ephemeral and the superficial—seduction, deceit, simulacra, and vanities.

3.3. *The Soul and the Mirror*

*The wise mind is the mirror of heaven and earth,
in which all things are reflected.
Chuang Tzu*

Beyond its optical and aesthetic qualities, the mirror possesses a spiritual dimension, attested to in many cultures: according to certain beliefs, it connects the material and spiritual worlds; it is sometimes used in rituals aimed at warding off negative energies, the reflection then being perceived as a way to attain spiritual clarity; in *The Golden Bough* (Vol. 1, *Taboo*), Frazer²⁷ notes that for certain peoples, a man's soul is contained in his reflection in water or in a mirror—hence the fact that mirrors (and portraits) are subject to taboo because they pose a danger to the soul they capture.

In the Christian world, Saint Augustine (354–430) established the mirror's truly spiritual function (in addition to its role as a reflector of images) with his work *The Sacred Mirror, or Moral Precepts Drawn from Holy Scripture* (here, the two Testaments). For Augustine, there are three kinds of moral mirrors: the mirror of the soul, which reflects the world of ideas; the mirror of the mind, which points to moral virtues and their transcendence; and the true mirror, constituted by the Scriptures, in which true religion is reflected. According to the philosopher, human beings, who share in the likeness of God through their spirit, reflect divine truth only imperfectly during their earthly life. However, “At the end of time, they will be given an incorruptible body, not to suffer, but to enter into glory. Then, in this image, the likeness to God will be perfect, when the vision of God is perfect. A vision of which St. Paul speaks: ‘Now we see through a glass, darkly, but then we shall see face to face’²⁸ and ‘we all, with unveiled face, reflect as in a mirror the splendor of the Lord’²⁹.”³⁰ And Saint Augustine concludes: “We have therefore striven, from this image that we are, to see in some way, as in a mirror, the One who made us.”³¹

In the Middle Ages, the mirror—which was still a luxury item—served as a privileged tool for gaining self-knowledge (through the visual perception of one's own body) and knowledge of others (neighbors

²⁶ In homage to Van Eyck, several of his contemporaries and successors incorporated the mirror motif into their paintings: Robert Campin in *The Werl Triptych* (1438), Petrus Christus in *A Goldsmith in His Workshop* (1449), Hans Memling in the *Maarten van Nieuwenhove Diptych* (1487) and in the *Diptych of the Virgin and the Donor* (1485–1490).

²⁷ James George Frazer (1854–1941): a Scottish anthropologist and folklorist. He is credited with compiling the first comprehensive global inventory of myths and rituals. The twelve volumes of *The Golden Bough*, published between 1911 and 1915, describe thousands of social and religious phenomena.

²⁸ Saint Paul, First Letter to the Corinthians: 1 Cor 13:12.

²⁹ *Ibid.*, 2 Co 3, 18.

³⁰ Augustine (St.), *The Works of St. Augustine*, Vol. 16, *On the Trinity*, Books VIII–XV, Institute of Augustinian Studies, text from the Benedictine edition, translated by Fr. Agaësse, S.J., with notes in collaboration with Joseph Moingt, 1997, Book XIV, 17.23, p. 411.

³¹ *Ibid.*, 2 Cor. 3:18.

or God). Thus, a rust-stained metal mirror, distorting the image of the person gazing into it, “reflects the imperfection or stain of original sin”³² and, as a result, is associated with deception.

Among the spiritual mirrors of the Middle Ages, two examples are of particular importance: a literary work, *The Mirror of Simple Souls* (1295) by Marguerite Porète³³, and a visual work, “The View”, one of *The Lady and the Unicorn* tapestries (early 15th century).

For the poet Marguerite Porète, the mirror imparts profound knowledge, but unlike other medieval encyclopedic mirrors—including Vincent de Beauvais’s *The Great Mirror*³⁴—it does not stem from reason, but from love. It is a moral and spiritual journey in seven stages in which the soul gradually divests itself (“annihilates itself”) during a dialogue between itself (the one who looks) and God (the one who is looked at), a dialogue that ultimately reverses the mirror’s reflective functions, with the soul becoming the one looked at and God the one who looks. In the seventh stage, the mirror shatters and the soul, now perfectly annihilated, no longer knows itself, merging completely with God.

The tapestry *The Lady and the Unicorn*³⁵ draws on a tradition that is as much Christian as it is Neoplatonic and Hermetic, in which the mirror is linked to the human soul—recall that for Saint Paul, the human heart is a “mirror reflecting God.” As for the unicorn, it symbolizes spiritual elevation, the divine mystery, the quest for immortality, but also the union of opposites. In the scene of “The View” (fig. 7), the mirror is made of precious materials (gold, gems) that symbolize the presence of the divine. The Lady, for her part, is adorned with a bridal crown that seems to mark her for a sacred marriage. But, far from gazing at herself in the mirror (and thus far from any narcissism), she holds it out to the unicorn in order to attain true vision: that of the heart, the seat of the soul, the only thing capable of perceiving the divine.

³² Pomel, F. (ed.), *Miroirs et jeux de miroirs dans la littérature médiévale (Mirrors and Reflections in Medieval Literature)*, with a foreword by Sabine Melchior-Bonnet, Rennes: Presses universitaires de Rennes, 2003, p. 18.

³³ Marguerite Porète: a Christian poet and 13th-century Beguine, burned at the stake as a heretic and relapsed heretic in Paris on June 1, 1310. *The Mirror of Simple Souls* (in plain English : translated and adapted by Ben Kucenski, 2025 ; <https://synergyexplorers.org/wp-content/uploads/2021/10/Mirror-of-Simple-Souls-M-Porete-1-1-1.pdf>) is one of the few firsthand accounts of the ideas associated with the Free Spirit movement. A major work of medieval mystical literature in the French language, it is also exceptional as a speculative work written by a woman in the Middle Ages. Its spiritual richness places its author in the tradition of St. John of the Cross, Meister Eckhart, and Hadewijch of Antwerp.

³⁴ Vincent de Beauvais’s *Speculum Majus (The Great Mirror)*, c. 1258: the quintessential symbol of knowledge and wisdom, bringing together treatises on natural history (*Mirror of Nature*), the sciences—including scholasticism (*Mirror of Doctrine*)—and historical accounts (*Mirror of History*).

³⁵ *The Lady and the Unicorn* tapestry series: a set of six tapestries from the early 16th century. Five of them constitute an allegory of the five senses, symbolized by the activities in which the Lady engages. The symbolism of the sixth tapestry, which bears the inscription “My Only Desire”, is a matter of debate: an allegory of the heart, the sixth sense prompting the Lady toward Christian charity? Renunciation of the senses? The tapestry series has given rise to numerous literary and artistic interpretations. But in every case, it represents the elevation of the soul through a transcendence of the animal condition to attain the rational desire that is uniquely human.



Figure 7. “The View” (*The Lady and the Unicorn*) – *The Lady*, between 1484 and 1500, tapestry. Paris, Cluny Museum; Wikimedia Commons.

4. Artistic Issues

It is no coincidence that contemporary art makes such extensive use of the mirror. Having become a medium in its own right for interactive works, it acts as a revealer of some of the major uncertainties haunting our postmodern era: how can we distinguish the interior from the exterior, the real from the virtual, matter from light, and the inert from the living, at a time when they may be hybridizing, and remain certain of our own subjective identity? Most of these questions date back to antiquity (Greek philosophers were already asking them), but techno-industrial modernity and then digital and quantum postmodernity have introduced other tools to address them, primarily of a scientific nature. At the intersection of art and science, mirrors and their avatars (new reflective surfaces, screens) are undoubtedly among these tools. Artists from different eras have employed them to expand their representational possibilities, to subvert the classical dictat of mimesis (unfaithful, multiplied, fragmented, blurred, or absent reflections, depicted alongside or in place of the subject from which they are supposed to emanate), and even to invite us to traverse them, at least through thought and gaze.

4.1. Reflecting, Disrupting

*Seeing oneself, seeing better, seeing more,
seeing something else, no longer seeing oneself.
Daniel Buren³⁶*

³⁶ Daniel Buren thus evokes in 1975, during an exhibition in Cologne, the reflexive powers of mirrors that he uses for the first time in his sculptures.

The history of painting is replete with depictions of figures with mirrors, their postures revealing certain visible or hidden parts of their bodies, thus giving rise to every possible combination between the figures and their reflections.

Some paintings show both a subject (from the back, front, or in profile) and their reflection in the mirror: in the tapestry “The View” of *The Lady and the Unicorn* (fig. 7), the unicorn is in profile and appears to be gazing at the mirror held out to her by the Lady; in Titian’s *Venus with a Mirror* (fig. 8), Venus’s body faces forward, but her face, in profile, is turned toward the mirrors held out to her by two cherubs; one mirror reflects the part of her face hidden from us, while the other, held above her head, reflects nothing; sometimes the subject faces forward and does not look at the mirror, which reflects her profile (for example, *Elisabeth Alexeievna with a Mirror*, by J. L. Mosnier, 1802) ; or, with the figure shown from behind, it is her reflection that reveals part of her face and upper body (as in *Female Model Before a Mirror* by C. W. Eckersberg, 1841). Other paintings, on the contrary, depict only the reflection of a subject outside the frame (consider the famous *Self-Portrait with a Bamboo Mirror* by Édouard Vuillard, 1890).



Figure 8. Titian, *Venus in the mirror*, circa 1555, painting, oil on canvas, 105.5 x 124.5. Washington D.C., National Gallery of Art; Wikimedia Commons.

Since the advent of contemporary art in the 1960s, the aesthetic status of the mirror as a medium has changed. Now less in the service of mimesis and more intended to provoke a critical gaze upon our multiplied world, it gives pride of place to mirrors of all kinds: sometimes marvelous, sometimes strange (empty, black), even unsettling. On the marvelous side, artist Jean-Michel Othoniel³⁷ has been

³⁷ Jean-Michel Othoniel (born in 1964): lives and works in France. Beginning in 1991, he explored the properties of glass, a material that would become his signature. In 1993, he discovered blown glass, which he would use to create his multicolored palette. In 1996, as a resident at the Villa Medici, he began creating a dialogue between his works and the landscape by suspending giant necklaces from the trees in the gardens. In 2000, he transformed the Palais Royal–Musée du Louvre Paris metro station into the *Kiosque des*
© 2026 ISTE OpenScience – Published by ISTE Ltd. London, UK – openscience.fr Page | 40

developing a “theory of reflections” for over ten years (with Mexican mathematician Aubin Arroyo). This culminated in a solo exhibition at the Petit Palais, “The Theorem of Narcissus”³⁸ (a flower-man who reflects himself and, in doing so, reflects the world around him), featuring shimmering works that invite the viewer to dream. In this regard, Othoniel stands apart from most contemporary artists, who prefer to explore the unsettling possibilities of reflective mirrors—mutual reflections, self-reflections, and hybridizations of reflection and image... In her book *Vertiges du miroir dans l’art contemporain*, contemporary art historian Soko Phay discusses, for example, Valérie Belin’s photographic series *Venice* (1997)—a detailed profusion of mirrors and glass objects that “refer only to themselves, reflecting emptiness ad infinitum like a cemetery of contemporary vanities. For in the absence of exchanged glances or desires, the reflections take on a spectral resonance.”³⁹ Or again, Philippe Segond’s abstract work, *Détail 29, Miroir* (2001), part painting, part reflections, which glows softly with its two silver panels and “seems to reveal a non-reflective liquid reflection, somewhere between translucent and veiled, a hybrid specular image, a chemical surface in effervescence.”⁴⁰ To characterize the aesthetics of these “reflections of a new kind,” Soko Phay coined the concepts of “mercurial mirror” and “spectral mirror,” in order to “capture the particular brilliance of shimmering surfaces that disturb or obscure the reflection.”

As early as 1964, with his iconic Pop Art work, *Girl in Mirror*, Roy Lichtenstein⁴¹ turned his back on mimesis: devoid of flesh or reflection, the girl with the plastered smile who looks at herself in the mirror, is merely a mass-produced, mechanized item (made of enamel on metal), as evidenced by the identical treatment of the real subject seen from behind and her supposed reflection in the mirror she holds in her hand—in this case, a few bold blocks of color and shapes with thick black outlines, the face and hand covered in Ben-Day⁴² dots simulating commercial printing techniques. This work, of which there are about ten editions, lies at the intersection of the major themes driving Pop Art: mass culture and alienation, desire, and artificial beauty (echoed by Britney Spears’ song “Girl In The Mirror”⁴³).

With his *Portrait of George Dyer in the Mirror* (1968), Francis Bacon disrupts our perception in yet another way. The distorting mirror reflects a reality that is itself distorted: the subject’s enigmatic posture, the elongation of his face, the inversion of the reflection of the room’s background. This composition exudes an atmosphere that is both fascinating and unsettling, as in most of Bacon’s works.

Noctambules: a double crown of glass and aluminum conceals a bench designed for encounters. Othoniel has exhibited at the Fondation Cartier since 1992 and collaborates with the glassmakers of Murano. His shimmering and luminescent works are exhibited worldwide.

³⁸ « Le théorème de Narcisse » (“The Narcissus Theorem”): exhibition at the Petit Palais, Paris, September 28, 2021 – January 9, 2022; book co-published by Actes Sud and Galerie Perrotin.

³⁹ Phay, S., op. cit., p. 202.

⁴⁰ Ibid., p. 207.

⁴¹ Roy Lichtenstein (1923–1997): an American artist and a leading figure in Pop Art. His works draw heavily on advertising, popular imagery, and the comic books of his time. His early works were influenced by Cubism and Abstract Expressionism, but he later focused on popular culture and mass media. In 1962, New York gallery owner Leo Castelli organized his first solo exhibition, which brought him immense commercial success. Paintings, posters, and metal and plastic sculptures demonstrate the diversity of the techniques he employed. In 1979, Lichtenstein was elected a member of the American Academy of Arts and Sciences. Finally, in the 1990s, he became interested in mirrors, particularly in the reflection of objects (see, for example, 1991’s *Interior with Mirrored Room*). In 1999, the Roy Lichtenstein Foundation opened its doors. In 2007, the first exhibition dedicated to him in France was held to mark the inauguration of the Pinacothèque de Paris. In 2013, the exhibition dedicated to him at the Centre Georges Pompidou was nominated for the 2014 Globes de Cristal in the “Best Exhibition” category.

⁴² Ben-Day: a halftone printing technique (using rows of dots), developed in 1879, that produces solid colors without gradations.

⁴³ *Girl in the Mirror* (1999) : “I can't believe it's what I see / That the girl in the mirror / The girl in the mirror / Is me / I can't believe what I see / No... / The girl in my mirror / The girl in my mirror is me / Ohh... is me. ”

In Bill Viola's⁴⁴ famous video *The Reflecting Pool* (1977–1979), we witness, over the course of seven minutes, a complete dissociation between what takes place in the supposedly real world on the one hand—a naked man (the artist himself) emerges from the vegetation surrounding a pool, at the edge of which he comes to a standstill—and the virtual world of the water's surface. In this resolutely non-narcissistic reworking of the myth of Narcissus, the artist plays with time by desynchronizing the events taking place in the pool from those affecting his surroundings: at first, the water's surface roughly reflects the body of the standing man; then, as he jumps and remains suspended in the air, the water, alternately smooth and rippling, begins to “live” independently of him, first ceasing to reflect anything, then playing out its specular part in a whimsical manner, reflecting at times the surrounding vegetation, at times the man in the position he occupied just a few minutes earlier... Then the man's figure fades while the reflections in the water multiply: human figures, then vegetation, then the man who does not exist outside the pool and seems to be swimming toward its edge... Finally, the light intensifies and we see the man emerge from the basin and disappear into the woods. As video art critic Jean-Paul Fargier noted, “Viola's basin is to video art what the apple is to Newton: a mirror that, like Cocteau's, reflects before speaking.”⁴⁵ A mirror that grants us access to another reality—that of a fabricated parallel world with dreamlike qualities.

Artist Bertrand Lavier⁴⁶ enjoys mixing materials, codes, and genres of everyday objects (furniture, household appliances). His “Painted Objects” series includes several works featuring mirrors: *On Reflexion* (1984) is a paradoxical and hybrid object, neither a true ready-made since it is painted, nor a reflector as its title might suggest. Another equally hybrid object, *Delfino* (1988), is a mirror covered in acrylic paint whose thick, textured strokes (Lavier's “Van Gogh touch”) make it resemble a sculpture. Finally, in *Menphis* (2000), the mirror, covered with a metallic paint that obscures its surface, produces only a few reflections, thus confronting the viewer with a blurred and distorted version of themselves.

Both an artist and a scientist, Piotr Kowalski⁴⁷ focuses in his work on capturing, in particular, the workings of perception. His installation *Identity No. 2* (1984) consists of three cubes of different sizes—red neon tubes mounted on steel bases—and three mirrors with adjustable orientations, which reflect the geometry of the cubes with decreasing fidelity. The distances between the cubes have been calculated to

⁴⁴ Bill Viola (1951–2024): video artist and installation artist. From his earliest videos, dating back to 1975, he positioned himself as the central subject while engaging the viewer. The space and time that interest Viola are not limited to the visible world, but also pertain to the unconscious and spirituality. Death, birth, and the exploration of human consciousness are key themes in his art. Viola's work has greatly contributed to the recognition of video as a medium in contemporary art. He is a recipient of the MacArthur Foundation Fellowship (1989), a Knight of the Order of Arts and Letters (2006), and holds several honorary doctorates. Notable exhibitions include “Installations and Videotapes” (1987) at MoMA and “A 25-Year Survey” (1997) at the Whitney Museum of American Art in New York, as well as “Hatsu-Yume (First Dream)” (2006–2007) at the Mori Art Museum in Tokyo.

⁴⁵ Fargier, J.-P., *The reflecting Pool de Bill Viola*, Yellow now, “Cote Films”, 2005, Back cover.

⁴⁶ Bertrand Lavier (born in 1949). A French artist and trained horticultural engineer, he lives and works in Paris and Aignay-le-Duc. His artistic career began in 1969, influenced by Land Art and Conceptual Art. By the early 1980s, he had established himself as a key figure in the European art scene through various series (including “Objets peints”), making extensive use of superimposition, hybridization, and transposition. In doing so, he challenges traditional categories of art and positions himself as a critical extension of Pop Art, Marcel Duchamp, and the Nouveaux Réalistes. Among the many exhibitions dedicated to him, the major retrospective organized in 2012 by the Centre Pompidou stands out.

⁴⁷ Piotr Kowalski (1927–2004): French-Polish painter, sculptor, architect and mathematician. After studying mathematics and architecture at the M.I.T. (Cambridge, USA), he settled in France at the end of the 1950s. Artist inventor in the wake of Leonardo da Vinci, he is convinced that the science – which he critically reads – inaugurates a new era for art. First manipulating light and electromagnetic energy, then holograms and the internet network, he puts science at the center of his works by bringing in the viewer. A thinker of technological art, Kowalski created machines inspired by Marcel Duchamp in the 1960s–70s and, in the last decade of the 20th century, used computers to develop networked works. In the 1980s and 1990s, he taught at the École Nationale Supérieure des Beaux-Arts in Paris and received several major honours.

allow the viewer, from a given vantage point, to see reflections of identical size in the mirrors, leading them to question their perception of reality...

We will conclude this brief overview of reflections in all their states of presence or absence with Gerhard Richter's⁴⁸ *Mirror, Gray* (2003), which also offers the viewer another version of their own reality. Neither a real mirror nor a monochrome painting, as the artist himself has pointed out, it is designed on a scale that allows the visitor to walk all the way around it; in doing so, the image they perceive varies, and they believe they see depth and tangibility in it. Generally speaking, in Richter's glass works, "visitors do not remain spectators but become creators themselves; they confront the gap between the actual exhibition space and the random reflection of reality on the glass."⁴⁹ This interactive effect of mirror-based works can also be achieved using one-way mirrors, which many artists employ to create immersive pieces that offer each viewer a unique experience.

4.2. Stepping Through the Looking Glass

Stepping through the space of the mirror to access a virtual world symmetrical to our own is a human desire that has itself spanned the ages, taking shape in literary, philosophical, and artistic forms, among others.

This fantastical journey—whether successful or not—is evoked in fantasy literature, beginning with Lewis Carroll's *Through the Looking-Glass* (1871): to discover what the world looks like in the mirror's reflection, Alice, who has fallen asleep, dives into the living room mirror and finds herself on the other side, in a "wonderland" where everything is inverted—from the objects in the House of Mirrors to the writing of a mysterious book. And since stepping through the mirror also means putting one's own identity at stake and testing the limits of the real and the virtual, as she travels through "the wood where things and living beings have no names," Alice even forgets her own name, and the novel ends with the question: "What is our life, if not a dream?" In Jean Cocteau's poem "L'Ange Heurtebise,"⁵⁰ passing through the mirror leads into the other world: "I reveal to you," said Heurtebise to Orpheus, "the secret of secrets. Mirrors are the doors through which death comes and goes. Moreover, if you gaze at yourself in a mirror your whole life, you will see death working like bees in a glass hive." Edgar Allan Poe's short story "A Descent into the Maelström" features a funnel that, like a black mirror, draws the gaze in only to lose it in the depths beyond⁵¹. And among contemporary young adult fiction novels, Christelle Dabos's *La Passe-miroir*⁵² features a young woman who possesses the gift of magically passing through mirrors and reading the past of objects through touch.

⁴⁸ Gerhard Richter (born in 1932): international German painter. Born in R.D.A, he fled to the West in 1961. He lives and works until today in Cologne. From 1962, a first stylistic shift led him to paint in a more abstract way, a trend he confirmed in the 1970s by turning towards geometric and lyrical abstraction, without abandoning figurative art. Very marked in his early youth by the Second World War and the post-war period in East Germany, the artist approaches the memory of the Nazi past in an introspective way. He is notably famous for his photo-paintings (paintings made from photographs). In 1997, Richter received the Golden Lion at the Venice Biennale. At the beginning of the 21st century, he created works on glass and was interested in digital images. From October 17, 2025 to March 2, 2026, the Fondation Vuitton (Paris) dedicated a vast retrospective to him.

⁴⁹ Bretz, J. et Küster, K., « Transparent and Reflected : Mirrors, Glass, and Strips », in Gerhard Richter : Abstraction. Exh. cat. (Potsdam, Musée Barberini, 2020), p. 198.

⁵⁰ « L'Ange Heurtebise » (The Angel Heurtebise): poem, Editions Stock, 1925. With a photo of Man Ray. Poem taken again from 1926 in the play *Orpheus*. During the 1927 revival, Cocteau himself played the role of Heurtebise.

⁵¹ "A Descent into the Maelström" — 2015 — The Annotated Poe, ed. Kevin J. Hayes (Cambridge, MA: The Belknap Press of Harvard University Press), pp. 210-228.

⁵² Dabos, C., *Les fiancés de l'hiver*, volume 1 of 4: "La Passe-miroir", Paris, Gallimard Jeunesse, 2013. Grand Prix Romans jeunesse 2016.

In the realm of philosophy, note Michel Foucault's text, "Other Spaces, Heterotopias," which offers a masterful analysis of the human gaze's journeys through the mirror: "The mirror, after all, is a utopia, since it is a place without a place. In the mirror, I see myself where I am not, in an unreal space that opens virtually behind the surface; I am there, where I am not, a kind of shadow that grants me my own visibility, that allows me to look at myself where I am absent—the utopia of the mirror. But it is also a heterotopia, insofar as the mirror actually exists and has a sort of reciprocal effect on the space I occupy; it is through the mirror that I discover myself absent from the place where I am, since I see myself over there. From this gaze that is somehow directed at me, from the depths of this virtual space on the other side of the glass, I return to myself and begin once more to turn my eyes toward myself and to reconstitute myself where I am; the mirror functions as a heterotopia in the sense that it renders this place I occupy at the moment I look at myself in the mirror both absolutely real—in connection with all the space surrounding it—and absolutely unreal, since it is compelled, in order to be perceived, to pass through that virtual point which is over there."⁵³ (my translation).

In contemporary art, journeys through the looking glass are always strange and unsettling. In 1961, in his performance *Armadillo for your show*, Oleg Kulik⁵⁴ walked through a sheet of glass to position himself on the other side, within the space of the reflection itself. Suspended several meters above the ground on a metal structure, his body was covered with hundreds of small square mirrors and projected thousands of flashes of light onto the audience. Thus camouflaged by the blinding light he diffracted, he virtually disappeared as a subject. Another example of refracted light is provided by artist Robert Smithson's⁵⁵ installation *Mirror Vortex* (1964)—three painted steel triangular prisms with inner walls lined with oblique triangular mirrors that meet at the back. Standing before this "Mirror Well" inspired by crystallography, the viewer is drawn into the depths of the vortex, which multiplies and fragments their image within an environment that is itself fragmented. Or take Anish Kapoor's *Halo* (2006), a monumental concave disc of reflective stainless steel, with fan-shaped folds. Since the angles of its reflective sections face outward, our reflection is fragmented within its folds... Finally, let's return to Alice with Philippe Ramette⁵⁶ and his sculptural object *Traversée du miroir* (2011), which embodies Alice's imaginary plunge. Thanks to holes cut into the mirror—through which one can slip one's arms and knee—one can begin to physically pass through it, but its physical opacity remains an insurmountable barrier.

⁵³ Foucault, M., « Des espaces autres, Hétérotopies » (Other spaces, heterotopias), lecture delivered on March 14, 1967 in Paris. <https://shs.cairn.info/revue-empan-2004-2-page-12?lang=>

⁵⁴ Oleg Kulik (born 1961): Russian sculptor, photographer and curator of Ukrainian origin. Lives and works in Moscow since 1986. Considered nowadays as one of the major Russian artists of his generation, Oleg Kulik explores the animal dimension of the human being through singular and militant actions and installations intended to raise controversy. By confronting the perception of the human body in behaviors and social exchanges, Kulik wishes to make visible the binding power of the norm on all bodies.

⁵⁵ Robert Irving Smithson (1938 –1973): American artist representative of minimalism, and one of the founders of Land Art, he is passionate about science and science fiction, architecture, spatio-temporal vertigo, philosophy, and literature. By intervening in wild places or wastelands, he sought to reintegrate art into a natural or social context, referring in particular to the notion of entropy and the qualities of materials. His first paintings relate to religious mythology, and his drawings and collages incorporate eclectic elements. In 1964, he created mirror-sculptures, which are inspired by the structure of crystals. In 1967, he produced the series of "non-sites", which mix sculptures of earth and rocks with glass or biased mirrors. In 1969, he created works of Land art, including *Mirror Displacements*, a series of photographs illustrating his essay *Incidents of Mirror Travels in the Yucatan* (1969). Through his inspired, visionary and self-reflexive work, Robert Smithson is emblematic of contemporary art.

⁵⁶ Philippe Ramette (born 1961): French artist and photographer. Lives and works in Paris. From 1987 to 1989, follows the artistic courses of the Villa Arson in Nice. His first sculptures are inspired by surrealism. With his installation *Les cendres de dieu (God's Ashes)* (1988), a box containing the burned remains of a painting, he signed his renunciation of painting and posed as a visual artist. Its extreme devices allow to physically experiment what should only be a thought. Among the recurring elements of his work, which balances between zany and absurd, are enigmatic object-characters. Philippe Ramette is a Chevalier des Arts et des Lettres (2011). Many French collections hold his works.

5. Conquering Space

We have already briefly mentioned optical mirrors and their many possible uses. Those related to astronomy are among the most significant, as they have immensely expanded the scope of the visible universe—thanks to mirror telescopes, whose development we will now trace.

5.1. Mirror Telescopes

Until the reflecting telescope was invented by Newton in 1668 and described in his *Opticks* (1704), astronomers had been using refracting telescopes⁵⁷ since Galileo (1609), in which lenses bent and focused light; for over a century, however, their performance was limited by chromatic aberration (the separation of light into its component colors) and the difficulty of manufacturing large lenses. By the early 18th century, chromatic aberration in telescopes had been eliminated, but since the reflective power of Newton's polished bronze mirror was poor, telescopes and refracting telescopes coexisted until the end of the 19th century. It was not until the early 20th century that telescopes completely supplanted refracting telescopes, thanks to Léon Foucault's development of silvered glass mirrors, which were significantly more reflective than bronze.

Optical reflecting telescopes typically consist of two mirrors: a large, concave, parabolic primary mirror collects light from a distant celestial object and reflects it, focusing it onto a smaller, flat secondary mirror; which then directs it toward the observer's eyepiece, where it can be magnified and analyzed. The quality of these mirrors depends primarily on the quality of the substrate surface. They are generally made by depositing metal⁵⁸ on the front surface, which prevents light from passing through the glass, thereby avoiding problems of distortion and loss of light energy associated with refraction or dispersion. Mirrors are also essential components of coronagraphs, instruments used to block the bright light of a star so that the fainter objects surrounding it (planets or circumstellar disks) can be observed.

To increase the light-gathering power and resolution of reflecting telescopes, astronomers have developed multi-mirror telescopes (also known as segmented mirrors), which combine the light collected by multiple mirrors to simulate the effect of a single, larger mirror. This increases the amount of light collected, improves the resulting images, and makes more distant objects observable. But astronomical observations faced a major obstacle: the Earth's atmosphere, whose turbulence causes the light from celestial objects to shimmer and become distorted... To eliminate these undesirable effects, adaptive optics systems have been developed, which use mirrors that can be deformed in real time: the atmospheric distortion of the incoming light is measured by a wavefront sensor; a computer system then calculates the necessary adjustments, and the mirror deforms accordingly, significantly improving image quality. The most spectacular example of a telescope equipped with adaptive optics is the Very Large Telescope (VLT). Consisting of four main telescopes and four auxiliary ones, it is located at the Cerro Paranal Observatory in the Atacama Desert (Chile) at an altitude of 2,635 meters. Launched in 1987, this European project of the European Southern Observatory (ESO) saw its first primary mirror installed in 1997. By 2001, all of its main telescopes were operational, and ten years later, the four 8-meter telescopes were combined, making the VLTI (the "I" stands for interferometer) the largest telescope in the world. In 2012, the KMOS instrument (K-band multi-object spectrograph) observed twenty-four objects simultaneously in the infrared for the first time⁵⁹. Finally, in 2018, a new adaptive optics system was installed on the VLT and coupled with the previous one, thereby enabling the correction of atmospheric turbulence at various altitudes.

⁵⁷ Eyeglasses, on the other hand, had already existed since the end of the 13th century.

⁵⁸ For the surface of the first mirror telescopes, an alloy composed of two thirds copper and one third tin was used, which allowed to obtain reflectivities of up to 70%.

⁵⁹ Far-infrared light (15 μm to 100 μm) makes it possible to see distant galaxies despite their redshift, to observe star formation despite the presence of dust, and to study objects that are, for the most part, very cold.

However, to completely overcome the turbulence of Earth’s atmosphere, the mirrors had to be moved away from it—in other words, placed in space. The idea was not new; first proposed in 1923 by the Austro-Hungarian physicist Hermann Oberth, it was taken up again in 1946 by Lyman Spitzer, an astrophysicist at Yale University. But since no satellite had yet been launched into orbit (Sputnik 1 would not be launched until 1957), the idea remained on the back burner until 1974, when NASA began developing a full-scale space telescope project, whose funding was approved by the U.S. Congress in 1977. Work on the telescope’s mirror began in late 1978, and the project, named Hubble in honor of the great astronomer Edwin Hubble, was launched in 1983. But in 1986, the tragic explosion of the space shuttle Challenger delayed the launch by more than four years. On April 24, 1990, the Hubble Space Telescope⁶⁰ was finally launched aboard the space shuttle Discovery. But shortly after launch, a serious aberration problem was identified, caused by an error in the shape of the primary mirror. This was corrected in 1993, thanks to a rescue mission carried out by seven astronauts aboard the space shuttle Endeavour: five pairs of corrective mirrors were then provided to the space telescope by COSTAR (Corrective Optics Space Telescope Axial Replacement). Hubble was finally able to deliver the high-quality images astronomers had been waiting for (more than 1.4 million observations that would result in over 16,000 scientific papers)⁶¹. The first astronomical object that Hubble’s corrective optics allowed us to observe was the spiral galaxy M100 (Fig. 9), with a wealth of detail never seen before!

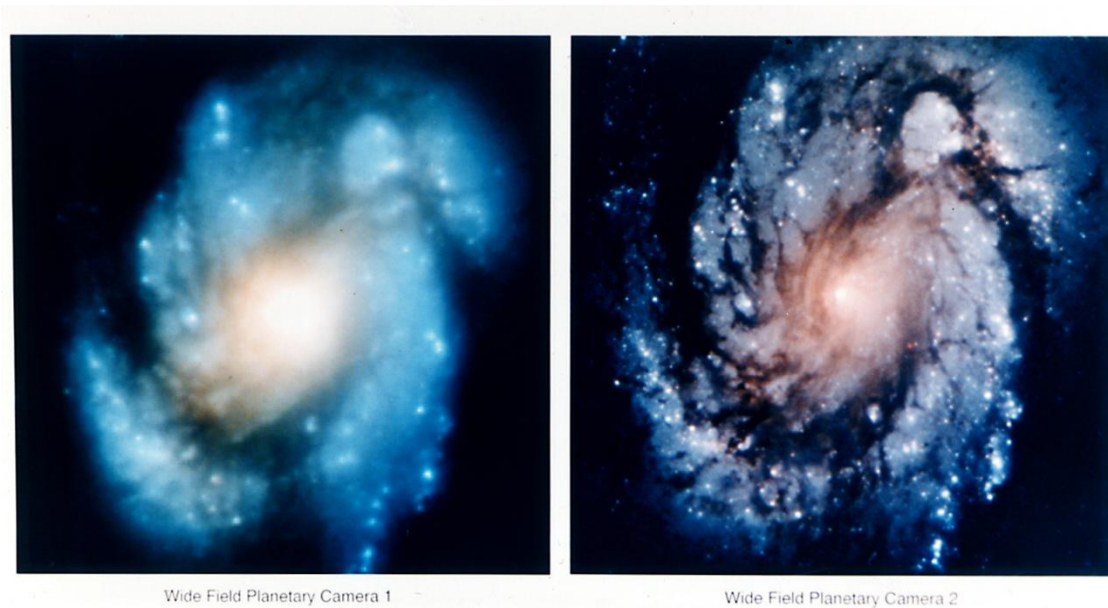


Figure 9. Hubble images of M100 before and after mirror repair - GPN-2002-000064.jpg; Wikimedia Commons.

In the image on the left, the core of the M100 galaxy, photographed with a WFPC-1 camera in wide-field mode on November 27, 1993, a few days before the 1993 servicing mission. The spherical aberration of the primary mirror scatters starlight, blurs details, and obscures faint structures. In the image on the right, the photo was taken on December 31, 1993, after the optical correction mission, by the WFPC-2 camera in its high-resolution channel. The image clearly shows, for the first time, structures as small as 30 light-years across in a galaxy located tens of millions of light-years away. It should be noted, however, that space telescopes have not completely replaced ground-based telescopes: thanks to the VLT and the new GALACSI adaptive optics system on the MUSE (Multi Unit Spectroscopic

⁶⁰ Hubble Telescope: a Cassegrain-type telescope (a reflecting optical system proposed in 1672 by Laurent Cassegrain), consisting of a concave, parabolic primary mirror (here, 2.4 meters in diameter) and a hyperbolic, convex secondary mirror (here, several smaller mirrors).

⁶¹ Source : <https://www.futura-sciences.com/sciences/actualites/hubble-hubble-reve-grand-telescope-spatial-devint-realite-80728/#xtor%3DRSS-8>

Explorer) instrument⁶², images obtained from the ground are sometimes of higher quality than those from the Hubble Space Telescope, as demonstrated by tests conducted on the planet Neptune.

Studies aimed at developing the successor to the Hubble Space Telescope began as early as 1989—that is, even before the Hubble was launched—and its mission lasted until 2005. The new telescope, named the James Webb Space Telescope (JWST or Webb) in 2002, was launched on December 25, 2021, by the Ariane 5 rocket. The result of a broad international collaboration (NASA, ESA, CSA, CEA, CNRS), it operates from the L2 Lagrange point of the Earth-Sun system, 1.5 million kilometers from our planet! While Hubble operated in the visible and ultraviolet ranges of the light spectrum, Webb is optimized for observing infrared radiation, and its significantly greater power compared to Hubble allows it to observe even more distant celestial objects—that is, even older ones. Since it became operational, the data it has delivered has been exceptional: images of the solar system, but also of the first galaxies that formed in the Universe, as well as exoplanets with their atmospheres.

So what are the characteristics of the JWST's mirrors that enable such performance? Its primary mirror, with a diameter of 6.5 meters (a record in the history of space observation), captures light from deep space and reflects it toward a secondary mirror, which redirects it to the scientific instruments located inside the telescope. The total collecting area is approximately 25 square meters (six times larger than Hubble's) and consists of 18 hexagonal segments (each measuring 1.3 meters wide and weighing about 20 kilograms) made of beryllium, a very lightweight metal that resists deformation even in the freezing cold of space (down to -220°C); these hexagons are coated with a layer of gold 100 nanometers thick (just enough to fully cover the mirror), which gives them extraordinary reflectivity, reaching up to 98%. Whatever the next advances in space telescopes may be, we can already say that with the JWST, astronomical observation has entered a new era.

5.2. In view of infinity

It is for several reasons that the mirror returns to infinity. On the one hand, as a material object, it is finite, but through the light it receives and reflects, it has a part linked with infinity: a single mirror can capture the light of an object located "at infinity"⁶³; two parallel mirrors, which face each other by reflecting each other, produce almost infinite⁶⁴ images; finally, several adequately positioned mirrors (for example, flat mirrors on the walls of a room or contiguous spherical mirrors) produce an infinity of reflections. On the other hand, as a speculative object (scientific or mystical), the mirror is associated with the universe or the divine.

Many contemporary artists have tackled head-on the question of infinity generated by multiple mirrors. Those we will now mention have made this theme a central element of their work. Among them, most were aimed at "the conquest of space"⁶⁵, according to the expression of the Belgian poet,

⁶² MUSE now has two adaptive optics modes: the wide-field mode, coupled with GALACSI in ground-layer mode, corrects for the effects of atmospheric turbulence up to one kilometer above the telescope across a relatively wide field of view. The new narrow-field mode, which uses laser tomography, corrects virtually all atmospheric turbulence above the telescope, but over a smaller region of the sky.

⁶³ Object "at infinity": fanciful way of saying that all the light rays coming from the object are parallel to each other. Which is only an approximation because the object emits or reflects light in all possible directions.

⁶⁴ Parallel mirrors: if an object is located between two parallel mirrors, each of them gives a symmetrical virtual image of it. The image in the first mirror can serve as an object for the second mirror, which forms an image of the image, with the front and back sides of each image being inverted with respect to its object. If several mirrors are placed parallel to each other, and the object is at a different point from the middle point between them, then this image formation of an image continues endlessly and we obtain a double infinity of images.

⁶⁵ Marcel Broodthaers, *The Conquest of Space. Atlas for artists and soldiers*, Lebeer Hossmann Éditeurs, Brussels and Hamburg, 1975.

filmmaker and visual artist Marcel Broodthaers, but others also played with time, such as Dan Graham⁶⁶ with his installation *Present Continuous Past(s)* (1974), of which here is the device: in a cubic room with mirror walls, a spectator looks at a camera that records everything, including what the mirrors reflect. Eight seconds later, a screen placed under the camera shows the recorded image, which is itself reflected in the mirror, recorded by the camera and projected onto the monitor eight seconds later. In front of this one, the spectator thus sees both his own image, eight seconds before it, and the reflection of his own image, still eight seconds before it, or sixteen seconds into the past. "The temporal infinity produced by the interplay between camera, screen and mirror is that [...] of a *différance*⁶⁷ that occurs indefinitely, as if the present only showed itself in an infinitely past in the process of presenting it in its very shift."⁶⁸

It is through repetition that the Japanese artist Yayoi Kusama⁶⁹ reaches infinity: obsessive repetition of the pattern of dots, which embody the spatio-temporal infinity of the universe⁷⁰ and make his works immediately recognizable; infinite repetition of reflections generated by mirrors: reflections of oneself in a room lined with mirrors, or reflections of the entire environment produced by mirrored spheres. Kusama's fascination with polka dots is expressed in the most iconic way in his Infinity Rooms, immersive installations dating back to the 1960s, in which rooms featuring mirrors, lights and repeated polka dot patterns, disorient the viewer by plunging him into illusions of infinite reflections. By sometimes covering herself with polka dots, as in *Self Obliteration by Dots* (1968), the artist includes herself in this infinity within which she dissolves. The mirrored spheres, on the other hand, appear in several versions of the installation *Narcissus Garden*⁷¹, a sea of 1500 mirror balls that reflect both the

⁶⁶ Dan Graham (1942-2022): American artist. Since the 1960s, his work has embraced conceptual art, installations, performance and social criticism. His innovative approach, which uses photography, video, rock culture and even architecture, has exerted a great influence on the discourse of contemporary art. It is essentially characterized by the involvement of the spectator and the parallelism between video and mirror. From 1969 to 1976, through video, he became interested in visual perception by playing with the optics of devices and the perceptual experiences of the viewer. He will notably create spaces including both mirrors where one reflects oneself to infinity, cameras and monitors that reflect the image of the spectator. The mirror, which simultaneously generates a visual, bodily and mental experience, thus leads the viewer to reflect on himself within the space. Dan Graham has been exhibited in the most prestigious international institutions, such as the Centre Pompidou (Paris), the Tate Modern (London), the MoMa (New York), and during the *Documenta 7* of Cassel in 1982.

⁶⁷ *Différance*: central concept of the philosophy of deconstruction by Jacques Derrida. Observing that language rests on chains of signs where each signifier refers indefinitely to other signifiers, Derrida opposes the classical view of truth as present and accessible. For him, on the contrary, it is a continuous movement of difference and rejection of meaning, as meanings only exist in relation to each other, thus never being fully present.

⁶⁸ Éric Clémens, « Du renvoi à l'infini » (An infinite loop), in Éric van Essche (dir.), *Spéculations spéculaires : la réflexion du miroir dans l'image contemporaine (Specular speculations; the reflection of the mirror in the contemporary image)*, La Lettre volée/Iselp, 2011, p. 90.

⁶⁹ Yayoi Kusama: Yayoi Kusama (born in 1929): contemporary Japanese artist. Avant-garde painter, sculptress, writer. After a childhood in Japan marked by her toxic relationships with her mother, she studies traditional and modern Japanese painting in Kyoto. In 1958 she settled in New York and set up exhibitions of photos, collages and installations, notably with Jasper Johns, Yves Klein, Claes Oldenburg and Andy Warhol. From the 1960s, she turned to happening and performance. In 1966, she participated in the Venice Biennale without invitation or authorization, and presented there the work *Narcissus Garden* which met with immense success. In 1973 she returns to Japan. Suffering from obsessive-compulsive disorder, she has been living since then and at her request in a psychiatric hospital where she has a workshop. In 1993, she was invited to the Venice Biennale, this time as an official representative of Japan. Her works are now in the collections of major museums around the world, several of which have devoted retrospectives to her. Kusama's influence extends to fashion and design.

⁷⁰ For Yayoi Kusama, "Our Earth is only one point among a million stars in the cosmos / Peas are a path to infinity." The artist's tropism for the infinity of the universe also appears in the titles of some of her works, such as *Infinity Mirrored Room—Aftermath of Obliteration of Eternity* (2009) and *Infinity Mirrored Room—The Souls of Millions of Light Years Away* (2013).

⁷¹ *Narcissus Garden* (1966-2018): these balls, first made of plastic during the first exhibition at the 36th Venice Biennale in 1966, were later made of steel.

viewer and the surroundings, and reflect each other, creating the illusion of an infinitely multiple reality (fig.10).



Figure 10. Yayoi Kusama, *Narcissus Garden*, 2011, installation. Inhotim in Brumadinho, Brazil; Creative Commons.

A major figure in contemporary art associated with the birth of Arte Povera, Michelangelo Pistoletto⁷² became known at the beginning of the 1960s for his *Tableaux-Miroirs*. His sculpture *Mètre cube d'infini* belongs to *Objets en moins* (1965-1966), which in his eyes "are not constructions but releases". This seemingly neutral work – six mirrors assembled in a cube and turned inwards – is in reality highly symbolic. In accordance with its title, it indeed contains infinity: an infinity of reflections, but left to the sole imagination, the mirrors "looking" all towards the inside. With this wonderfully simple work, Pistoletto reminds us that infinity (physical or metaphysical) is always thinkable or desirable, even and perhaps especially because it is invisible.

Belgian painter and sculptor with an imagination as playful as it is mathematical, Pol Bury plays with materials (wood, copper, brass, steel), with light and with water, this natural mirror that he sets in motion in order to move volumes – notably spheres themselves reflective. Starting in the 1980s, he thus installed outdoor "sky sensors" in stainless steel, with infinitely changing reflections, which seem to prefigure certain works by Anish Kapoor. In his 1995 installation, *Fountain* (fig. 11), fifteen shimmering balls placed on cylinders arising from a gushing water, are offered to all the light of the sky.

⁷² Michelangelo Pistoletto (born in 1933): Italian artist and art theorist. In 1961-1962, his first *Tableaux-Miroirs* (applications of images obtained by photographic transfer on polished stainless steel plates) already included the viewer, the environment and real time in the work. They represent the foundation of his theoretical thought and his subsequent works, and will earn him international recognition. In 1967, he turned to performance, video art and theater. In the years 1980-1990, his art becomes more political and appears in major international exhibitions as well as in the Venice Biennials (1984, 1986, 1993). Between 2000 and 2020, prizes and retrospectives multiplied; he notably received the Golden Lion at the 2003 Venice Biennale for his entire body of work.

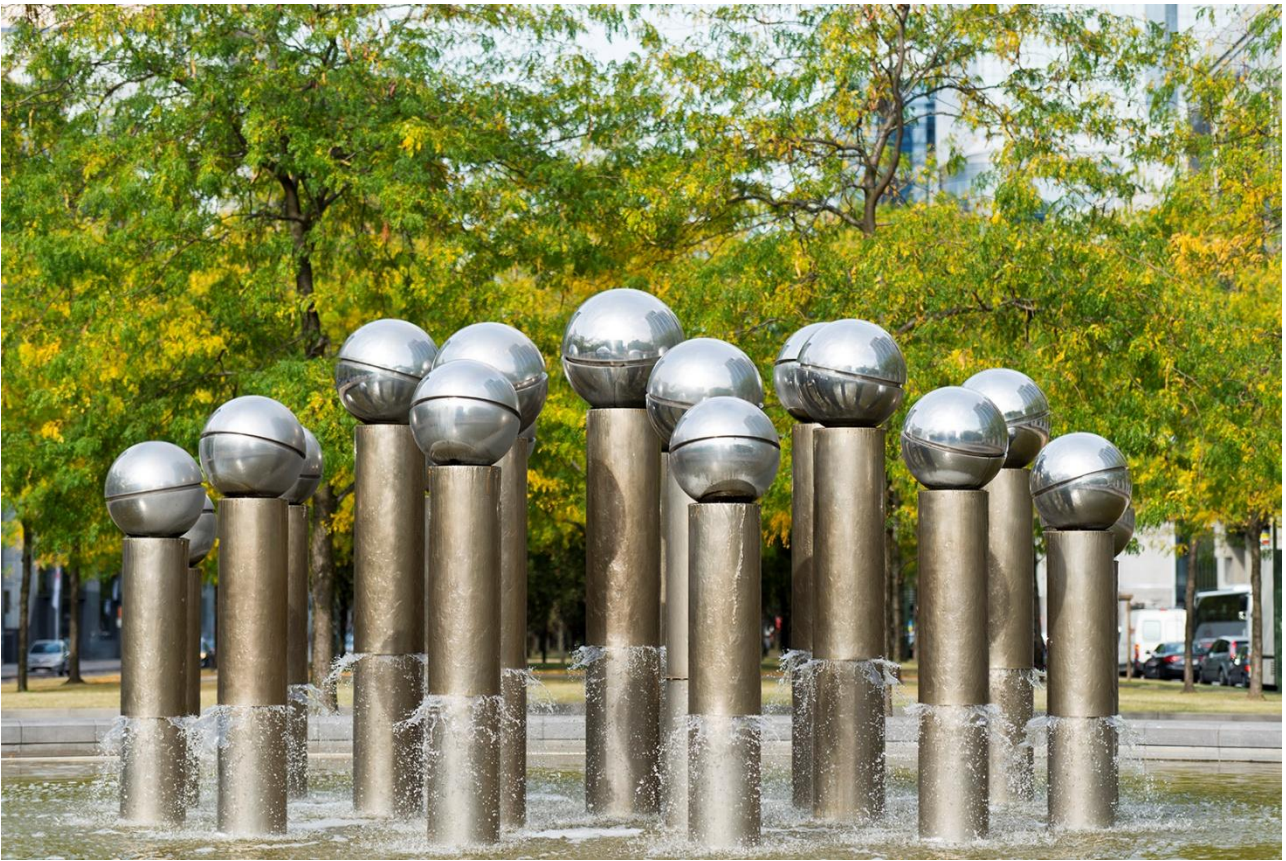


Figure 11. Pol Bury, *Fontaine*, 1995; Wikimedia Commons.

Artist of the infinitely large, the infinitesimally small and illusion, Anish Kapoor⁷³ wants to evoke through his works "the relationship with the infinite of our cosmic system, and with the darkness of our corporeal universe"⁷⁴. He does it by means of installations and gigantic mirrors, as in the urban sculpture *Sky Mirror* (2001), a concave stainless steel mirror, of which a version of 6.1 meters and 9.1 tons is located in the Wellington Circus in Nottingham, and another, of 23 tons, at the Rockefeller Center in New York. Despite its monumental character, *Sky Mirror* often seems to disappear into its environment: "It's as if we put the sky on the ground. It's also almost like a hole in space. It's almost as if the object doesn't exist. It's a kind of endless passage through. *Sky Mirror* turns the world upside down."⁷⁵ And seeing 'the sky on the ground' can encourage one to raise one's head to better look at 'the sky from the sky' and meditate on these two infinities. The artist will take up this theme a few years later with *Cloud Gate* (2006) in Millennium Park in Chicago, a 10-meter high mirror placed on the ground, shaped like a bean (hence his nickname "The Bean") composed of 168 welded stainless steel plates. Its polished

⁷³ Sir Anish Kapoor: British sculptor of Indian origin born in 1954. A pioneering and influential figure in contemporary sculpture, whose work transcends the conventional limits of material form and space. After a childhood lived within a multicultural family (Indian Hindu Punjabi father, Iraqi Jewish mother), he settled in London in 1973, but returned to India in 1979. He became known in the 1980s through his sculptures and biomorphic installations. His fascination for the concept of vacuum manifested itself at the Venice Biennale in 1990 (installation *Void Field*, a grid of sandstone blocks dotted with black holes). The following year, he received the Turner Prize. The beginning of the 21st century saw a multiplication of his monumental and revolutionary installations, such as *Cloud Gate* (2004) and *ArcelorMittal Orbit* (2012). Subsequently, he continued to push the boundaries of sculpture, sometimes causing great controversy in the art world, as did his exclusive use of Vantablack, the blackest painting (see Ruth Scheps, "Le noir, une quête infinie", *Arts et sciences* 9 (1), January 7, 2025, ISTE OpenScience; DOI: 10.21494/ISTE.OP.2025.1241).

⁷⁴ Anish Kapoor, interview given to Valérie Duponchelle: "Infinity according to Anish Kapoor". <http://www.lefigaro.fr/culture/2011/05/02/03004-20110502ARTFIG00616-l-infini-selon-anish-kapoor.php>

⁷⁵ Interview on the American channel CNN (2012); translation by Joël Chevrier, in "Anish Kapoor's mirrors: playing with light, looking at the world", 27 August 2015. <https://www.echosciences-grenoble.fr/articles/les-miroirs-d-anish-kapoor-jouer-avec-la-lumiere-regarder-le-monde>

exterior, which evokes liquid mercury, reflects and distorts all the surrounding architectures as well as the silhouettes of the spectators who see their image reverberated and multiplied by the 'omphalos', a cavity forming a chamber in-above their heads when they pass under the Cloud Gate arch. As they move in relation to the mirror, each one can thus make appear an infinity of images mixing the sky, the various urban spaces and possibly their own person.

Cinema has also taken up the theme of mirrors generating infinity. Let us simply recall the closing scene of Orson Welles' film *The Lady from Shanghai* (1947), where the labyrinth of mirrors that sees the three main protagonists (including Rita Hayworth and Orson Welles) confront each other multiplies their images to infinity, making reality indistinguishable from its nightmarish mirages... Until the murderous shots that will eventually break the mirrors.

5. Conclusion

The mirror feeds on light, which it absorbs and reflects according to its composition and environment. It virtually duplicates, multiplies or divides the elements of the real world. Its uses involve it either in the singular or in the plural (parallel mirrors or in networks). Guided by artists or scientists, each one is then reflected in the others, in games that make you dizzy.

The mirror is faithful or unfaithful, opaque or transparent, full or empty; its ambiguities, contradictory or undecidable effects fascinate and destabilize. Tool of knowledge and troublemaker, generator of new visibilities and destroyer of certainties, it gathers in itself all the light that reaches it, wherever it comes from.

Humans have searched, and found how to use its powers: by making it smoother, bigger, and more precise; by dreaming about what it hides in its beyond; by dreaming themselves, loved or hated by it; by finally asking it for the impossible: the truth about themselves (cf. the magic mirror of the queen in *Snow White*) and on the world. The mirror holds no absolute truth; in fact, the perception of the object by the human eye is true and false, as shown well by Magritte's painting entitled *Le Faux miroir* (1928): an eye whose transparent iris reveals a blue sky where white clouds float... Writers and philosophers have made it a powerful instrument: an instrument of truth for some, such as Baudelaire, or Sartre, for whom the mirror reflects the truth of the human existential condition, which is to pass from one state to another; an instrument of various illusions for others, such as Jorge Luis Borges, or Maurice Rollinat.

Failing to reveal the Truth, the mirror has other superpowers: as a utopia *and* a heterotopia, it creates a paradoxical reality ("I am over there, where I am not" and "I discover myself absent in the place where I am," says Foucault) and moreover it increases the visibility of the world (objects hidden from view and revealed by painting or medicine, increasingly distant stars made visible by mirror telescopes). However, these powers, as extensive as they seem to us, are not absolute. They find their limit in the invisible of infinity (cosmic or metaphysical), destined to escape eternally from any human enterprise.