Time-Lapse Machine. Plants, Crystals and Clouds

Marie Rebecchi

Time machine

cinematic temporalities

ANTONIO SOMAINI

WITH ÉLINE GRIGNARD & MARIE REBECCHI

Time machine

time machine

cinematic temporalities

SKIRA

ANTONIO SOMAINI

WITH ÉLINE GRIGNARD
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The curators of the exhibition and the editors of the book wish to thank here all the institutions and the private sponsors that have made the book and the exhibition possible: the Comune di Parma, with its departments of Culture and Tourism; the main sponsor Parmalat, the sponsor OCME. We also thank wholeheartedly the Fondazione Solares delle Arti, with its president Andrea Gambetta, its director of production Stefano Caselli, and its production coordinators Carlotta Gruzzi, Maura Dellanoce and Massimiliano Di Liberto: the entire team of the Fondazione Solares has accompanied us throughout the curatorial process, and has very effectively managed the production of the exhibition and of the film program.

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TIME-LAPSE MACHINE PLANTS, CRYSTALS AND CLOUDS : THE KALEIDOSCOPE OF TIME

Marie Rebecchi

"If you knew Time as well as I do," said the Hatter,
"you wouldn't talk about wasting it. It's him."
"I don't know what you mean," said Alice.
"Of course you don't!" the Hatter said,
tossing his head contemptuously.
"I dare say you never even spoke to Time!"
"Perhaps not," Alice cautiously replied:
"but I know I have to beat time when I learn music."
"Ah! that accounts for it," said the
Hatter. "He won't stand beating.
Now, if you only kept on good terms with him,
he'd do almost anything you liked with the clock".
(Lewis Carroll, Alice's *Adventures in* Wonderland, with illustrations by John Tenniel, Macmillian, 1865, 34)

In the Deserts of the West, still today,
there are Tattered Ruins of that Map,
inhabited by Animals and Beggars;
in all the Land there is no other Relic
of the Disciplines of Geography.
(Suárez Miranda, *Viajes de varones prudentes*, 1658,
in Jorge Luis Borges, "On Exactitude in Science,"
trans. Andrew Hurley, *Collected Fictions*, Penguin, 1998, 705)**1**

A JOURNEY THROUGH THE LOOKING-GLASS INTO THE COUNTRY OF "NOWHERE": ELASTIC TIME & THE INTELLIGENCE OF A MACHINE

If we travel through the mirror, the sheet of crystal, as Lewis Carroll recounts in the first few pages of *Through the Looking-Glass and What Alice Found There* **Fig. 1 ↦ Lewis Carroll, *Through the Looking-Glass and What Alice Found There*, ill. John Tenniel (1871),** we come face to face with a dream: a labyrinthine space-time, a geographically undisciplined country, a kaleidoscopic vision, a "cosmic pantomime" that could only be reflected by the enormous "covered mirrors"**2** sprouting from Borges' childhood memories in the wake of Carroll's wonders:

> As a child, I knew that horror of the spectral duplication or multiplication of reality, but mine would come as I stood before large mirrors. As soon as it began to grow dark outside, the constant, infallible functioning of mirrors, the way they followed my every movement, their cosmic pantomime, would seem eerie to me.**3**

Translated by Angelina Zontine.

1 See Lewis Carroll, *Sylvie and Bruno*, Macmillian and Co., 1889. It was likely Carroll's third and last novel that served as inspiration for Borges' text "On Exactitude in Science." See Gilles Palsky, "Borges, Carroll et la carte au 1/1," in *Cybergeo. European Journal of Geography*, 106, 1999.

2 Jorge Luis Borges, "Covered Mirrors," translated by Andrew Hurley, in *Collected Fictions*. (London: Penguin, 1998). See also Louis Marin, "L'Utopie et la carte," in *Variation Borges*, 5, 1998.

3 Jorge Luis Borges, "Covered Mirrors," 662.

In order to catch a glimpse of the image of another time, a time that does not exist, one that is abstract, already passed and forgotten, a future still to come, present but invisible to the naked eye, what is needed is a time machine: a means of bypassing reality and travelling beyond the present. To step through a mirror, take a hallucinogen, dive into a pool of tears, get lost in a maze, look through a kaleidoscope, observe inert matter under the microscope, read the science fiction of H.G. Wells,**4** watch time and history condense, accelerate, disassemble and reassemble themselves from the seats of a movie theater.

On the one hand, European fantastic literature and science fiction about "nowhere" from the second half of the 19th century (from *Journey to the Center of the Earth* by Jules Verne, 1864 to *Erewhon: or, Over the Range* by Samuel Butler, 1872 and Carroll's *Wonderland*) fueled and set the stage for Wells' science fiction *Time Machine*, an imaginary which in turn helped to heighten the mythical status of the year 1895 as the beginning of the film history calendar.**5** On the other hand, it was only when the new laws of physics encountered the technology of new media that we began to glimpse another time: an elastic time in a restricted space. Cinematographic time.

Pioneering media theorist Friedrich Kittler theorizes that it was the invention of three fundamental technical media—gramophone, film and typewriter**6**—and their expansion over the last thirty years of the 19th century that marked the dawn of the founding age of technological media (*Mediengründerzeit*). This is well known in contemporary media theories. It remains to be connected with another parameter, however, one that at first glance might seem somewhat distant from an archaeological survey of technical media. The second half of the 1800s also set the stage for a surprising anachronic coincidence, the rediscovery of a prehistoric world surviving alongside a dehumanized future. A vision of "original nature" as a garden of the underworld brimming with dinosaurs overlapped with the imaginary of a "second nature" populated by machines grown independent of their creators. A distant time that could be defined as the Aleph**7** of history, to borrow Borges' space-time system; an infinite space in which "all the places of the earth" appear at once; a time at the origins of the earth and of humanity demanding to be put on display in a very near present as an omen of a forthcoming apocalyptic future. Like cinema and the time machine—and cinema as a time machine—"prehistory is an invention of the 19th century," one of modernity's most enigmatic and powerful ones. It is this assertion that Maria Stavrinaki, in her book *Saisis par la préhistoire. Enquête*

4 See Antonio Somaini's text in this volume.

5 This date marks the first for-pay screening of the Cinématographe Lumière that took place December 28, 1895 at the Salon Indien of the Grand Café in Paris.

6 Friedrich A. Kittler, *Gramophone, Film, Typewriter*, trans. Geoffrey Winthrop-Young, Writing Science (Stanford: Stanford University Press, 1999).

7 "...When I opened my eyes, I saw the Aleph. 'The Aleph?' I repeated. Yes, the place where, without admixture or confusion, all the places of the world, seen from every angle, coexist. [...] How can one transmit to others the infinite Aleph, which my timorous memory can scarcely contain?" Jorge Luis Borges, "The Aleph," *Collected Fictions* (London: Penguin, 1998), 636-39.

sur l'art and le temps des modernes,**8** uses to launch a meandering investigation into the lengthy period of mankind, the earth and art conducted in the age of the "Moderns." Not only has this population "never been modern,"**9** it also looks to prehistory as the chimeric wellspring of modern and contemporary culture. That is the nature of prehistory; comparable to the time manipulated by cinema. It is elastic time, and the age of the earth an impenetrable temporal arc. As early as the 1700s, cosmologists and naturalists such as Buffon had understood that 18th century natural history must begin transforming the fluctuating and incalculable time of the earth into a metaphor if it hoped to construct a narrative about the world's origin appealing enough to take over the empty space once occupied by the sacred Scriptures. What was needed was a flexible time, a temporality exaggeratedly extended to resemble as closely as possible the reality of time carved in the natural world and yet simultaneously shortened to a human scale to accommodate the limits of the human intellect. It was in this period that Charles Darwin published *On the Origin of Species* (1859), that Charles Lyell, one of the founders of modern geology together with James Hutton, gave his speech "On the Occurrence of Works of Human Art in Post-Pliocène Deposits" before the British Society for the Advancement of Science, arguing that geology itself attests to the deep roots of mankind, and that anthropologist John Lubbock introduced the idea of subdividing prehistory into the "Paleolithic" and "Neolithic" in his 1865 London publication *Pre-historic Times, as Illustrated by Ancient Remains and Manners and Customs of Modern Savages*. Prehistory and cinema are two modern "inventions" that have taken a deep and invisible, thick and manipulatable temporality and rendered it conceivable and visible.

A time machine designed not only to travel to another era but also to shape and manipulate time must be able, for example, to display the highly drawn-out prehistoric age in a narrow string of time. The first examples of such time travel can be found in the visual culture of evolutionism at the turn of the 20th century and, in particular, in a series of early films made by British naturalist and microcinematography pioneer F. Martin Duncan. These films sought to use the language of images, especially moving images, to translate Darwinian theories about the origin of species and natural selection into a visual form.**10** Frank Percy Smith, a forerunner of naturalist documentary makers, likewise joined in this tradition of seeking to wrest the biological sciences from hands of the elite so as to make them accessible to the popular classes, thereby helping to ensure the success of the "popular-science film" genre.**11** In the catalogue of Duncan's films,

8 Maria Stavrinaki, *Saisis par la préhistoire. Enquête sur l'art et le temps des modernes* (Dijon: Les Presses du réel, 2019).

9 See Bruno Latour, *Nous n'avons jamais été modernes: Essai d'anthropologie symétrique*. Eng. trans. Catherine Porter: *We Have Never Been Modern* (Cambridge: Harvard University Press, 1993).

10 An example is the series of films made by F. Martin Duncan for the Charles Urban Trading Company, entitled "The Denizens of the Deep." See Oliver Gaycken, "Early cinema and evolution," in *Evolution and Victorian Culture*, edited by Bernard V. Lightman, Bennett Zon. (Cambridge: Cambridge University Press, 2014), 104-07.

11 See Oliver Gaycken, "Revealing Nature's Closet Secret" and "Juggling Flies and Gravid Plants: F. Percy Smith's Early Popular-Science Film," in *Devices of Curiosity. Early Cinema and Popular Science*. (Oxford: Oxford University Press, 2015), 15-89.


2

this journey through time in its two-fold meaning of "time travel" and "spatiotemporal trip" proceeds in two different directions. One is evolution, in the sense of scientific time travel into the deep well of beginning-time: think of the 1905 movie *The Amoeba, the beginning of life*.**12** The other is the direction of time manipulation techniques, in the sense of a photo-cinematographic "time trip" made possible by high-speed photography and time-lapse techniques.

As early as the end of the 19th century, physicist and philosopher Ernst Mach was already imagining how cinema might be applied to the principles underlying long-lasting phenomena. As Oliver Gaycken has observed, Mack hypothesized in 1888 that time-lapse could be applied to chronophotography, thus offering one of the first formulations of cinematographic time-lapse: "Should not the principle of *temporal diminution* be of value as well? In point of fact, let us consider photographically fixing the growth stages of a plant, the stages of an embryo's development, the limbs of the Darwinian genealogical tree of animals, and exhibiting them in a quick series of 'magic lantern slides.'"**13**

There seemed to be a need to break movement down in order to view the individual moments of its progression over time, a need to take both ultra-fast phenomena (from the "splash"**14** of a drop falling into the mirrored surface of a basin of water and milk to the imperceptible trajectory of a bullet piercing a soap bubble)**15** **Fig. 2 ↦ A. M. Worthington, *A Splash of a Drop* (1895). Fig. 3 ↦ L. Bull, *Rupture d'une bulle de savon par un projectile* (1904)** and ultra-slow ones (from a flower's blooming and wilting to the developmental stages of an embryo) and make them available to the human eye and, especially, the perspicuous gaze of the scientist. It was this need that drove the experimentation and technical inventions through which several preeminent figures of the late 19th century scientific universe—Jules Janssen, Étienne-Jules Marey, and his pupil Lucien Bull—developed the earliest techniques for manipulating time through photography and cinema: from the photographic revolver to chrono-photography, from high-speed photography capable of capturing lightning-paced phenomena to photographic and filmic devices capable of documenting ultra-slow movements (time-lapse).**16** And herein lies the "magic" of a cinema that had begun to reveal the unconscious world of the visible and the scientific precision of the invisible.

The theory and practice of cinematic intelligence did not appear until a few decades later, between the beginning of the 1920s and the 1940s, in the writings and films of Jean Epstein. As a theorist of "animist cinema,"**17** Epstein understood the cinematographic camera as a machine capable not only of revealing the invisible but also of putting

12 See Oliver Gaycken, "Early cinema and evolution," 107.

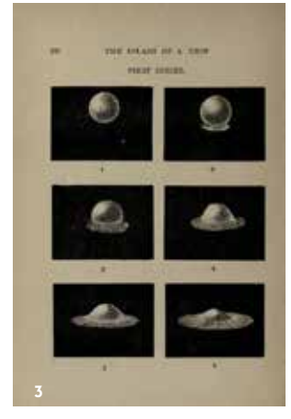
13 Ibid., 108-09 and 119. The Gaycken quote is drawn from Ernst Mach, "Bemerkungen über wissenschaftliche Anwendungen der Photographie", in *Jahrbuch für Photographie und Reproduktionstechnik* 2 (1888).

14 Arthur Mason Worthington, *A Study of Splashes*. (London, New York, Bombay, Calcutta: Longmans, Green, and Co, 1908).

15 See the PhD dissertation, forthcoming, by Antoine Prévost-Balga on the techniques of high-speed photography and cinematography applied to the sciences (including the stereoscopic films made in 1904 by Lucien Bull, projected at a speed of 1500 fps). See also Georges Didi-Huberman's text in this volume regarding Étienne-Jules Marey's use of chronophotography.

16 Colin Williamson, *Hidden in Plain Sight: An Archaeology of Magic and the Cinema* (New Brunswick, New Jersey, and London: Rutgers University Press, 2015), 78-9.

17 Teresa Castro, "Penser le 'cinéma animiste' avec Jean Epstein", in *Jean Epstein. Actualités et postérités*, edited by R. Hamery and Éric Thouvenel (Rennes: PUR 2016), 248.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its intelligence to the test by animating all manner of things, causing apparently inert objects to move through its ability to manipulate the temporality of images and, in so doing, to carry out the kind of temporal alterations necessary to make living forms visible. In a 1935 text *L'Intelligence d'une machine* published in *Inter-Ciné* **18** (not to be confused with another text bearing the same title published in 1946), Epstein attributes cinema with an intelligence all its own, an innate technical capacity to animate "the inert and the living" according to their own specific principles.

> "Along the paths down which the cinematograph must evolve, there are a few small facts that cause us to halt, like red warning lights. Life is about surpassing oneself. When man had to do better than walking, he invented the wheel, something other than legs; when he had to do more than swim or fly, he discovered the propeller, something other than fins or wings. And to do better than seeing and hearing, man added to the various optical and acoustic systems the cinematograph, something other than eyes and ears, which at a later stage will probably involve other senses, enabling them all to surpass their psychological limits. It is unimaginable that such an instrument would remain uninfluenced by thought. *The machines invented by man have their own intelligence, from which human intelligence borrows.* The arguably most apparent characteristic of cinematographic intelligence is its *animism*. As soon as the first slow-motion and fast-motion projections were revealed, the barriers we had imagined between the inert and the living were swept away. In its performance, cinema shows that *nothing is immobile*. Crystals grow, move, multiply like cells. Plants have animal-like gestures. Insects meet, chattering with their antennas, similar to two cripples when one's fingers tap on the other's palm. Where can we now place the borders between the kingdoms of nature?" **19**

Sergei Eisenstein also contributed to formulating an animist theory of cinema in the 1940s in his notes on Walt Disney; these were notes he intended to integrate into his work *Method* **20** but which remained unfinished and ended up being published posthumously. In a section of the Disney notes entitled *Animism*, Eisenstein identifies the medium of drawing and specifically the graphic line as an opportunity to endow inert matter with a soul, that is to say, to set the inanimate in motion: "In English, the moving drawings of Disney are called... an animated cartoon. In this term both concepts are bound together: both 'animation' (*anima*—the soul)," and 'liveliness' (*animation* – liveliness, mobility). **21**

18 Jean Epstein, "L'Intelligence d'une machine" (1935), in *Écrits sur le cinéma 1*, t. I. (Paris: Seghers, coll. "Cinéma Club," 1974), 241-42.

19 "Le long des voies selon lesquelles est obligé d'évoluer le cinématographe, quelques petits faits ainsi nous arrêtent comme les feux rouges des dangers. La vie est de se dépasser. Quand l'homme dut faire mieux que marcher, il inventa la roue qui est autre chose que la jambe; quand il dut faire plus que nager ou voler, il trouva l'hélice qui est autre chose que la nageoire ou l'aile. Et pour mieux que voir et qu'entendre, l'homme ajouta à divers systèmes optiques et acoustiques le cinématographe qui est autre chose que l'œil et que l'oreille, qui intéressera — probablement par la suite d'autres sens, pour leur permettre à tous de dépasser leurs limites psychologiques. Il est inimaginable qu'un tel instrument demeure sans influence sur la pensée. Les machines qu'invente l'homme ont leur intelligence à laquelle l'intelligence humaine emprunte. Le caractère sans doute le plus apparent de l'intelligence cinématographique est son animisme. Dès les premières projections ralenties et accélérées, furent balayées les barrières que nous avions imaginées entre inerte et le vivant. Et se jouant, le cinématographe montre — qu'il n'y a rien d'immobile, pas de mort. Les cristaux grandissent, se déplacent, se multiplient comme des cellules. Les plantes ont des gestes animaux. Des insectes qui se rencontrent, palabrent à coups d'antennes, pareils à certains infirmes quand les doigts de l'un pianotent sur la paume de l'autre. Où situer maintenant les frontières entre les règnes de la nature". Ibid, 243-44.

20 There are two different Russian editions of Sergei Eisenstein's *Metod. Tajny masterov* volumes 1 and 2, ed. Naum Kleiman. (Moscou: Muzej kino, 2002); and Sergei Eisenstein, *Metod*, volumes 1-4, ed. Oksana Bulgakowa. (Berlin: Potemkin Press, 2008). An Italian translation of *Method I*, edited by Alessia Cervini for Marsilio, will also be published in 2020.

21 Sergei Eisenstein, *Walt Disney*, ed. Oksana Bulgakowa and Dietmar Hochmuth. (Berlin, San Francisco: Potemkin Press, 2011), 51.

22 For a discussion of the distinction between anthropocentrism and anthropomorphism, see Teresa Castro, "The Mediated Plant" in e-*flux*, Journal #102, September 2019. See also Teresa Castro, Perig Pitrou, Marie Rebecchi, *Puissances du végétal et cinéma animiste. La vitalité révélée par la technique* (Dijon: Les presses du réel, 2020 forthcoming).

23 Regarding the notion of "time axis manipulation" coined by Friedrich Kittler, see the essays by Emmanuel Alloa and Noam Elcott in this volume.

24 See Emanuele Coccia, *The Life of Plants: A Metaphysics of Mixture* (Cambridge: Polity Press, 2018).

25 Johann Wolfgang von Goethe, *The Metamorphosis of Plants* (1790), introduction by Gordon L. Miller (Cambridge, Massachusetts: MIT Press, 2009).

26 Ernst Haeckel, *Kunstformen der Natur* (1899-1904), now in *Art Forms in Nature*, ed. Olaf Breidbach and Irenaus Eibl-Eibesfeldt (Munich-New York: Prestel, 1998).

27 Matthew Vollgraff, *Vegetal Gestures: Cinema and the Knowledge of Life in Weimar Germany*, in "Grey Roomn" 72. See the text by Noam M. Elcott in this volume.

ART FORMS IN NATURE: THE MIRACLE OF PLANTS

How can we participate in the rhythm of a plant's "life," observing the animation underlying its movements and its all-but-imperceptible metamorphoses in a timeframe suited to our perceptive capacities, yet without setting up some contrived parallelism with the human senses or an uncritical form of anthropocentrism or anthropomorphism? **22**

This is the question that scientists, biologists, filmmakers and artists were asking themselves at the beginning of the 20th century, a moment when the heuristic and expressive power of cinema had paved the way for potentially manipulating time and space. **23** Thanks to techniques such as acceleration, time-lapse, enlargement and double exposure, filmmakers were unveiling the "life of plants" on the silver screen. **24** Already during the 19th century, German biologist and philosopher Ernst Haeckel had focused his research on the intimate link between living and artistic forms. Drawing on Charles Darwin's evolutionary theory and Goethe's work on plant metamorphosis, **25** Haeckel explored the transformative power of biological life from an artistic and ornamental point of view. Together with the first photographic studies of plant forms (such as Anna Atkins' highly important cyanotypes, published in *British Algae: Cyanotype Impressions*, 1843), his atlas *Art Forms in Nature* **26** (1899-1904) **Fig. 4 ↦ Ernst Haeckel, *Melethallia. Gesellige Algetten*, Tafel 34, *Kunstformen der Natur* (1899-1904)** constitutes an essential landmark in the development of 1800s visual culture. While scientific studies on the morphology of the plant world began to impact the field of aesthetics in the 19th century, the first works to leave their mark on film theory were scientific films on plant movement: from Wilhelm Pfeffer's *Studies of Plant Movement* (1898-1900) to Percy Smith's *Birth of a Flower* (1910); from Max Reichmann's *Das Blumenwunder* (1925) **27** to Jean Comandon's *Croissance des végétaux* (1929). Early "cinema of attractions" works also turned their gaze toward the plant world. The hand-colored films made for the Pathé Brothers by Gaston Velle with photography by Segundo de Chomón, such as *La Fée aux fleurs* (1905) and *Les Fleurs animées* (1906), are the most striking and alluring examples. During the 1920s, the European and Soviet avant-garde from Germaine Dulac to Sergei Eisenstein likewise became captivated by the expressive power of these cinematic herbaria. As early

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as 1929, Eisenstein himself suggested making an animated film about the "expressive movement of plants."**28**

THE GROWTH OF PLANTS: TIME-LAPSE & THE HETERO-TEMPORALITY OF THE VEGETAL WORLD

One compelling attempt to visualize the animation process of living forms which are apparently incapable of movement can be found in a film made with modelling clay (a form of 3-D animation carried out by "clay animation") by Hans Elias, a physician who emigrated to the United States to work as a professor of anatomy in 1950s Chicago. This animated film, entitled *Développement de la fleur de Atropa Belladona*, depicts a flower unfolding through the plastic power of the moving image. Here, movement and animation allow us to grasp a phenomenon invisible and imperceptible to the naked eye, namely the life of plants; at the same time, the film also reveals the plasticity of an inert material such as modeling clay. In so doing, it demonstrates the "vitality" of plants in terms of the timing and movement through which we consider them. The film shows a manifestation of life, the vitality of a plant, through the vital process of growth.

Hans Elias' animated film can be read as an example of what Teresa Castro, writing on Jean Epstein's "animist cinema," defines as the "dual significance of animism": the way it attributes "interiority to the things of the world" while simultaneously assigning cinema itself a vitality, a soul or intelligence.**29** In *Le cinématographe vu de l'Etna* (1926), Epstein suggests that cinema is both a machine that brings things to life and a machine that is itself alive and intelligent: "Cinema grants the iciest apparitions of things and beings the greatest gift that can be given before death: life. And it confers this life beginning from its highest aspect: personality. Personality passes through intelligence. Personality is the visible soul of things and people, their apparent heredity, where their past becomes unforgettable and their future already present. All the aspects of the world that cinema selects for life are selected only if they have their own personality."**30** In this case, animism is understood as both the material presence of a vital substance and interiority, that is, personality and intentionality.**31**

Epstein's theorizing also establishes a link between accelerated motion techniques and the discovery that certain life forms which might seem inert to the human eye actually do move: "the breadth of playing with space-time perspective, games that involve accelerated movement,

28 See Elena Vogman, *Le mouvement expressif des plantes. Notes sur un projet de film d'Eisenstein*, in T. Castro, P. Pitrou, M. Rebecchi, *Puissances du végétal* (forthcoming).

29 See Teresa Castro, "Penser le 'cinéma animiste' avec Jean Epstein," 248.

30 Jean Epstein, "Le cinématographe vu de l'Etna" (1926) in *Écrits sur le cinéma* 1, t. I (Paris: Seghers, coll. "Cinéma Club," 1974), 140. Translation mine.

31 Philippe Descola, *Par-delà nature et culture* (Paris: Gallimard, 2005), 168-69.

slow motion and close-ups, reveal movement and life in what was considered immutable and inert. Through accelerated projection, the scale of the kingdoms is shifted—more or less, depending on its relationship with acceleration—towards a greater qualification of existence. Thus, crystals begin to vegetate in the manner of living cells; plants come alive, choose their sources of light and sustenance, express their vitality with movements."**32**

We have seen that "viewing the invisible" through cinematographic (and micro-cinematographic) techniques enables a form of mediation in order to perceive the vitality of things. Imperceptibly ultra-slow movements can only be viewed thanks to certain specific techniques such as time-lapse, a highly accelerated effect created image by image. To obtain the acceleration effect, the frame rate cannot follow the standard projection speed of 24 (or 25) frames per second; it must instead be set to 12-8-6 frames per second, thus accelerating projection by 2-3-4 times. British naturalist Percy Smith was one of the pioneers of time-lapse in cinema, with his 1910 Kinemacolor film *The Birth of a Flower*. The film contains nine scenes depicting the spectacular opening and transformation of nine different types of flowers, including hyacinths, lilies, anemones, daffodils, tulips, roses and anemones that curl and unfurl their petals like the lenses of a kaleidoscope **Fig. 5 ↦ P. Smith, Garden Anemone, *The Birth of a Flower* (1910).**33 The flowers open and close in a temporal space manipulated by the cinematographic technique to render it perceptible by the human eye.

Jean Comandon's contribution was the invention of various devices for observing the invisible in the living world, including both ultra-fast and ultra-slow effects. "The vegetable world that he films at a very slow speed, for long periods of time, ceases to appear motionless; flowers bloom, present themselves in their fullness and then wither."**34** Like the first time-lapse films of plant life by German botanist Wilhelm Pfeffer and American photographer Arthur Pillsbury, Comandon's *La croissance des végétaux* (1929) **Fig. 6 ↦ J. Comandon, *La Croissance des végétaux* (1929)** was probably influenced by Charles Darwin's writings on the movement of plants—*The Power of Movement in Plants*, 1880—and Ernst Mach's discoveries about supersonic speed from the second half of the 19th century.**35** As we have seen, this drive to visualize the movement of plants necessarily requires intervening in temporal coordinates. Indeed, the temporality of plants is a "hetero-temporality,"**36** a temporality which is quantitatively and qualitatively different from that which characterizes the existence of human beings. It is a "vegetal-time" that requires the use of cinema—as a technical medium with the power to develop and extend the

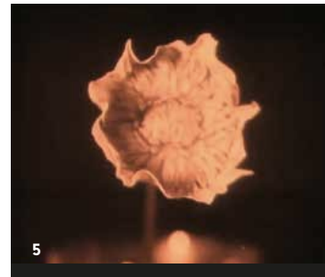
32 Jean Epstein, *L'Intelligence d'une machine* (1946), 287.

33 For a discussion of the analogy between kaleidoscopes and anemones in the sequence in Percy Smith's film The Birth of a Flower, see Oliver Gaycken, *Devices of Curiosity. Early Cinema and Popular Science*, 74.

34 Text introducing "Ballet botanique," an afternoon of study on Jean Comandon's film-making organized at the Bibliothèque nationale de France (BnF), February 16, 2012. See Laurent Mannoni, "Jean Comandon technicien" in *Filmer la science comprendre la vie. Le cinéma de Jean Comandon*. (Paris: CNC, 2012), 59.

35 See Oliver Gaycken, "Early Cinema and Evolution", 108-09.

36 Michael Marder, "Plant-Time (I): Vegetal Hetero-Temporality" in *Plant-Thinking. A Philosophy of Vegetal Life*. (New York: Columbia University Press, 2013), 95-107.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innate capacities of an organism—to be transformed into a form of temporality with which the human eye can engage.

Through time-lapse films, cinema reveals that plants possess a complex sensory motility, that is, a sensitivity that allows them to move in response to their environment, such as the ability to perceive different types of stimuli (light, temperature). As made visible by the spatiotemporal manipulations of cinema, recognizing the sensitivity and movement of plants is tantamount to attributing them two faculties generally considered exclusive to animals.

As revealed by photography and cinema, this common "soul" possessed by animal and plant life forms alike, this porosity between plants and animals, speaks to the sort of "unity of life" that Jean Epstein asserts in a very concise passage from his essay *L'Intelligence d'une machine*: "The entire universe is an immense beast whose stones, flowers, and birds are organs, all exactly consistent by virtue of participating in a single, common soul. All those rigorous and superficial classifications that are supposed to characterize nature are nothing but artifice and illusion. Underneath those mirages, the people of forms are essentially homogeneous and strangely anarchic."**37**

THE KALEIDOSCOPE OF MATTER: CRYSTALS IN MOTION

Ô ce cri sur la mer, cette voix dans les bois!
Ce sera comme quand on ignore des causes;
Un lent réveil après bien des métempsycoses:
Les choses seront plus les mêmes qu'autrefois.
(Paul Verlaine, "Kaléidoscope,"
in *Jadis et Naguère*, 1884)**38**

In *The Kaleidoscope, its History, Theory and Construction with its Application to the Fine and Usefull Arts* (1856), kaleidoscope inventor Sir David Brewster describes this scientific "toy" as a device that uses a system of tilted lenses arranged along a tube to transform our optical perception of objects. This invention set off a sea change in 19th century visual culture.**39** A new form of knowledge based on deconstructing and reconstructing our perception of reality overturned the epistemological framework that had been employed up to then to conceptualize the relationships between science, art and optics (between experiment, abstraction and ornament). For some time, the optical model of the kaleidoscope remained in a state of invisibility, hidden away in the molecular geometry that makes up the matter of crystals. It came to light in the 1920s through the scientific cinema of Jan Cornelis Mol and his films presenting techniques for visualizing the crystallization of certain chemical elements (such as potassium). Mol, an amateur photographer fascinated by the micro-cinematography of German physicist Henry Wilhelm Friedrich Siedentopf, worked with Dr. H. W. Van Seters of the University of Leyda in 1924 to co-produce a film entitled *Antoni van Leeuwenhoek* that contains a kaleidoscopic crystalline sequence.**40** In 1928, a new version of *Antoni van Leeuwenhoek* appeared in avant-garde cinemas, first in Amsterdam and then in Paris, where it was screened as an autonomous film using three projectors—and under the supervision of Abel Gance—at Studio 28.

Since 1927 when *From the Kingdom of Crystal* (*Uit het rijk der kristallen*) was originally made, multiple versions of this 13-minute film have been released (with the new title *Kristallen in kleur*, *Crystals in Color*), with sound added in the 1930s and colorized using the new color techniques developed by Louis Dufay around the same time.**41** **Fig. 7 ↦ J.C. Mol, *Kristallen in kleur* (1927).** As Jean-Michel Durafour notes in his treatise on "econology,"**42** the very act of observing crystal growth and transformation under the microscope, illuminated by a beam of light polarized by a Nicol prism, generates a condition of progressive animation among the mineral forms: the crystals come alive thanks to cinema. In this sense, the very process of crystallogenesis is inseparable from the accelerated motion of the images displaying it through the calculated use of film editing. Following Durafour's reasoning, crystals are therefore "filmic" by their very nature.

Another wondrous product of the cinematographic encounter between kaleidoscopic optics and the microscopic observation of crystals is *Transition de phase dans le cristaux liquides (Phase Transition in Liquid Crystals)* **Fig. 8 ↦ Jean Painlevé, *Cristaux liquides* (1978).** This 7-minute film was made in 1978 by Jean Painlevé, biologist as well as the founder and director of the Institut de cinématographie scientifique, a figure who bridges the gap between the rigor of scientific documentaries and the aesthetics of surrealist cinema from the 1920s onwards. Somewhere between a psychedelic film, a pyrotechnics documentary and an observation of matter "chromo-metamorphosis" under the microscope, *Cristaux liquides* uses a polarizing microscope to show various liquids crystallizing in a surprising variety of shapes and colors, under different temperatures and degrees of pressure.**43** Like the images comprising Painlevé's films, liquid crystals are organic compounds (discovered by the Austrian botanist Friedrich Reinitzer in 1888) that hang suspended between two states of matter: liquid and solid

37 Jean Epstein, *L'Intelligence d'une machine* (1946), in *Écrits sur le cinéma* 1 (Paris: Seghers, coll. "Cinéma Club" 1974), 257. Our translation. See the essay by Philippe Dubois in this volume.

38 "Oh, this cry on the sea and this voice in the wood! / This shall seem as though all lay afar from one's range; / An awakening slowly from cycles of change / And with all clearer shown and with all understood." Paul Verlaine, "Kaleidoscope", in *Paul Verlaine: His Absinthe-Tinted Song*, trans. Ralph Fletcher Seymour (Chicago: The Alderbrink Press, 1916), 138.

39 Ekki Huhtamo, "All the World's a Kaleidoscope. A Media Archaeological Perspective to the Incubation Era of Media Culture" in *Rivista di estetica* "Schermi Screens", 55 (2014), 139-53. See also Jonathan Crary, *Techniques of the Observer. On Vision and Modernity in the Nineteenth Century* (Boston: MIT Press, 1990).

40 Jean-Michel Durafour, *Cinéma et cristaux. Traité d'éconologie* (Paris: Mimésis France, 2018), 70-74.

41 Ibid., 71

42 Ibid.

43 For an archaeology of the relationship between science and art in the visualization of liquid crystals, see *Esther Leslie, Liquid Crystals. The Science and Art of a Fluid Form* (London: Reaktion Books, 2016).


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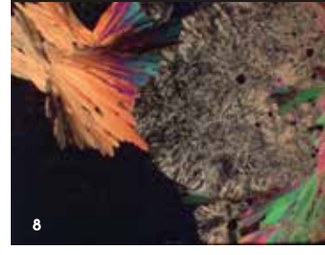
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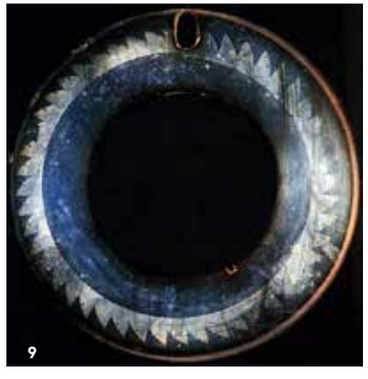
states coexist in intermediate phases, presenting the characteristic features of both crystalline and liquid states.

The story behind the making of this film is closely interwoven with the scientific research Painlevé conducted in collaboration with Yves Bouligand at the Arago de Banyuls-sur-Mer laboratory during the 1960s.[44] A chance 1973 encounter at the Annecy Animation Festival with François de Roubaix, a composer and diver with a passion for the undersea environment, ended up generating what Panlevé himself termed the "*hasard cosmique*"[45] (cosmic chance) in which the images of liquid crystals from Painlevé and Bouligand's micro-cinematographic footage were synchronized with the music De Roubaix composed the same year he tragically died during a diving trip to the Canary Islands. For viewers, this fortuitous cosmic audiovisual encounter is tantamount to a "mental time trip," a whirlwind journey through the chromatic metamorphosis of matter, a psychedelic trip under the effect of LSD... Almost as if the scientific object of the film, the liquid crystals, might complete their cycle of transformation by taking the place of the very matter making up the screen: an LCD monitor (liquid crystal display).[46]

WHAT'S THE WEATHER LIKE? TIME-LAPSE MANIPULATION & ABE MASANAO'S CLOUDS

> For instance, it is the practice of nature to give character to the outlines of her clouds, by perpetual angles and right lines. Perhaps once in a month, by diligent watching, we might be able to see a cloud altogether rounded and made up of curves; but the artist who paints nothing but curved clouds must yet be considered thoroughly and inexcusably false. (John Ruskin, *Modern Painters*, I, ch. IV, 1843)[47]

From the transformational movements of matter, which remains invisible (to the naked eye), to the non-(precisely)-determinable movements of the planets: beginning in the second half of the 19th century, scientists—from astronomers to biologists and physiologists—developed a keen interest in using various photographic techniques and inventions to observe, record and break down the timing of the movements of celestial and terrestrial bodies. In 1873, astrophysicist Jules Janssen turned to photography to objectively determine Venus' passage between the Earth and the Sun. His solution involved the invention of a new device, "the photographic revolver" **Fig. 9 ↦ Photographic revolver by J. Jenssen** meant to measure exactly how long this passage takes and thereby ascertain the average distance between the center of the Sun and that of the Earth **Fig. 10 ↦ S. Starling, *Black Drop* (2012).**[48]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Besides the stars and planets, there was also another phenomenon that required augmenting the scientific eye with optical instruments, namely the formation of clouds. In this case the equipment was needed to observe meteorological conditions so as to photographically and cinematographically record specific moments of time in the weather and its mutations. To read one of the most interesting 20th century visual treatises on nimbology, we must travel not only through time but also through space. It was in mid-1920s Japan that Count Masanao Abe (1891-1966), a meteorologist from an aristocratic family with a military legacy and enthusiastic aesthete who since childhood had been gripped by an "optical mania" for observing clouds,[49] established his own meteorological observatory at the foot of Mount Fuji. Through the "Abe Cloud Air Current Research Observatory" founded in 1927, Abe dedicated his entire life to studying, and photographically and cinematographically recording, the turbulent correlations between clouds and atmospheric currents around Mount Fuji. In 1923, during a trip to Italy, he was struck by the lingering of a lenticular-shaped cloud that hung motionless above Mount Etna before disappearing for good among the mountain peaks: this cloud, named "the Countess of the Winds", became the focus of much of his observation time from 1925 onwards. As an inventor of new image technologies and engineer of new photographic devices, Masanao Abe personally devised the meteorological measuring and recording instruments he used. His designs drew heavily on animated stereoscopic images and accelerated filming techniques such as time-lapse **Fig. 11 ↦ Sequential photograph of a round cloud at Ninooka, 10-second interval.** As Helmut Völter has observed,[50] as a manipulator of time and space Abe designed machines that allowed him to record and observe temporal processes in three-dimensional spaces. He was well-versed in topographic techniques for the observation of mountainous terrain. Adapting these to the stereoscopic camera, he came up with the idea of altering and increasing the standard distance between the stereoscopic device's two lenses by installing a second observation point about five hundred meters away from the first and connecting them with an electric cable so as to open the shutters at the same time. Thanks to this approach, he was able to capture an illusory but effective image of the passage and formation of clouds over Mount Fuji. From a contemporary perspective and in light of Kittler's theory of Time Axis Manipulation,[51] some


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44 Roxane Hamery, Jean Painlevé. *Le cinéma au cœur de la vie* (Rennes: PUR, 2009), 254-57.

45 Ibid., 256

46 Thank you to James Cahill, the author of *Zoological Surrealism: The Nonhuman Cinema of Jean Painlevé* (Minneapolis: University of Minnesota Press, 2019) for having suggested this idea.

47 John Ruskin, *Modern Painters. Of many things*, vol. I (New York: John Wiley, 1860), 64. See also Antonio Somaini, "The Atmospheric Screen: Turner, Hazlitt, Ruskin" in *Screen Genealogies: From Optical Device to Environmental Medium*, ed. Craig Buckley, Rüdiger Campe, and Francesco Casetti (Amsterdam: Amsterdam University Press, forthcoming).

48 As a development and extension of Jenssen's observations, in 2012 artist Simon Starling made a 35mm film entitled *Black Drop*, produced in association with Modern Art, Oxford, and the Radcliffe Observatory, Oxford. This film encompasses heterogeneous materials, including footage shot in Hawaii and Tahiti on the occasion of Venus's 2012 transit and other archival materials.

49 Kei Osawa, "Des nuages dans les mains: optique et nimbologie chez Masanao Abe" in *Le comte des nuages* (see the conference at Cinémathèque française, November 8, 2019).

50 See Helmut Völter, "Les films de nuages de Masanao Abe", in *Le comte des nuages*, 185-88. See also Helmut Völter, The Movement of Clouds around Mount Fuji (Leipzig: Spector Books, 2016).

51 Friedrich A. Kittler, *Gramophone, Film, Typewriter*, trans. Geoffrey Winthrop-Young, Writing Science (Stanford: Stanford University Press, 1999).

of Masanao Abe's films from the late 1920s depicting an all-encompassing vision of the sky around Fuji (made with "whole sky" lenses)**52** can be interpreted as a series of experiments in "time-lapse manipulation." In this case, the experimentation represents an accelerated form of the spatialization of time in scientific cinema. As Kittler observes, the manipulation of the temporal axis implies first and foremost the spatialization of the individual instants that make up a temporal sequence: the fourth dimension can thus be seen in the possible spatial inversion of the temporal axis.**53**

The way cinema manipulates the slow and imperceptible time of plants, crystals and clouds and spatializes them in kaleidoscopic forms allows us to immerse ourselves in an unknown spatiotemporal dimension, in a fourth dimension that in Lewis Carroll's time seemed accessible only by stepping across the mirror and anthropomorphizing time through Alice's eyes: "For instance, the pictures on the wall next the fire seemed to be all alive, and the very clock on the chimney-piece (you know you can only see the back of it in the Looking-glass) had got the face of a little old man, and grinned at her"**54** **Fig. 12 ↦ Lewis Carroll, *Through the Looking-Glass and What Alice Found There*, ill. John Tenniel (1871).**

52 "Hemispherical" photography enabled a 180° view of the sky (also called "fish-eye" or "whole-sky"), with Hill's Whole Sky Camera invented by Robin Hill in 1923 offering a new approach to the observation of the heavens. I would like to thank Kei Osawa and Adèle Yon for their guidance and discussions of these techniques.

53 See Emmanuel Alloa, "Au pied de la lettre. L'infra-structuralisme de Kittler," in *Gramophone, Film, Typewriter*, French ed. F. Vagoz, E. Alloa, E Guez. (Dijon: Les presses du réel, 2018), 22-24.

54 Lewis Carroll, *Alice's Adventures in Wonderland*, 34.

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7 ANIMATE, INANIMATE