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The Garden in the Laboratory: Arthur C. Pillsbury's Time-Lapse Films and the American Conservation Movement

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Abstract: From the 1910s through the 1930s, the American naturalist and photographer Arthur C. Pillsbury made time-lapse and microscopic films documenting what he, in common parlance, called the “miracles of plant life”. While these films are now mostly lost, they were part of Pillsbury’s prolific work as a conservationist and traveling film lecturer who used his cameras everywhere from Yosemite National Park to Samoa to promote both public understanding of plants and a desire to protect the natural world. Guiding this work was Pillsbury’s belief that the nonhuman optics of the film camera, which revealed the animacy of plants, could also incite viewers to sympathize with them. In the context of the early American conservation movement, that sympathy stemmed in complicated ways from longstanding transcendental and pastoral ideas of nature that were entangled with imperialist visions of controlling nature. With an eye to that context, I show that Pillsbury’s filmmaking was not simply about using motion picture technologies to shape attitudes toward plants and nature more broadly; it was also about using nature to think through the techno-scientific possibilities of the cinema in the early part of the twentieth century.

Keywords: Arthur C. Pillsbury; time-lapse photography; natural history film; national parks; aesthetics; environmentalism; American visual culture



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Pursuing my lonely way down the valley, I turned again and again to gaze on the glorious picture, throwing up my arms to inclose it as in a frame.

—John Muir *The Mountains of California*

When Americans want to understand their relationship to the natural world, they often turn to images.

—Finis Dunaway *Natural Visions: The Power of Images in American Environmental Reform*

1. Pillsbury’s Nature

In 1937, the American naturalist, photographer, and filmmaker Arthur C. Pillsbury described a curious experiment he had undertaken while filming wildflowers with what he called a “traveling camera”. The device consisted of a 16 mm motion picture camera mounted on a ten-foot aluminum rail that stood on legs a short height above the ground. The camera was rigged with a battery-operated motor and would travel at a constant speed along the rail, which was flexible enough to be shaped into a curve so that Pillsbury could create “panoramic” motion pictures of plants. The goal was to produce more dynamic and aesthetically engaging filmic views of flowers “in their natural habitat” where on the surface—e.g., looking out onto a field of California poppies—one typically does not see much life or movement. However, the dynamism of the traveling camera and the scenic beauty it offered up on its journey through nature were only part of the attraction. According to Pillsbury, the apparatus could be positioned so that the moving camera “finish[es] on two or three buds that have been carefully placed; these buds are then matched up in the laboratory with the lapse-time [sic] camera and open as though it were one continuous picture” [1] (pp. 177–178).¹ The idea was that the viewer would

have the impression of beholding a flower as it bloomed not in the laboratory but in its natural habitat.

On a practical level, the substitution trick solved a simple problem. Pillsbury could not successfully record plants in their natural habitats using time-lapse photography because the uncontrollability of weather and lighting resulted in inconsistencies from frame to frame that undermined the illusion of continuous motion. So, he filmed buds opening in the laboratory and staged the nature captured by the traveling camera such that the two would blend seamlessly, or at least the seam would be bridged by passing the camera's movement to the movement of the flower blooming. However, beyond practicality the trick also rehearsed a complicated fantasy. If beholding the secret movements of a flower blooming required filming in the laboratory, then merging that footage with footage from the traveling camera into "one continuous picture" suggests a desire to see a flower bloom "naturally", that is, without manipulation, as if the camera happened upon it "in nature" at the end of the aluminum rail and recorded it in real time. The desire makes Pillsbury's experiment a site of significant tensions, for instance between ideas about uncontrolled nature and the controlled environment of the laboratory; between the organic and contingent movements of a flower and the precise, mechanized, and uniform movements of the traveling camera; and between the time of the flower—of its life and movement in its natural habitat—and the time of the camera—its clockwork photographic time with calculated intervals.

What follows is an account of how these tensions informed Pillsbury's vision for filming plant life as a means of establishing a harmonious relationship between humans and nature in the early part of the twentieth century. From the 1910s through the 1930s, Pillsbury made time-lapse and microscopic films documenting what he, in common parlance, called the "miracles of plant life". While these films are now mostly lost, their traces in the archival record show that Pillsbury was prolific as a conservationist and traveling film lecturer. He used his cameras everywhere from Yosemite National Park and the Missouri Botanical Garden to Pago Pago to promote both public understanding of plants and a desire to protect the natural world. Guiding this work was his belief that the nonhuman time and optics of the film camera, which revealed the animacy of plants, could also incite viewers to sympathize with them. In the American context that sympathy stemmed in complicated ways from longstanding transcendental and pastoral ideas about harmonizing with nature that were entangled with imperialist visions of controlling nature.

Pillsbury was not systematic in theorizing the relation of his work to that broader context. His ideas evolved in a piecemeal fashion over several decades of experimenting with joining his love for nature and his fascination with photographic technologies. He was very much a child of America's early conservation movement who worked with policy makers, activists, and environmental organizations, such as the seminal Sierra Club, to protect plant life in the country's wilderness areas. Furthermore, like his contemporary, the famed naturalist and preservationist John Muir, Pillsbury envisioned nature as a "glorious picture" with inherent aesthetic values that needed to be preserved. He was also an ardent technophile who dedicated his entire career to understanding and expanding the aesthetic possibilities of film and photography through invention and innovation. The way that Pillsbury brought these two strands together—the aesthetics of nature and the aesthetics of film—in the service of recording plant life raises interesting questions about time-lapse photography. For instance, what made time lapse useful to the American conservation movement? What aspects of place—local and national—defined that usefulness? Furthermore, in those places, what did seeing the "miracles of plant life" have to do with historically specific ideas about nature and technology?

With an eye to these questions, I consider how Pillsbury's filmmaking was not only about using motion picture technologies to shape attitudes toward plants and nature more broadly; it was also about using nature to think through the techno-scientific possibilities of the cinema. While Pillsbury's case resembles many others in this regard, its significance is in the fact that his approach to filming plant life stemmed from distinctly American ideas about the relationship between nature and technology in a country that was rapidly

modernizing. As I will show, his understanding of that relationship led him to envision time lapse as means of bringing not only viewers but also the motion picture camera into harmony with the natural world. To record the movements of plants, Pillsbury developed complex automated photography systems that could produce time-lapse footage largely without the aid of the human hand. The automations imbued his photographic machines with a mechanical life that was complemented by the plant life Pillsbury sought to capture. By understanding that complementarity, I argue, we can see how Pillsbury's filmmaking brought nature and moving image technologies into a kind of sympathetic relation such that each—plants and film—was involved in shaping ideas about the other.

2. Seeing Nature

While studying mechanical engineering at Stanford University in the 1890s, Pillsbury discovered a passion for photography that he developed into a career as a professional photographer first for the U.S. Census Bureau in Alaska and then for the *San Francisco Examiner*. He subsequently shifted to making time-lapse films of wildflowers, primarily in Yosemite National Park and the surrounding Sierra Nevada mountains of California on the West Coast of the United States. From 1906 to 1927, Pillsbury operated a photography studio in Yosemite where he sold still photographs and projected lantern slides and motion pictures (scenics and time-lapse films) of the landscape, plants, and animals to park visitors. In the 1930s, he experimented with microcinematography, time-lapse X-ray imaging technologies, and underwater cameras while documenting everything from hydroponics and healing bone fractures in Berkeley, California, to flora and fauna in Jamaica and Samoa. His work generally adhered to natural history filmmaking conventions that were popular at the time. Furthermore, his time-lapse films of plants were not particularly distinctive compared to those of his contemporaries. Flowers appeared against the familiar black background that was a condition of filming in a controlled laboratory setting; and they were framed in close-up to emphasize the movement of buds blooming. Oftentimes, Pillsbury added the attraction of color, especially when Kodachrome film stocks became more widely available in the mid-1930s. His films also tended to be encyclopedic in that they surveyed a wide range of species in a particular region, and they were exhibited to tourists, garden club members, and a variety of international publics in a lecture format that Pillsbury liked to frame as a "journey into the mysteries of plant life" [2].

These time-lapse journeys followed the logic of "nature study", an observational mode "marked", as Jennifer Peterson explains, "by idealization and simplification" that privileged the aesthetic experience of nature's dramas and wonders over specialized scientific discourse [3] (p. 146). Take Pillsbury's educational science film *Reproduction in Plants and Lower Animals* (ca. 1930), which details biological processes with the aid of time-lapse photography and microcinematography. The premise of the film is that "[a] clear understanding of fertilization, conjugation, and cell division is essential in the study of natural science". And the central theme—what an opening title card calls "A primal urge of all life—to reproduce its kind"—is mapped with a series of observations about flowers, algae, worms, and anemones. The observations are delivered with title cards that provide some basic information about the processes being depicted, but the information is clearly subordinate to spectacles of plant and animal life. For instance, while time-lapse footage of a Spider Lily blooming is used to introduce the topic of fertilization, the connection between the time-lapse footage of the flower's movements and the lesson on pollination is not made. Likewise, in a brief segment on conjugation in the world of algae, simple descriptions of behaviors and structures of plant cells are paired with lengthy and largely independent shots of filaments floating and forming underwater arabesques and cellular matter squiggling around beneath the lens of a microscope (Figure 1). The pairing follows a larger pattern in the film of creating space for viewers to simply marvel at the sight of mesmerizing movements and forms in nature that are revealed, also marvelously, with Pillsbury's cameras.

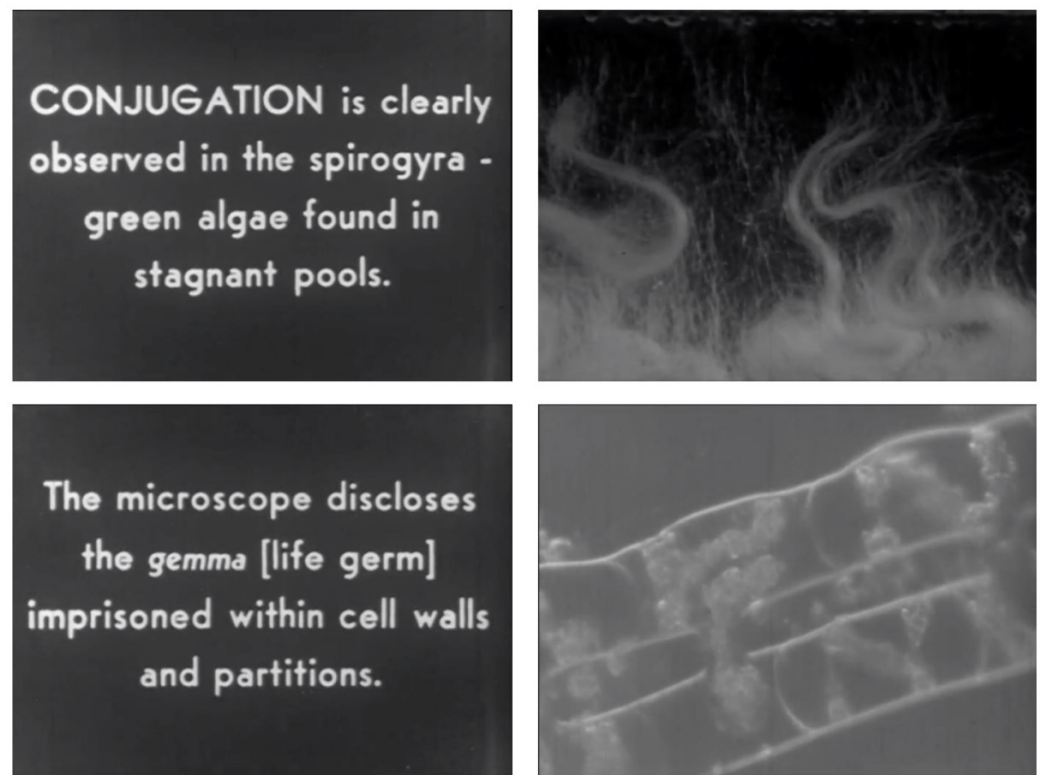


Figure 1. Screen grabs from Arthur C. Pillsbury's *Reproduction in Plants and Lower Animals* (c. 1930). Source: Prelinger Archives <https://archive.org/details/0971ReproductionInPlantsAndLowerAnimals> (accessed on 1 July 2022).

The aesthetics of plant life were inseparable from Pillsbury's sincere affection for nature, which stemmed from the pleasures he took in observing the intricate and varied appearances and behaviors of plants. We see this reflected in his book on the subject, *Picturing Miracles of Plant and Animal Life* (1937), when he positions himself as an artist who uses "[a] beam of light for a brush, a silver salt for paint, a transparent ribbon of celluloid for the canvas, chemicals to render it visible and permanent" [1] (p. 18). Filming plant life was for him firstly a way of capturing those everyday beauties of form and color and, as in a travelogue, making them available to audiences who might not have the opportunity to encounter them otherwise. However, the art—"painting" with film—was in his ability to wield the motion picture camera to make plant life newly visible, to transform the aesthetic experience of observing flowers in their natural habitats by abstracting their movements and forms with the aid of time-lapse photography and microcinematography. This is not to say that Pillsbury was unscientific in his endeavors—he was in fact interested and versed in botany—but rather that he did not seek primarily to popularize science or even necessarily to promote scientific ways of seeing nature. By aligning his filmmaking with painting, he placed his work in a different register, one where the science and technology of filmmaking made possible an art of defamiliarization that encouraged audiences to see the natural world anew.

The vision that Pillsbury had in mind for helping people to see nature differently was shaped by early twentieth-century discourses on the environment and tends to be ecological in orientation. As a photographer and filmmaker in Yosemite, Pillsbury was motivated to protect wildflowers after observing the destruction of their habitats to create grazing grounds for livestock. The motivation went beyond a concern for the ways that the scenic beauty of the landscape was being degraded. Intense debates about the environment that were taking place at the time turned on whether and how nature should be protected from human encroachments. Notably, in 1906, when Pillsbury began his career in Yosemite, President Theodore Roosevelt placed the park under the protection of the

federal government. The move was in part the result of ardent work done by John Muir and the Sierra Club, who were advocating for preserving the area against development on the grounds that the “pristine” environment held unique spiritual values for visitors amidst the decadence of modern life. As Muir put it, “Yosemite Park is a place of rest, a refuge from the roar and dust and weary, nervous, wasting work of the lowlands, in which one gains the advantages of both solitude and society” [4] (p. 350). A turning point in those efforts came in 1913 when a proposal to dam the Tuolumne River in the park to help meet San Francisco’s growing water needs—an issue that was magnified after a 1906 earthquake sparked devastating fires in the city—was approved and Yosemite became the focus of a conservationist project organized around land use and resource management.

The events during these years were formative for Pillsbury. He was active in the debates over Yosemite and subscribed to Muir’s ideals. He also believed film and photography could do good preservationist work to keep the aesthetic values of the landscape from withering.² When Pillsbury began filming plant life in 1912, his time-lapse photography aligned with a broad Emersonian tradition which was flourishing in America at the time as a critical response to the growing industrial exploitation and development of the environment. The tradition has origins in early settler colonial fantasies of North America as an Edenic wilderness, an idealized pastoral paradise that was uncorrupted by civilization (cf. [5]). In the nineteenth century, that vision was renewed prominently by the transcendentalist Ralph Waldo Emerson, who advocated for cultivating a reverent and harmonious relationship with the wilderness as a way of uplifting the moral and spiritual character of an industrializing America where, to his mind, peoples’ relationship to nature was at risk of growing discordant. Mark Stoll explains that in the first few decades of the twentieth century, as Pillsbury worked, Emerson’s ideas were guiding both the design of national parks as shrines to the American wilderness, as well as the work of artists such as Georgia O’Keeffe and Ansel Adams who, with their respective painted and photographic images of untouched, pristine American landscapes, sought to “educate the public to perceive beauty and thus bring humanity into harmony with nature” [6] (p. 118). For Pillsbury, who like Adams found a spiritual connection to Yosemite, time-lapse photography could do for viewers what the national parks did for visitors: offer aesthetic experiences that restored an intimate connection between humans and nature.

To understand the restorative potential of time-lapse films of flowers, we must understand Pillsbury’s relationship with photography. His early photography with the U.S. Census Bureau and the *San Francisco Examiner*, for example, is firmly in the tradition of scenics and travelogues, and he was heavily influenced by discourses on the sublime. In the American context at the time, sublimity was tethered to visions of “wild” nature and the awesome scale of geographical features such as Niagara Falls and the Grand Canyon that can provoke in beholders powerful feelings of astonishment and incomprehensibility, what Edmund Burke called “that state of the soul, in which all its motions are suspended, with some degree of horror” [7] (p. 53). For example, many of Pillsbury’s photographs, taken with a panorama camera of his own invention, sometimes while aloft in a manned balloon, depict such things as people and settlements dwarfed by the magisterial Alaskan wilderness and the awe-inspiring conflagration that followed the 1906 San Francisco earthquake. Pillsbury often aimed his camera at encounters between the natural sublime—e.g., vast mountain ranges and bodies of water—and the technological sublime—e.g., steamboats and railroads. Furthermore, while we might be tempted to read these as the meeting of opposing forces—wild nature and industrialization—many Americans at the turn of the century did not. David Nye explains that American industrial and engineering power and ingenuity were largely seen as “extensions” of the awesome natural power of the North American landscape to the degree that “[t]he natural sublime would inspire the engineer to produce works in harmony with it” [8] (pp. 62–63). For instance, in Pillsbury’s photograph “White Pass and Yukon Railroad, ca. 1899,” train tracks are threaded into mountains that reach up to the heavens and give the impression that the extraordinary feat of engineering

is one with the sublimity of the landscape (Figure 2). Here, nature offers a way of thinking about technology.



Figure 2. White Pass and Yukon Railroad, ca. 1899. Dimensions: 33.11 × 9.32 in. Panoramic photograph by Arthur C. Pillsbury. Source: Arthur C. Pillsbury Photograph Collection, The Seattle Public Library: “This item is in the public domain. No known copyright restrictions identified by the library at the time of scanning in July 2019”.

Of course, the experiences offered by time-lapse films of flowers are not the same as those offered by the landscapes captured in such photographs. Plant life operates at a radically different scale than that pertaining to the discomfiting vastness which philosophers such as Burke and Immanuel Kant placed at the heart of the sublime and which inspired Pillsbury’s landscape photography. Nonetheless, for him, photographic technologies did function, like the railroad, as opportunities for bringing viewers into a kind of aesthetic harmony with nature. We see this in his panorama camera, itself a mechanical marvel that Pillsbury explained “looked like half a wash tub and made a picture 10 × 36 inches taking in almost half a circle” [9]. Furthermore, while neither the camera nor its photographs were sublime objects, it was as though the technology suggested in its form the scale of the views it recorded and produced pictures that would be seen in kind. Similarly, in 1919 he filmed Yosemite while aboard a biplane, another icon of the technological sublime that quite literally gave Pillsbury’s camera a transcendental view of sublime nature that would uproot viewers from their habitual perceptions and sweep them away into the awe-inspiring landscape.

When Pillsbury brought nature into his laboratory to film wildflowers growing, time-lapse photography became a tool for revealing that there was beauty hidden behind nature’s appearances, that another aspect of the grandeur which one might encounter in the face of sublime North American vistas was dwelling quietly, unseen, and unnoticed everywhere in “the miracle of plant life”. I say “beauty” rather than sublime because, in addition to the matter of scale, for Pillsbury the aesthetics of plant life were entangled with a discourse of affection (even love) rather than awe and terror. Turning to film on those grounds was a significant shift in his photographic practice, for it was with time lapse that he began thinking about synergies between motion pictures and plants that could reshape humans’ relationships with the natural world. The secret beauties of plant life revealed by Pillsbury’s cameras did more than infuse natural history lessons with the visual pleasure of beholding astonishing spectacles of movement where, to borrow the words of his promotional materials, nature is otherwise “apparently as still as death to the naked eye” [10]. In Pillsbury’s work, seeing plant life involved the possibility of discovering an unexpected connection—a kinship even—between plants and humans. A brochure for one of his film programs makes this explicit with the inclusion of an excerpt from a 1925 *Boston Herald* review that mused, “Wild flowers are like people—they have their births, their loves, their deaths, their moments of triumph, their inevitable tragedies; to watch a Mariposa Lily or an Evening Primrose struggle into being, live its life and pass on, is as poignant and beautiful a spectacle as anything ever produced by the greatest dramatists. Are human beings and flowers of the same life source? Are the wild flowers of the fields, the mountain slopes and the home garden simply an earlier stage of human life?” [11]. The musing was

not new. Charles Darwin used recordings of plant growth to propose a similar evolutionary link between plants and animals as early as 1880, a topic that Oliver Gaycken has explored thoroughly [12]. However, for Pillsbury such a possible kinship was not an opportunity for advancing scientific knowledge; it was grounds for calling lay people back to nature.

Pillsbury understood this call mainly in aesthetic and spiritual terms. Writing in *Picturing Miracles of Plant and Animal Life*, he explained, “One of the first reactions of seeing a reel of flowers growing and opening was to instill a love for them, a realization of their life struggles so similar to ours” [1] (p. 25). The realization, prompted by the sight of flowers apparently dancing, pushing, jostling, aspiring, and suffering as humans do, might jolt viewers out of seeing nature as something separate from themselves. For Pillsbury, a naturalist and conservationist eyeing the threats posed by a civilization that was increasingly encroaching on wilderness spaces like Yosemite, that vision of separateness fueled an unwelcome attitude toward nature as something to be used and exploited. And, he believed, it was the jolt of encountering the wondrous animacy of plants in a time-lapse film that could cultivate in viewers “a wish to do something to stop the ruthless destruction of them [wildflowers] which was fast causing them to become extinct” [1] (p. 25). This was the harmony he envisioned for viewers, from visitors at Yosemite to garden club members in Missouri and audiences of his film lectures abroad: struck by the secret world of plant life that was revealed by his time-lapse cameras, one might be inspired to revere and protect nature, that is, to enter, through technology, into a kind of Emersonian “communion” with it.³

3. Timing Nature

The relationship to nature that Pillsbury imagined for viewers of his time-lapse films extended to his cameras, which he understood to have an affinity with plants. In many ways the early film camera was an emblem of modernity that embodied prominent tensions between technology and nature in American society; it was, as Leo Marx would have it, a machine like the locomotive before it that signaled the intrusion of industrial civilization into “the garden,” the Arcadian ideal of an untouched and unspoiled North American wilderness (cf. [5]).⁴ Indeed, to borrow Mark Stoll’s words, national parks like Yosemite where Pillsbury worked were premised on the idea of protecting that ideal by “preserv[ing] the illusion of an uninhabited world of otherworldly beauty” [6] (p. 136). These spaces were conceived as refuges that articulated pastoral fantasies of restoring a harmony with nature, which many believed had been disrupted by the radical changes brought about by industrialization, urbanization, and the machinery of modern life in the nineteenth century. Such fantasies raise the question of how Pillsbury reconciled his enthusiasm for technology with his love of so-called unspoiled nature and a desire to protect plants from the forces of civilization.

The simple answer is that Pillsbury, like many other American photographers and filmmakers at the time, did not see the camera as a machine at odds with nature but rather as a tool for restoring harmony with it. Writing about American environmentalism in the early twentieth century, Finis Dunaway explains: “As they witnessed the alteration and loss of particular places, many artists and activists expressed ambivalence or even outright hostility toward technology, blaming it for the destruction of the American landscape. Yet, they continued to rely on the camera—a technology of representation—to convey their ideas about the natural world [. . .] With a sometimes naïve belief in the camera’s mechanical, objective vision, they hoped that photographs and films could record the reality of nature and bring Americans closer to the nonhuman world” [13] (p. xvii). For Pillsbury, objectivity was a pretense for an idealized vision of harmony that was ultimately about control, a topic to which I will return later. Furthermore, beneath this vision was a complicated understanding of the relationship between film and nature that had to do with ideas about time.⁵

Time-lapse photography is of course always already about time, about the manipulation of intervals to make visible otherwise imperceptible movements in time. However,

Pillsbury was remarkably preoccupied with a matter of time that all filmmakers who are in the business of recording plant life confront in some form: plants do not all grow at the same speed. Variability in the rates at which different species of flowers germinate, sprout, bloom, and die makes it so that the movements corresponding to those processes cannot be recorded effectively using a standard or uniform set of time-lapse intervals. For instance, filming a slow-growing plant and a fast-growing plant at the same rate of one frame per hour may result in filmed movements that are smooth and jittery, respectively. The results will be affected as well by variations in the speed of each plant's individual processes—e.g., one frame per hour may result in a filmed movement that is smooth when the flower is sprouting and jittery when it is blooming. The issue, for Pillsbury, was that failing to take these variables into account can lead to films that are displeasing to the eye and thus out of sync with the natural beauty of the subject being recorded. “So”, he advised, “in making your lapse-time pictures you must know when the bud starts to open, day or night; how long it takes before the petals fall; how much of it is worth picturing—as sometimes its death is more dramatic than its birth; and then how long the entire picture will hold the interest” [1] (pp. 40–41).

The idea is that making a beautiful time-lapse film—one that holds interest and pleases the eye—depends on the filmmaker's ability to bring the time of the camera into harmony with the time of the plant being recorded. To that end, Pillsbury studied plants carefully in their natural habitats and developed a comprehensive understanding of the timing of stages in their individual life cycles. What he found was that, generally, while those cycles vary considerably across species of flowers, each one is “remarkably uniform in its habits,” meaning that their individual stages and processes occur at consistent and predictable times, like clockwork [1] (p. 52). However, within that uniformity the movements of life and the time of specific processes are highly irregular. The irregularity was well established in early twentieth-century Western scientific theories as a unique characteristic of living things, a marker of what the French bio-physicist and philosopher Pierre Lecomte du Noüy in the 1930s called the “biological time” of organisms (cf. [14,15]).

For Pillsbury, the biological time of flowers revealed a curious affinity. The 16 mm and 35 mm motion picture cameras that he used functioned according to clockwork mechanisms that recorded images at regular intervals. In that regard, the machine was like a flower that is “remarkably uniform in its habits”. However, taking a similarly uniform approach of simply adding time between the camera's regular intervals was inadequate for recording the movements of plants. Getting a good picture—essentially one in which a flower looks alive—required modifying the regularity of the camera's clockwork mechanism to record at irregular intervals, which the device was also exceptionally capable of doing if it was properly reengineered. Jimena Canales points out that such modifications were identified as being necessary to cinematic studies of life as early as the 1910s when, in light of theories holding that living things move in irregular rather than cadenced ways, “scientists became increasingly concerned with filming at the speed of biological organisms ‘according to the activity of the culture [or specimen]’ rather than at predetermined, clock-controlled intervals” [15] (pp. 250–251). In Pillsbury's case the scientific implications were marginal to the aesthetic ones and the ways in which filming the beauties of plant life meant getting his cameras to keep time with nature.

Working out of a laboratory (first in Yosemite and then in Berkeley, California), Pillsbury developed complex mechanical systems for synchronizing his cameras with the life processes of plants. His typical time-lapse unit consisted of a camera mounted on a long track in a greenhouse that was rigged with an electrical lighting system. The camera was operated by a motor that controlled the process of making exposures and advancing the film according to an interval schedule that was set by a series of pins on a wheel attached to the motor shaft (Figure 3). Pillsbury's description of the system is worth quoting in full because its status as a mechanical marvel is important:

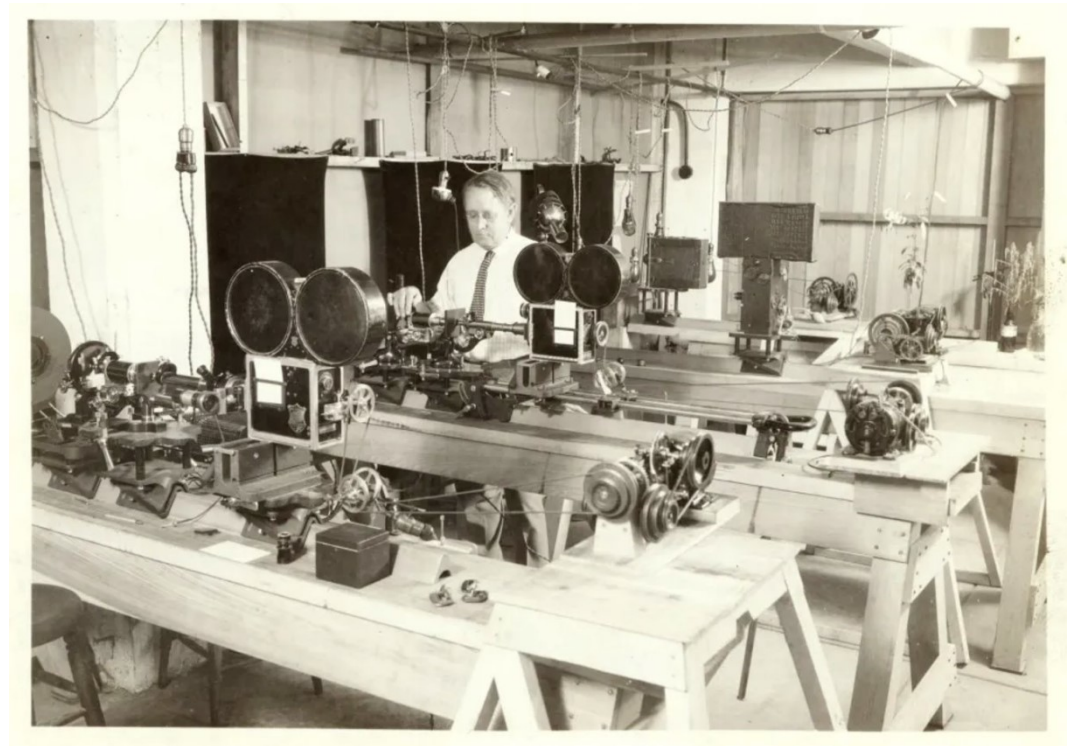


Figure 3. A version of Pillsbury’s automated time-lapse photography systems at the Missouri Botanical Garden. Source: Time-lapse photography set up. Arthur Pillsbury. *Missouri Botanical Garden Bulletin* 1927, Vol. 15, no. 7, p. 111 [16]. Image Credit: Missouri Botanical Garden. With permission from Missouri Botanical Garden.

One pin [on the wheel] would pass a given point [. . .] every minute, or 5–10–20 or 30 min, as often as desired. Just above this slowly revolving wheel was hung a pendulum-like rod. At its upper end, projecting above the wheel, a mercury tube switch almost balanced was installed. The pegs in the wheel came along slowly, hitting a projecting arm on the pendulum and caused the mercury to run to one end of the tube, which made an electric connection without sparking. This started a small motor that was geared down to make a shaft run one revolution in thirty seconds or a minute, as I desired, while the long end of the pendulum was lifted up [. . .] high enough to keep the mercury in its end of the tube giving an electric connection, running the small motor connected with a reduction gear—running it until it had made one complete revolution. This one revolution was connected with a chain belt and sprockets to the camera, giving one picture or frame. At the same time the motor started, the electric lights came on, giving the correct amount of illumination required for the exposure. Just as the same shaft that was connected with the camera by its chain belt made its complete revolution an arm kicked off the holding lever of the pendulum. Stopping itself it would swing back to its vertical position, the mercury would flow away from the connecting end of the tube without a spark [. . .], the lights would go out, the motor stop and nothing more would happen until the next taper pin in the so-called clock wheel came along and started the chain of operations again [1] (pp. 35–36).

Similar contraptions can be found throughout the history of time-lapse photography, from the technique’s origins into our contemporary moment, with Pillsbury’s being an innovation on earlier cases, such as F. Percy Smith’s and Lucien Bull’s time-lapse units.⁶ His electric lighting system provided uniform exposures from frame to frame so that a plant’s movements onscreen appeared to unfold continuously in unified space without lapses as though the plant had been recorded in “real” time. That seamlessness extended

to the way the pin system was designed to allow for the fine-grained programming of irregular intervals, which Pillsbury could tailor to the specific life processes of different plants—e.g., using slower frame rates during the growth of a stem and faster rates when the flower was blooming to enhance the drama of that moment. In theory, the apparatus could be programmed to unlock what he deemed to be the unique aesthetic potential of any plant that could be grown in the laboratory.

Pillsbury's operational description of the time-lapse unit is also revealing because he described the plants he studied with the same language, passion for detail, and sense of wonder that he expresses above toward the mechanics of his own invention.⁷ Oftentimes this took the form of him musing explicitly on the ways that the form and function of plant cells, leaves, and blossoms resembled mechanical devices of wonder. For example, he proclaimed the leaf "more wonderful than any of our most modern [factories], because it furnishes its own power and product" [1] (p. 127). Sometimes the connection was more accidental. For example, his greenhouse laboratory was equipped with a window shutter system that would block out the sunlight when the electric lights were triggered. The system turned the entire building into a kind of camera that simulated with its mechanical systems inside the conditions under which plants grow in their natural habitats outside. Furthermore, while Pillsbury did not theorize these resemblances in any meaningful way, he clearly engineered his time-lapse cameras as extensions of nature; every turn of the gears, movement of the pendulum, and exposure on celluloid was animated by the biological time of the plants he filmed.

The harmony was bolstered by the fact that the entire camera system was fully automated, as though the time-lapse unit behaved like a living organism. The automation was partly practical. The amount of human labor needed to manually operate multiple time-lapse cameras for long periods of time exceeded Pillsbury's capabilities as a filmmaker who worked largely alone. Doing the work by hand also risked compromising the kind of precision he sought in tailoring his cameras to the movements of plants because human factors such as mental and physical fatigue increased the possibility that he would make errors when applying his calculations to the filming process. The camera system he developed solved both problems by allocating matters of efficiency and control to a machine. We can see this as a kind of inversion of the Taylorist model in which, rather than the human laborer synchronizing their body to the mechanical time of a machine or an assembly line, the mechanical camera is synchronized to the biological time of a plant.⁸

The automation was also partly itself a source of wonder. In Pillsbury's description of the motors and gears and pendulums and switches that brought his time-lapse cameras to life, one gets the impression that he is marveling at his own absence from the machine, which could be set to run itself for days or months on end as he monitored its progress. His laboratory in turn stood like a shrine to technological wonders where plant life and his photographic technologies harmonized within a kind of mechanical ecosystem of his own invention.

Pillsbury's work was thus marked by the fact that his desire to understand the biological processes of plants and unlock their secret beauties was entangled with a desire to understand the technical processes of photographic reproduction. Put simply, plant life taught him about the nature and aesthetic possibilities of film, a lesson that Max Long has called the "co-production of knowledge" in natural history films of the period [17]. Pillsbury's writings brim with lengthy discussions of probing the limits of film chemistry and technology to come up with innovative solutions to problems that he encountered in the process of studying plants—e.g., using X-rays to visualize the inner workings of a flower blooming. This meant that, while he was firstly "a student of the phenomena of plant life" [1] (p. 45), as he phrased it, he was ultimately an inventor of mechanical contrivances whose experiments with flowers were also experiments with the art, form, and function of motion picture technologies.

From this perspective, the automation of his time-lapse cameras was also partly (and unintentionally) symbolic. Recall that Pillsbury's vision of nature was formed by Yosemite

National Park, which was, like other national parks in the United States, “designed as much as possible to look like no one was there” [6] (p. 129). The carefully constructed image of an unpeopled and untouched wilderness informed his understanding of the aesthetics of plant life as something that could be accessed most fully by the nonhuman optics of the motion picture camera, a kind of unpeopled machine. Furthermore, upon unlocking those secret beauties the camera could help people discover a new harmony in which nature is revered and observed but not touched. That vision extended to his automated time-lapse systems, which, in being designed to operate when no one was there, brought his mechanical devices even further into alignment with his ideas about nature.

We see a similar alignment in the prominent and pervasive interest that theorists and avant-garde filmmakers in the 1920s and 30s took in natural history films. Scholars such as Hannah Landecker [18], James Cahill [19], Caroline Hovanec [20], and Oliver Gaycken [21] have shown how early filmmakers’ uses of time-lapse photography and microcinematography to reveal secret dimensions of plant and animal life helped crystalize then-dominant discourses on the medium specificity of film, namely the aesthetic values of the camera’s unique mechanical ability to transcend the limits of human vision and defamiliarize the visible world. Hovanec explains that “proponents [of natural history filmmaking] believed that cinema opens up a nonhuman world before our eyes, bypassing human intent and intervention to reveal, in Virginia Woolf’s words, ‘life as it is when we have no part in it.’ Within this logic, nature films, which showcased the living forms of plants and animals in motion, were seen as the purest expression of a cinematic aesthetic. These films came closest to realizing what classical theorists considered the essential purpose of film: to let nature speak” [20] (p. 246). Pillsbury arrived at this non-anthropocentric sense of cinema independently and by way of experimentation; decentering himself in the photographic process was firstly a technical matter of figuring out how to film plant life.⁹ Nonetheless, he understood that plants and the motion picture camera speak to each other, that they have their own special kind of sympathetic relationship. And for him that sympathy made film, at the level of its most basic properties as a photographic medium, uniquely suited to his vision for conserving the American wilderness.¹⁰

4. Conserving Nature

The importance of Pillsbury’s interest in linking time-lapse and conservation is magnified when we consider that his films on the surface do not look much different from many other filmmakers’ time-lapse studies of plant life. For example, except for the color schemes, Pillsbury’s rose, filmed at the Missouri Botanical Garden around 1927, is nearly indistinguishable from F. Percy Smith’s in *The Birth of a Flower* (1910) and John Ott’s in the 1950s (Figure 4). For much of the twentieth century, the iconography of plant life in science and natural history films in Europe and North America was remarkably consistent along those lines: flowers grow from seeds to blossoms against blank backdrops without much variation. Given that such views circulate as seemingly endless copies of each other, it is no wonder that they give the impression of being ahistorical, which of course they are not. As I have shown elsewhere, much of the historicity of time-lapse films of flowers is behind the images in the specific methods and mechanics of their production, the constantly changing technoscience that makes picturing plant life possible (cf. [22,23]). So, while Pillsbury’s rose may be indistinguishable from Smith’s, the specific significance of his photographic processes is in how he wedded them to ideas about a particular place—Yosemite—as well as to particular national concerns—early twentieth century environmentalism in the United States.

I have touched on those concerns to varying degrees above, but here I want to turn briefly and in a more focused way to the intriguing fact that for Pillsbury filming plant life was a deeply American project.¹¹ The affections he expressed for the beauties of an untouched nature rehearsed a longstanding fantasy that emerged when European explorers and settlers developed a picture of North America as an unspoiled landscape that, they believed, “looked [. . .] the way the world might have been supposed to look before the

beginning of civilization” [5] (p. 36). That picture became a defining feature of (namely white and patriarchal) American society, especially in the nineteenth century when the “wilderness”—embodied by the frontier that was ever moving westward—functioned prominently as a measure of the industrializing nation (cf. [24]). For, the wilderness was the idealized site where American civilization performed its possibilities by transforming nature through settlement and mechanical invention. (Recall Pillsbury’s panoramic photographs of encounters between the technological sublime and the natural sublime.) However, the stakes of the transformation were incredibly high. As Finis Dunaway explains, “Following the U.S. Census Bureau’s announcement of a ‘closed’ frontier in 1890 [signaling that the so-called unspoiled landscape had been completely settled], more Americans became worried about the loss of wilderness and the scarcity of resources” [13] (p. xvii). The worry gave rise to the American conservation movement, which in the first decades of the twentieth century dealt with the loss in part by preserving the fantasy of untouched nature in places like Yosemite and the pictures that people made of them.

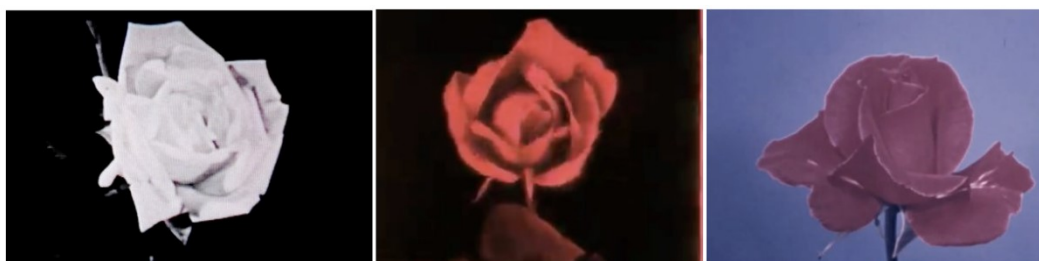


Figure 4. Screen grabs of time-lapse roses. Left: Pillsbury, *Flowers Growing and Opening* (1927). Middle: F. Percy Smith’s *The Birth of a Flower* (1910). Right: John Ott, film fragment from *Plants and Flowers: From the John Nash Ott Collection*, Winnetka Historical Society Available online: <https://youtu.be/4J0xXwwIIvY> (accessed on 1 July 2022).

As part of that fantasy, Pillsbury’s time-lapse films are inscribed by an important taxidermic impulse that shaped the early history of American conservation. For people like Pillsbury, Yosemite was, to borrow Rebecca Solnit’s words, “the very crucible and touchstone for American landscape” [25] (p. 221) because the park embalmed an idealized vision of pristine nature, preserving it against the decadence of modern life and the passage of time at a crucial moment when for some the wilderness appeared to be on the verge of vanishing entirely. From this perspective, it makes sense that Pillsbury saw film as a medium that was uniquely suited to carrying out that preservation. The American conservation movement in the early 1900s was broadly underpinned by an idea of nature that was essentially photographic.¹² Writing about the art of taxidermy in American museums of natural history at the time, Donna Haraway explains photography’s resonance with the country’s conservationist mission: “To make an exact image is to insure against disappearance, to cannibalize life until it is safely and permanently a specular image, a ghost. It arrested decay. That is why nature photography is so beautiful and so religious—and such a powerful hint of an apocalyptic future” [24] (p. 42). Hence, the significance of Pillsbury’s choice to *film* the natural world. Bringing Yosemite’s wildflowers to life through time-lapse photography was not only a way of defamiliarizing nature in the hopes that viewers might develop a love for it; it was a way of countering nature’s death and destruction by reproducing the vanishing wilderness in pictures. Furthermore, like Yosemite, those pictures provided idealized encounters with nature: the secret beauties of plant life were only visible to viewers on film, not in the plants’ natural habitats.¹³

The core tension in Pillsbury’s work, then, is that his vision for bringing humanity into harmony with nature was entangled with ideas about controlling nature and time. The entanglement is clearest in a curious episode from his career. Around 1928, Pillsbury began experimenting with using X-ray technologies to produce time-lapse films of plants. The idea was that producing X-ray motion pictures of a flower blooming would reveal

wondrous aspects of the inner workings of a blossom that were previously unknown to science and otherwise inaccessible even to the time-lapse camera. Pillsbury was a bit at pains to justify the scientific values of the undertaking, for which he invented a customized lens-less camera apparatus that made 3×4 -inch exposures on 200-foot rolls of film (Figure 5). However, the experiments led him to an unexpected discovery. After filming two plants simultaneously, one with the X-ray camera and one with his standard time-lapse camera, he reported: “I had not paid much attention to the roses I had worked on except set them aside, when I suddenly noticed the X-rayed blossom was still almost perfect, while on the other, taken in the usual way, the petals had fallen and the haw was forming. Still it did not make much impression on my mind, although they were the same kind of roses and of equal development when I started, but in each recurring picture I got the same results—prolonged life of the blossom” [1] (pp. 146–147). The taxidermic qualities of film apparently bled back into nature.

The discovery added a new layer to a practice Pillsbury had developed of manipulating the growth of plants using aspirin, whiskey, and strychnine, which, he reported, helped some flowers to bloom more quickly and more fully for his cameras in the laboratory. As with the X-ray camera, the manipulations were simply meant to reveal and enhance the secret beauties of plant life. However, such interventions in the biological time of plants—accelerating, augmenting, and prolonging life—also mean that for Pillsbury the aesthetics of nature were always already constructed by and for the motion picture camera. This is particularly true in the case of his “traveling camera” that I mentioned at the beginning of this article wherein Pillsbury sought to blend time-lapse footage of plants with footage of them in their natural habitat, giving the impression that the “techno-flower”, as Sarah Cooper puts it (cf. [26]), bloomed not in the laboratory but in nature. His was through and through a cinematic vision of nature, or rather, the two—film and nature—worked synergistically to shape ideas about each other.

In the early part of the twentieth century, that vision and synergy articulated what Dunaway, writing about American environmentalism’s visual culture, calls “a desire to domesticate the wilderness by creating pictures” [13] (p. 6). (This extends as well to the longstanding entanglement, which was particularly prominent at the time, between natural history and imperialism.) Wrapped in ideas about discovering a kind of spiritual harmony with and love for untouched nature, in the American context the desire was animated by ideas about possession and control that resonated strongly with the capacities of photography and film to defamiliarize the visible world and to embalm time. André Bazin’s familiar description of those capacities is strikingly and unexpectedly apt here: “Only the impassive lens, stripping its object of all those ways of seeing it, those piled-up preconceptions, that spiritual dust and grime with which my eyes have covered over it, is able to present it in all its virginal purity to my attention and consequently to my love” [27] (p. 15). In the United States, being reproduced as an image meant that nature could be fitted neatly into an analogous fantasy of keeping the wilderness pristine in part so that it could be made to serve as a spiritual refuge for weary citizens of a modernizing nation.

Pillsbury was distinct in exploring the potential of time-lapse films of plant life to fulfill that desire just as the contours of the American conservation movement were beginning to take shape. This is not to say that he was exceptional, but his work is particularly useful for giving some much needed specificity to the now ubiquitous picture of time lapse photography as a technique for recording the secret beauties of the natural world. Often the beauty of these kinds of films is attributed to the mechanical objectivity of the motion picture camera and the ways that time lapse simply reveals inherent aesthetic values of nature that are otherwise inaccessible to humans. Pillsbury thought as much when he deployed his time-lapse cameras to record plant life and conserve the purportedly timeless beauties of an untouched natural world. However, what his cameras revealed was far from objective and ahistorical; his time-lapse flowers were very much political in that they participated in the construction of specifically American ideas about nature.

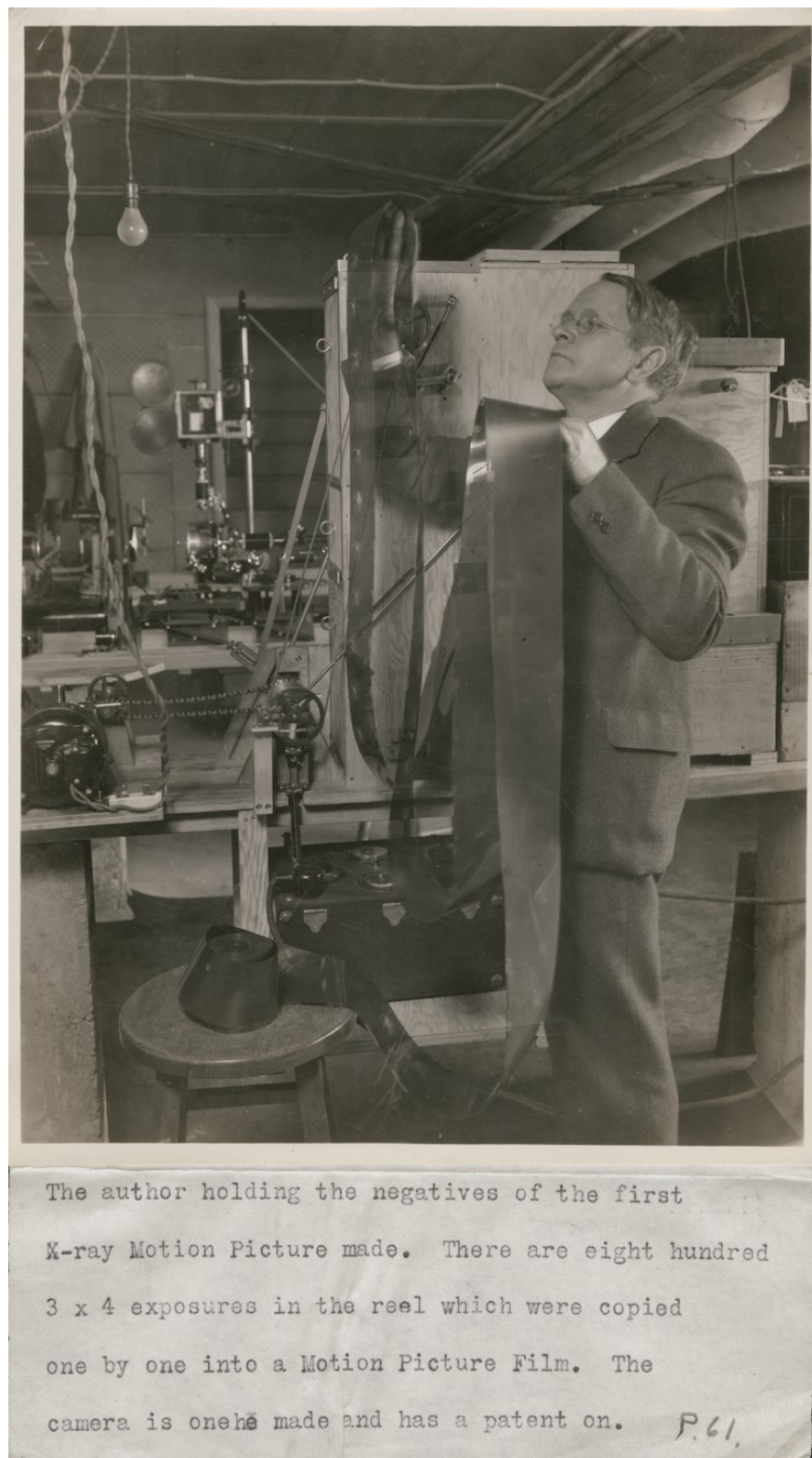


Figure 5. Pillsbury with film from his X-ray time-lapse camera. Source: Arthur C. Pillsbury Photographs, MSS P-83 box 1, folder 3. Reprinted with permission from L. Tom Perry Special Collections, Harold B. Lee Library, Brigham Young University, Provo, UT 84602.

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Notes

- ¹ Pillsbury consistently used the term “lapse-time” to describe his filmmaking practice. In this essay I have chosen to use the more common “time-lapse” when referring to the same process.
- ² Notably, Pillsbury supplied most of the photographs for John Muir’s book *The Yosemite* (New York: The Century Company, 1912) [28].
- ³ The kinship between humans and plants that Pillsbury saw as being important for inspiring people to love nature has an interesting resonance with Emerson’s famous passage in *Nature* (1836): “Standing on the bare ground—my head bathed by the blithe air, and uplifted into infinite space,—all mean egotism vanishes. I become a transparent eye-ball; I am nothing; I see all; the currents of the Universal Being circulate through me; I am part or particle of God” [29] (p. 8) Pillsbury did not express such a natural-theological view, but his sense that the animacy of plants shared in the same vitalistic energy as humans casts the common trope of the anthropomorphic time-lapse flower curiously in the light of American transcendental thinking like Emerson’s.
- ⁴ In the American context, the Arcadian ideal is also entangled with the “salvage ethnography” project that was powerfully shaping discourses on race and imperialism in film and photography cultures during the decades that Pillsbury worked. See further Fatimah Tobing Rony, *The Third Eye: Race, Cinema, and Ethnographic Spectacle* (Durham: Duke University Press, 1996) [30], and Alison Griffiths, *Wondrous Difference: Cinema, Anthropology, and Turn-of-the-Century Visual Culture* (New York: Columbia University Press, 2002) [31]. The centrality of the national parks to that project, particularly as those spaces intersected with racist fantasies about so-called vanishing Native Americans, makes Pillsbury’s work inseparable from the politics of the salvage paradigm in the United States.
- ⁵ Pillsbury did not have a theory of time. As with his film and photography practices, he arrived at a particular understanding of time through observation and experimentation, but neither was informed by scientific or philosophical discourses that were in circulation at the time.
- ⁶ Pillsbury’s time-lapse technologies are followed in the American context by the extraordinary automated systems created by the American time-lapse filmmaker John Ott in the 1940s and 1950s (cf. [22]).
- ⁷ A similar preoccupation with operational descriptions of time-lapse photography and the technological challenges of filming plant life animates Mary Field and F. Percy Smith’s book *Secrets of Nature* (1934) [32]. I have not been able to determine whether Pillsbury was aware of Field and Smith’s work or their book, which is quite similar to the one he published in 1937.
- ⁸ I am very grateful to one of the anonymous reviewers of this manuscript for making this wonderful connection to “Taylorized time”. See further along these lines Mary Ann Doane, *The Emergence of Cinematic Time: Modernity, Contingency, the Archive* (Cambridge, MA: Harvard University Press, 2002) [33].
- ⁹ As of writing this essay, I have found no evidence that Pillsbury intersected with the avant-garde and film criticism circles where these ideas were circulating at the time.
- ¹⁰ For a wonderful recent account of the ways that ideas about entanglements of film with nature have been theorized, see Cassandra Guan and Adam O’Brien’s “Cinema’s Natural Aesthetics: Environments and Perspectives in Contemporary Film Theory, *Screen* 61.2 (2020), pp. 272–321 [34].
- ¹¹ I am not suggesting that there is anything inherently or essentially “American” about time-lapse photography but rather that Pillsbury saw in the technique something that made it particularly useful for exploring a set of historically-specific ideas in American culture.
- ¹² We can think, too, of the importance of nature in the history of photography theory, particularly the role of nature in developing ideas about the medium’s ontologies in the nineteenth century. See, for example, Geoffrey Batchen, *Burning with Desire: The Conception of Photography* (Cambridge: MIT Press, 1999) [35].
- ¹³ I am indebted here to Donna Haraway’s history and theory of taxidermy in early twentieth-century natural history museum displays as modeling idealized encounters with nature that have no physical referent (cf. [24]).

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