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# THE SHROUD OF TURIN AND THE DIALECTIC OF LIGHT: ICONOPHOTOLOGICAL FOUNDATIONS OF THE IMAGE

# *O SUDÁRIO DE TURIM E A DIALÉTICA DA LUZ: FUNDAMENTOS ICONOFOTOLÓGICOS DA IMAGEM*

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**ABSTRACT** – This essay presents an iconophotological interpretation of the Shroud of Turin, integrating philosophical foundations of light, image theory, and the physicochemical principles behind both analog and digital photographic processes. Tracing from the luminous ideas of Plotinus and Dionysius the Areopagite to Heidegger's phenomenology, the insights of Flusser, and the historically anachronic, survival-focused perspectives of Didi-Huberman, it is shown that the sindonic image does not adhere to any artistic or pictorial logic—given the lack of pigments, brushstrokes, or technical devices—and its three-dimensional structure challenges any consistent hypothesis of medieval production. Therefore, the Shroud can be viewed as a liminal symbol between the visible and the invisible, where light acts as the physical testimony of a presence, surpassing the boundaries of art, science, and faith.

**KEYWORDS** – Shroud of Turin; iconophotology; light; photography; three-dimensional image.

**RESUMO** – Este ensaio apresenta uma interpretação iconofotológica do Sudário de Turim, integrando fundamentos filosóficos da luz, teoria da imagem e os princípios físico-químicos subjacentes aos processos fotográficos analógicos e digitais. Partindo das ideias luminosas de Plotino e Dionísio, o Areopagita, passando pela fenomenologia de Heidegger, pelas reflexões de Flusser e pelas perspectivas historicamente anacrônicas e focadas na sobrevivência de Didi-Huberman, demonstra-se que a imagem sindônica não se submete a

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nenhuma lógica artística ou pictórica – dada a ausência de pigmentos, pinceladas ou recursos técnicos – e sua estrutura tridimensional desafia qualquer hipótese consistente de produção medieval. Portanto, o Sudário pode ser visto como um símbolo liminar entre o visível e o invisível, onde a luz atua como testemunho físico de uma presença, transcendendo as fronteiras da arte, da ciência e da fé.

**PALAVRAS-CHAVE** – Sudário de Turim; iconofotologia; luz; fotografia; imagem tridimensional.

**Introduction**

Some images present themselves to the viewer; others, however, challenge it, as they go further: they invoke the spirit to contemplation, echoing, in part, the Hegelian desire to go beyond mere imitation. Among all the images preserved by history, few have challenged – and continue to challenge – the human gaze as profoundly as the Shroud of Turin.

This essay argues that the Shroud functions as a limit-image: a luminous and indexical phenomenon whose formation defies traditional regimes of the pictorial, photographic, or digital, acting as an epistemic agent capable of reshaping our understanding of the visible.

The possible burial cloth – one of the most studied and controversial relics in history – is a linen sheet measuring 4.41 by 1.13 meters, bearing the frontal and dorsal images of a human body. Documented since the fourteenth century, its origins remain elusive. This image, whose creation continues to be the focus of multidisciplinary investigation, transcends its religious significance and stands as an object of deep philosophical, scientific, and iconophotological interest.

This essay, therefore, seeks to deepen understanding of the Shroud from an iconophotological perspective. By iconophotology, we understand the theoretical field that articulates iconological, historical, phenomenological, and physic-chemical dimensions of the image, examining it as a luminous and vestigial inscription that integrates body, light, and support. It is an approach capable of comprehending images that escape conventional models of representation, exploring two central tensions at the core of the object: the ontological – between the visible and the invisible, the negative and the positive – and the technical-formative – between the analog, the digital, and the three-dimensional structure peculiar to the sindonic image.

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The analysis will be guided by a dialogue with thinkers who have explored the dialectics of opposites, the nature of images, and the phenomenology of perception. The use of these authors is not decorative; it aims to demonstrate how the sindonic image invokes categories that span ontology, phenomenology, and image theory. The negative nature of the Shroud – and the absence of pigments that would explain a manually created image – provides fertile ground for examining the philosophical relationship between negative and positive. This dialectic, present in various Western thought traditions, highlights its emergence as a phenomenon rooted in the nearly ontological tension between presence and absence, light and shadow, being and non-being. More than a devout object or scientific curiosity, the Shroud, with its almost spectral presence, seems to condense the paradoxes of the image, acting as a true iconophotological epiphany. In it, light – the principle of photography and a symbol of the transcendent – mediates between matter and spirit. The linen surface, traversed by a presence lacking pictorial traces, reveals a probable luminous impression, as if anticipating the emergence of photography itself, not merely serving as an image support but embodying a presence-absence imprinted upon it. The photographic process introduced a new ontology of light and image: the world was not only made visible through light but also imprinted by it. While this was already revolutionary in the nineteenth century, the existence of an earlier image containing the tonal inversion characteristic of the photographic negative raised not only technical questions but also ontological and theological ones.

It is therefore reasonable to ask: could the Shroud serve as an archetype of the photographic image, a kind of primitive photogenic form? This comparison is not arbitrary: in 1898, when Secondo Pia captured the first photographic image of the cloth, he found that the negative image on the Shroud was actually positive – a discovery that surprised the scientific community and established a new visual paradigm. The Shroud seemed to contain within itself the luminous inversion that characterizes the core of the photographic image.

The encounter between this sacred object and modern technology created a shared symbolic framework where light functions as the script of presence and absence, revealing with extraordinary clarity the figure of a man brutally tortured, yet whose peaceful expression suggests the dead Christ.


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This discovery had a profound impact on the academic community: transforming a technical negative into a unique positive became an event that touched both the symbolic and the spiritual, especially during a time when society was moving away from religion. What initially seemed unclear on the cloth – the positive – became clear through photography – the negative.

Light in the Shroud – or its absence – ceases to be just a record and becomes an event: something that occurs in time, imprinting on the cloth the testimony of a body. Luminous matter, fixed in the photographic act, transforms into a revelation, almost a theological symbol. Since every revelation involves concealment (DERRIDA, 1990), what is shown today on the linen was, at some point, hidden – and photography simply made explicit what the image already contained in potential.

Thus, the Shroud was not only revealed by photography but also acts as a precursor to photography: the linen revealed itself to hold, in situ, the seed of the photographic image – both analog and, as we will see, even digital.

Therefore, the Shroud signifies not only what some call a religious mystery but also the very mystery of light, which since the Greeks has symbolized truth and manifestation. Heidegger notes that the essence of truth is aletheia, unveiling, bringing-into-presence. The Shroud, therefore, appears as an event of unveiling in which the invisible becomes visible through light.

Iconophotology thus emerges as a field capable of integrating the iconological, iconographic, historical, phenomenological, physical, chemical, and theological dimensions of the image – especially those that challenge conventional categories of perception and interpretation. The image of the Shroud, with its enigmatic nature and characteristics that anticipate photography, is a privileged object for such a reading, functioning as a bridge between the visible and the invisible, matter and transcendence, word, icon, and light.

Such a field provides the necessary tools to view the Shroud not just as a simple relic or a forged artifact, but as a symbolic model of the sacred and religious image. Achieving this requires moving beyond superficial readings that stay on the surface of the linen without engaging with its historical, imaging, and phenomenological richness.

However, some scientific objects cannot be confined to a single interpretive path. They behave like open circles, with points that extend infinitely, requiring multiple interpretive approaches. The case of

the Shroud exemplifies this, as since Secondo Pia photographed it in 1898, it has proven to be a unique object, impossible to simplify with quick or definitive explanations. Based on these premises, this study examines: (1) the historical and material development of the Shroud; (2) its philosophical and iconophotological frameworks; and (3) its comparative relationship with both analog and digital photographic systems. This approach will demonstrate that the Shroud is not merely a research object but a cognitive operator that redefines the role of technical images.

**The Advent of the Shroud in Western Europe**

To understand the scientific and philosophical debates around the Shroud, it's important to trace its documented history in Western Europe. Even a brief look at the relic's history is necessary, especially considering how its material uniqueness shaped perceptions of its image over the centuries. The earliest documented record of the cloth appears around 1350 in Europe, specifically in the small town of Lirey, France—marking the point when its controversial nature first became evident and sparked conflicting reactions. The absence of earlier records and the striking visual impact of the image fueled both suspicion and devotion.

The relic remained hidden in the hands of Geoffrey de Charny—who never revealed its origin nor explained how the cloth came into his possession—until his death. Before that, Geoffrey aimed to build a place that would serve not just as protection for the cloth and a potential pilgrimage site but also as a family mausoleum. In 1349, he sought permission from Pope Clement VI to construct a church on his land with six canons. He received approval and started building a temporary wooden structure; however, his plans were interrupted when he was captured by the English. Believing he would stay imprisoned forever, he vowed to dedicate a church to the Virgin Mary if he was released (WILSON, 1979). He was indeed ransomed by King John II, "the Good," in July 1351. In 1354, he renewed his request—this time to Pope Innocent VI—and once again received permission to establish the collegiate church. Two years later, Bishop Henri de Poitiers consecrated the new church in a ceremony filled with praise, though he made no mention of the Shroud—apparently unaware of it. A few months after the opening, on September 19, 1356, Geoffrey died in battle. Even then, no mention of the cloth appeared in the masses held for

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his soul, which deepened the mystery of its origins. The "authentic burial cloth of Jesus"—as it was called to attract pilgrims—was displayed for public veneration for the first time around 1357. It is possible that Geoffrey's widow, Jeanne de Vergy, was responsible for this decision, perhaps learning about the cloth's existence after her husband's death or even earlier. This theory is supported by the discovery in 1855 of a medal found in the River Seine, likely purchased by pilgrims who attended the early exhibitions (fig. 1).

**FIGURE 1**

Souvenir possibly related to an exhibition of the Shroud found in the River Seine, 1855

The medal shows the Shroud laid out horizontally, featuring two human figures—front and back—flanked by the coats of arms of the Charny family (on the left, with three small shields) and the Vergy family (on the right, with three five-petaled roses). Below, an open tomb is depicted with a cross emerging from it, possibly surrounded by a crown of thorns, with two flags beside it. Above, two priests in liturgical vestments hold up the cloth. This depiction partly confirms the well-known Memorandum of Bishop d'Arcis, which states that the

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exhibitions were held with great solemnity: "with two priests vested in albs, wearing stoles and maniples, showing the greatest reverence, surrounded by burning torches, upon a platform built especially for this purpose." (WILSON, 1979, p. 319) Since its earliest appearances in Lirey, the Shroud prompted different reactions. The figure's visual impact—both recognizable and mysterious—drew intense popular devotion but also raised suspicion among church authorities concerned with maintaining orthodoxy and controlling cult objects. In this context, Henri de Poitiers, after consulting theologians, concluded that the relic was not authentic and banned its display. Although this initial action had little lasting effect, it already showed the tension between faith and authority that would persist around the Shroud for centuries. The dispute peaked decades later. In 1389, Bishop Pierre d'Arcis renewed the fraud accusation, claiming the image was made by an artist whose supposed confession was recorded by his predecessor. D'Arcis sent a detailed document to Antipope Clement VII asking for the immediate removal of the exhibitions. In his letter, he not only questioned the cloth's authenticity but also criticized what he saw as the canons' use of the relic for financial profit.

The papal response took a different approach. In 1390, Clement VII issued a bull that did not fully endorse the accusation: he authorized exhibitions, with the cloth presented not as the true Shroud of Christ but as a "representational image." This conciliatory stance avoided both a total ban on the cult and an escalation of the conflict between the bishop and the canons. This episode marks the first major institutional intervention in the history of the Shroud. It demonstrates that the divide between popular devotion and official skepticism is not a recent development but has accompanied the object since its earliest mention. It also suggests that even under suspicion, the image had enough influence for the Holy See to accept a compromise, implicitly acknowledging the object's spiritual and visual importance. In May 1398, Geoffrey II died in battle in Hungary, and the Shroud remained with the canons of Lirey. However, with the outbreak of the Hundred Years' War, the relic was moved among nobles and churchholders, being transferred to safer locations. Marguerite de Charny, Geoffrey's daughter and later wife of Humbert de Villersexel, received the jewels and relics of the collegiate church,

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including "a cloth on which there was the image or representation of the Shroud of Our Lord Jesus Christ […] kept in a box adorned with the seal of the Charny family" (WILSON, 1979, p. 257). Humbert signed the receipt on July 6, 1418, promising to return all objects once the conflicts were over—especially the Shroud. The relic was taken to Saint-Hippolyte-sur-le-Doubs, the residence of the Counts of la Roche, near Besançon. While Marguerite initially intended to return her inherited items, her stance toward the Shroud changed, especially as the relic began to be displayed during regional religious festivals. This likely led to the creation of various copies—including the well-known **Shroud of Besançon**. After her husband's death in 1438, Marguerite became the sole keeper of the relics. In 1443, the dean of Lirey began legal proceedings to reclaim them. She returned the other items but refused to surrender the Shroud, claiming it was a family possession and part of her grandfather's spoils of war. At the same time, the collegiate church had only served as a custodian (WILSON, 1979, p. 46). Already in her sixties and without heirs, Marguerite sought a noble family strong enough to protect the Shroud. She displayed the relic in Chimay and later at the Château de Germolles, but without success. Finally, on 22 March 1453, she transferred the Shroud to Duke Louis of Savoy, who compensated her with the Castle of Rarambon and the revenues of Miribel. With its transfer to the House of Savoy, a new and important chapter began, marked by greater stability and more regular exhibitions, culminating centuries later in Secondo Pia's photographic reveal. In 1502, Duke Amadeus, son of Louis of Savoy, carried the Shroud in a solemn procession to the ducal chapel in Chambéry, where the Clarissan sisters took charge of it. In 1532, a fire ravaged the Sainte-Chapelle: the silver reliquary partially melted, and molten metal dripped onto the cloth, leaving the marks and patches seen today. On September 14, 1578, the relic was officially moved to Turin, following the relocation of the Savoy capital. From the seventeenth century onward, its public display became less frequent – sixteen times in the seventeenth, nine in the eighteenth, and five in the nineteenth century. Many of these exhibitions coincided with ducal celebrations, such as the wedding festivities that prompted the 1898 exposition, where Secondo Pia photographed the Shroud, bringing it out of the obscurity that had grown during the Enlightenment. This photographic

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breakthrough not only moved the relic beyond its strictly sacred sphere but also placed it within the scientific domain because of its remarkable uniqueness: the photographic plate, which should have shown a negative, instead behaved like a positive, revealing details invisible to the naked eye (BRANDÃO, 2020).

This initial historical phase is crucial not only from a documentary point of view but also because it already reveals the image's role as a contested object – a feature that will continue throughout the Shroud's journey into modern technical and photographic analysis.

## Light and the Shroud from a Philosophical Perspective

### Light, Transformation, and the Tension of Opposites: Heraclitus

Since ancient times, light has been understood not only as a physical phenomenon but also as an ontological and theophanic principle. For example, the Greeks considered φῶς (phōs – light) not only as illuminating the world, objects, and people but also—and in a special way—their thoughts.

Thus, for Heraclitus of Ephesus (c. 535–475 BC), reality is defined by the unity of opposites and by constant change—πάντα ῥεῖ (panta rhei)—with fire as the principle of the cosmos (arché), symbolizing ongoing transformation and the coexistence of opposites in perpetual motion: everything is born, and everything perishes. The conflict and tension between opposites are therefore not merely destructive but fundamental to the universe's harmony, as seen in fragments like: "Road up and road down are one and the same" (COSTA, 2002, p. 204); or "God: day–night, winter–summer, war–peace, satiety–hunger" (COSTA, 2002, p. 200).

We can compare the event that created the image on the Shroud to Heraclitean fire, since both involve a moment of transition, metamorphosis—an instant when matter is transformed by energy and death is crossed by light. The sindonic image could be seen as expressing a fundamental dialectical tension: it is a negative, an absence of light, revealing a presence. However, the light that may have emanated from the body and reached the cloth, creating the image, is also the force that generated this metaphorical specter and made it visible through tonal inversion. Some scientists attribute its formation to a radiant energy event (JACKSON, 1991; FANTI; MORONI, 2002; FANTI, 2010), suggesting a dynamic, transformative process akin to Heraclitean fire, which both consumes and creates. The image on

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the Shroud, therefore, is not static but a record of a potential energetic event that unified and separated positive and negative moments in a fleeting act of intense transformation.

**Light as Emanation and Participation: Plotinus**

Plotinus (c. 204–270 AD), the leading figure of Neoplatonism, describes the One as the ultimate and ineffable principle that surpasses all existence and naming. The One is "beyond being" and is therefore characterized by a transcendent negativity; it is nothing that exists, yet the source of everything. The reality flowing from it through successive hypostases – Intellect, World Soul – becomes more differentiated and less perfect but still participates in its fullness (PLOTINUS, 1998). Matter, at the end of emanation, is the greatest privation of the One, not an absolute negation but a distant reflection of its light.

Plotinus argued that the act of seeing exceeds simple sensory perception: to see is also to partake in the light and in what is seen. In the Enneads, he states that "the eye would never see the sun if it had not first become sun-like" (PLOTINUS I, 6, 9); thus, he establishes that knowledge involves a process of assimilation between subject and object. He repeats this analogy when describing intellectual vision as a mutual illumination, where intellect and the intelligible become "a single light" (PLOTINUS I, V, 3, 8).

This idea captures the essence of Plotinian epistemology, which sees knowledge as a form of unity with the luminous principle of being. In this view, vision is not passive reception but active participation—a luminous communion that dissolves the gap between seer and seen.

This concept is, in a sense, adopted within Christian theology, where Jesus is lux mundi ("the light of the world," Jn 8:12); creation itself, as described in Genesis, begins with the fiat lux ("let there be light," Gn 1:3), an initial act that establishes not only the cosmos and life as we understand them but also the very possibility of visibility.

The image of the Shroud, in this context, can be seen as an emanation or reflection of a transcendent reality, since its *αχειροποίητος* (*acheiropoíetos*—not made by human hands) nature links it to an origin that transcends material and artistic causality. Additionally, as a negative, it represents a form of privation that paradoxically reveals presence. It's as if the absence of human intervention allowed the light of the One to imprint itself directly, free from distortions of matter or technique.


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**Negativity and the Photographic Negative: Hegel**

For Hegel (1770–1831), reality is Spirit itself in the process of self-knowledge, unfolding through an internal dialectical movement. Although the familiar framework of affirmation (thesis), negation (antithesis), and the negation of the negation (synthesis) was not explicitly articulated by him, we can use it here as a rough illustration of the process. In Hegel's view, what truly operates is an immanent negativity through which each determination contains the impulse toward its own overcoming. Negation is not simply absence but an active force that displaces and transforms the forms of Spirit. The so-called "negation of the negation" marks the moment when a limitation is overcome and preserved within a higher determination, driving the progress of truth. The negative, therefore, becomes the essential element through which reality manifests itself (HEGEL, 1986).

The Shroud, as a negative image, can also be interpreted through a Hegelian perspective: it does not merely present an absence of the positive but functions as an active form of revelation. By denying that the Sindon is a painting or engraving, one opens the possibility of examining the image for its unique nature, which results from a process of tonal inversion; the Shroud itself appears as the negation (antithesis) of traditional artistic representation. Science, on its part, aims to negate this negation (synthesis) by establishing a relation between the physical image and the probable event that created it, striving to understand the underlying fact behind this apparent negation of human technique.

**Index, Trace, and Contiguity: Peirce**

With Charles Sanders Peirce (1839–1914), reflection on the nature of the image establishes one of the strongest foundations of modern philosophy of signification. In proposing his triadic theory of the sign – icon, index, and symbol – Peirce develops an ontology of modes of representation that extends beyond the linguistic realm, enabling the image to be understood not only as imitation but also as a semiotic event of the real. A sign, or representamen, is, according to him, something that stands for something else in some aspect or capacity (PEIRCE, 2005). This definition already shows that every sign is relational and processual: it is created in the movement between object, sign, and interpretant.


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In the realm of images, the distinction between icon, index, and symbol is especially significant. The icon maintains a formal resemblance to its object; the symbol depends on cultural conventions and codes; and the index, however, is based on a relation of physical or causal proximity, serving as a mark left by the actual presence of the object and influenced by it (PEIRCE, 2005). The index is primarily a trace of presence, a record of reality that occurs not through representation but through impact, contact, or impression. It is, therefore, the sign that most closely aligns with what we might call the ontological event of the image, as its origin is rooted in the very being of the object that created it. As Dubois notes, drawing on Peirce, "photography is the purest type of indexical sign" (DUBOIS, 1993, p. 48), since it results from the direct action of light on a sensitive surface, without human intervention. From this perspective, the Shroud of Turin can be seen as the pinnacle of this indexical logic; unlike iconic images that depict their object through resemblance, such as paintings or engravings, the image on the Shroud is not the result of *μίμησις* (mimesis – imitation), but of a potential physical and existential relationship between a body and the cloth. Since there are no pigments or brushstrokes on its surface, and no aesthetic intention, we are dealing with a trace of presence left by a body that was there. It is, therefore, an image which, in Peircean terms, is defined by the causal force of presence, not by convention. By marking the passage of the real, the index reveals what is no longer there. In this sense, the Shroud embodies what Peirce would call a sinsign (existential sign), because its existence depends on the actual presence of the body that created it. The image becomes a liminal manifestation between being and non-being, presence and withdrawal. Reflecting on the indexical nature of photography, Barthes would describe it as "that which has been" (BARTHES, 1984, p. 127). This idea finds its most radical form in the Shroud: the image not only points to the past but also embodies the remnant of the event. The Shroud of Turin, therefore, can be seen as the paradigm of the indexical image, for it not only refers to reality but also stands as an epiphany of contact—a conjunction of light, body, and matter that produces an irremovable trace, in which absence becomes presence through the force of the sign itself.

**Unveiling, Clearing, and Event: Heidegger**


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Martin Heidegger (1889–1976) explores the question of being through the concept of *ἀλήθεια* (aletheia – unveiling, unconcealment), suggesting that every disclosure is always partial because it contains a moment of concealment within itself. Being reveals itself while simultaneously withdrawing, creating a continuous interplay between presence and absence; therefore, truth is not merely a property of propositions but the very event in which being allows itself to appear (HEIDEGGER, 2005). Resuming the phenomenological tradition, Heidegger redefines the concept of Being through the idea of Lichtung, which means "clearing." For him, Being is neither substance nor thing but the event of appearing – the open space where beings can manifest. Being "gives itself as Lichtung, that is, as open space where things can appear" (HEIDEGGER, 1977). The clearing is not just a visual metaphor but an ontological condition for manifestation: in it, the entity reveals itself in its own openness. The phenomenon is thus "das Sich-an-ihm-selbst-zeigende" (HEIDEGGER, 1967, p. 28), meaning it shows itself from within itself. Appearing is not created by a subject but is a letting-be of beings in their luminosity. In this view, light stops being only a metaphor for reason and instead signifies the mode of being of being itself: the event where the hidden becomes visible. From this perspective, the Shroud of Turin can be thought of as a Lichtung: the cloth, in its silent materiality, becomes a site of unveiling where the invisible reveals itself. Since the image does not result from any recognizable human intervention, it is not just representation but manifestation; the absence of the body becomes visible presence, and what death concealed reappears as luminous revelation. Among the hypotheses about how the image forms, the idea of luminous radiation makes the metaphor of the clearing even more powerful: it could have been light itself that caused the apparition. More than just a physical phenomenon, we see here an ontological epiphany—the light that reveals the being of Christ at the very moment the body is no longer present. The Shroud thus becomes a phenomenological site of revelation: the event where being manifests itself in the paradoxical form of presence-absence, a Lichtung placed between visible and invisible, between the world and mystery. We might say, then, that the Shroud of Turin realizes, in the realm of faith and image, something similar to what Heidegger envisioned in ontology: it is an event of ἀλήθεια, a

happening of truth as unveiling. In this unique image, being appears not as a tangible object but as a presence that reveals itself. Still, this revelation is always partial: the image also recedes, keeping its formation mysterious. Science tries to explain how it works, but the cloth resists complete understanding, holding onto an element of concealment. This tension—between what is shown and what remains hidden—makes the Shroud an object of ongoing questioning, where truth presents itself in the very process of revealing and concealing.

**Walter Benjamin: Fulguration, Aura, and Authenticity**

Walter Benjamin (1892–1940), in discussing the temporal structure proper to images in "On the Concept of History," writes that "the true image of the past passes by fleetingly. The past can be seized only as an image which flashes up in the instant when it can be recognized" (BENJAMIN, 1987, p. 224). This fulguration indicates that the image is not a static object but an event: it only realizes itself when it traverses the gaze and becomes legible. Certain images – and the Shroud is an exemplary case – do not immediately present themselves; they emerge as visual epiphanies whose meaning depends on a historical, technical, and hermeneutic relation that makes them recognizable. In "The Work of Art in the Age of Its Technological Reproducibility," Benjamin (1991a) explores how modern technology changes aesthetic experience. Technical reproduction, which has roots in practices like woodcut and lithography, significantly alters the status of the artwork because it shifts its "here and now," a concept central to its authenticity: "The here and now of the original constitutes the concept of its authenticity, and on this is founded the idea of a tradition which has transmitted that object as the same, identical thing down to the present day. The whole sphere of authenticity is outside technical – and, of course, not only technical – reproducibility" (BENJAMIN, 1991a, p. 437). This formulation offers a powerful conceptual tool for understanding the Shroud of Turin, even though Benjamin never explicitly mentions it. According to the philosopher's definition, authenticity isn't limited to an object's material integrity; it is rooted in the spatiotemporal continuity that conveys its uniqueness. The Shroud exemplifies this paradox profoundly because it is an image whose significance doesn't come from aesthetic intention or artistic craftsmanship – it is a remnant, an indexical inscription that depends on an originating event

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beyond any logic of production. Here, the Benjaminian tension emerges: although it is one of the most reproduced objects in Christian visual culture – photographed, digitized, modeled – no reproduction erases its "here and now." On the contrary, the proliferation of images amplifies the distance from the original, strengthening its aura. Secondo Pia's photograph in 1898 did not erase the cloth's singularity; it displaced and heightened it, revealing it in an entirely new way. The Shroud, therefore, both affirms and challenges Benjamin's understanding: it affirms it because it preserves an inescapable "here and now," but also challenges it because its reproductions do not destroy the aura; instead, they enhance its desirability and paradoxically make it feel more distant. In this way, the Shroud can be seen as an auratic brilliance: a surviving light that moves between life and death, body and spirit. It is not just mere representation; it is a luminous epiphany – an image that flashes as testimony, whose meaning is renewed each time it is viewed.

**Flesh of the World and Intercorporeity: Merleau-Ponty**

Maurice Merleau-Ponty (1908–1961), in his phenomenology of perception, highlights ambiguity and intercorporeality as fundamental structures of experience. The body is not merely an object among others but serves as the perceptual medium through which the world reveals itself. Perception functions as a weaving process: the observer and the observed intersect, shaping what he terms the chair du monde (flesh of the world) (MERLEAU-PONTY, 2005). In this perspective, positive and negative, presence and absence, figure and ground are not opposites but co-constitutive aspects of appearing. The Shroud aligns with this model as a unique expression of this "flesh of the world": a cloth bearing a bodily event's inscription of its own mode of appearing. As a negative image—yet simultaneously suggesting three-dimensionality—it demands perception beyond ordinary modes of representation. Faint contours, shadows, and tonal inversions invite the observer to participate in generating meaning. Thus, the Shroud is not merely a passive image but a tool of intercorporeality: the gaze finds a trace that calls out, demanding perceptual engagement. When studying how this luminous inscription forms, science seeks to understand how a body could leave such a distinctive mark on the cloth. However, phenomenology demonstrates that this trace is not

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just physical; it reflects the ontological connection between body, cloth, and gaze.

**Roland Barthes: Testimony, Time, and *Punctum***

Roland Barthes (1915–1980), in Camera Lucida, argues that photography is primarily a form of testimony: "that-has-been" (ça a été) (BARTHES, 1984, p. 96). According to him, the technical image captures a presence that no longer exists; it functions as an index of reality—a physical trace of something that once stood in front of the lens. The light hitting the body also exposes the film: there is an ontological link between object and image. Barthes, when describing photography as a "message without a code" (BARTHES, 1977, p. 43), aims to distinguish it from other forms of image-making like painting or engraving, which depend on conventions and stylistic rules. For him, photography is a purely denotative message because it has a direct physical connection to the real world. He also emphasizes that the negative preserves the truth of contact: "What the photograph reproduces to infinity has occurred only once: it mechanically repeats what can never existentially be repeated" (BARTHES, 1984, p. 13). What the eye perceives in the positive image is simply the translation of that initial, unseen contact that happened at the moment of exposure. The Shroud of Turin closely aligns with Barthes' view of photography's core nature—just as film is sensitized by the light reflected from an object, the cloth would have been marked by a luminous or energetic emission from the body inside it. The image is not just a representation but a vestige: the phenomenal record of a presence that has faded. Barthes notes that every photograph acts as a memento mori because what it shows has already passed. With the Shroud, this idea is intensified: it doesn't just show "what has been," but also the trace of a dead body, where the inscription symbolizes the connection between presence and absence. The punctum—that which wounds and touches—finds its deepest meaning in the cloth: the literal and symbolic wound imprinted on the linen urges the viewer to face the irretrievable. Therefore, the Shroud embodies, to a high degree, what Barthes describes as the essence of photography: the image as evidence of an absent presence. It acts as an archetype of a natural photograph, existing before the invention of photographic techniques because, in it, the real directly leaves an impression on the support without artistic mediation or aesthetic intent.

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**Jean-Luc Marion: Saturated Phenomenon and Gift of Presence**

Jean-Luc Marion (1946–) redefines phenomenology by introducing the concept of phénomènes saturés (saturated phenomena): those whose donation exceeds the conceptual capacity of consciousness (MARION, 1997). Saturation occurs when the visible surpasses what can be perceived, when the given presents itself in excess, beyond what the gaze can hold. Unlike ordinary phenomena, which the subject sees and defines, saturated phenomena present themselves as a gift, disrupting the usual intentional structure. It is not the subject who creates the phenomenon; rather, the phenomenon shapes the subject as the receiver.

Marion identifies various modes of saturation: aesthetic, erotic, historical, and revelatory. The latter relates to the manifestation of the sacred, where appearing manifests not only as sensory data but as spiritual presence (MARION, 2010). This is where the possible face of Christ on the Shroud can be understood: an image that surpasses scientific explanation and aesthetic interpretation.

The Shroud resists easy categorization: it is not a work of art because it lacks clear intention and technique; nor is it a purely scientific object, since its formation cannot be fully replicated or measured with current tools. The image thus avoids traditional modes of interpretation; it saturates the gaze because it offers more than can be contained.

In this way, seeing the Shroud is not just perceiving; it is receiving. The image presents itself as a gift, not as an object to be controlled. Its visibility is infused with invisibility; what shows itself points beyond itself, requiring a phenomenological "openness" rather than mere analysis. This presence that reveals itself also resonates with Emmanuel Levinas's idea that the face is always an epiphany and an ethical call.

**Georges Didi-Huberman: Survival, Trace, and *Nachleben***

Georges Didi-Huberman (1953–), in reevaluating the status of the image, demonstrates that it consists of an irreducible tension between presence and absence. The visible is never fully complete; it is always infused with latencies, remnants, and survivals—what Aby Warburg called Nachleben, the afterlife of images (DIDI-HUBERMAN, 2013). Therefore, seeing is never a neutral act: what we see also responds back, creating an asymmetrical exchange between subject and image (DIDI-HUBERMAN, 1998).

In this context, light plays a paradoxical role: it makes things

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visible but also enables what remains latent to be glimpsed. An image is always more than what it shows; each apparition contains a background of survival that returns, persists, and re-emerges (DIDI-HUBERMAN, 2015).

The Shroud of Turin exemplifies this idea. It presents itself to the viewer and simultaneously withdraws; it shows a figure but also safeguards a zone of spectrality; it bears a material inscription and, at the same time, an existence that surpasses its shape. The image is not entirely exhausted by what appears: within it, a trace—a presence—persistently urges, returns, and creates a genuine Nachleben. The face imprinted on the cloth not only appears but also addresses us: it redirects the gaze, inviting an encounter with something beyond itself.

In this process, light functions as a paradoxical force: it reveals and hides, illuminates and fractures, producing not a transparent object but a lacunar image—a visibility that carries within it the weight of the invisible. Therefore, the Shroud demonstrates a surviving presence: a form that endures beyond death and, by surviving, continues to generate meaning.

**Phenomenological and Iconophotological Synthesis of Light in the Shroud**

The Shroud can thus be understood as a *Lichtung*, a clearing where the invisible reveals itself without ever being fully exhausted in its visibility. It is not merely an artifact to be explained but a sign to reflect on, which helps clarify the difficulty in defining it. Its image appears as an icon: it is not only about seeing Christ but also about being, in a sense, seen by Him—in the phenomenological sense of an interpellation that precedes and summons the gaze. This dynamic echoes what Didi-Huberman describes as the paradoxical structure of the image: what reveals itself also withdraws; what we see also looks back at us; every image contains a remainder, an excess, a latent presence that returns. Within this horizon, the Warburgian concept of Nachleben is relevant: the survival of forms, their afterlife, their persistence beyond their original context. The image of the Shroud participates in this idea because what it offers to the gaze does not fully match what survives within it. There is, in the cloth, a permanence that surpasses materiality and manifests as a vestige—a presence that endures through time. Thus, the face of Jesus manifests as a gift of presence,

challenging both scientific objectivity and artistic aesthetics, positioning itself within the realm of revelation—a process combining luminous inscription and formal survival, not merely appearance but also reappearance. Confronted with this image, the observer is prompted to let go of a stance of epistemological control and instead adopt an attitude of listening and receptivity. To see the Shroud is to allow oneself to be influenced by this dual movement: the light that reveals and the form that endures. This fosters a reconciliation between phenomenology and theology—between the visible and the invisible, human and divine, apparition and that which remains latent yet continues to resonate. In this journey, light becomes the guiding thread that connects theology, phenomenology, Warburgian iconology, and photographic technique. In Christian theology, it symbolizes divine presence: Ego sum lux mundi ("I am the light of the world," Jn 8:12). In Heideggerian phenomenology, it is the medium through which being reveals itself: the Lichtung, or clearing where Being appears. In Marion, it manifests as saturation—a phenomenon that surpasses consciousness and presents itself as a gift. In Didi-Huberman, it is what causes the surviving vestige to emerge, making Nachleben visible. In photography, light is the fundamental condition: photós + gráphein, "to draw with light." The Shroud—often regarded by researchers as a form of natural photography—thus becomes a convergence point between sacred icon and technical image, between theophany and luminous impression, between physical relic and symbolic survival. Light, more than just a physical medium, emerges as an ontological and historical principle that links the spiritual and the material, shaping the Nachleben inscribed in the cloth and allowing the Shroud to serve as a crossing point between the visible and invisible—a place where divine presence manifests as a luminous vestige that persists, returns, and endures. From this perspective, each philosophical approach offers a unique view on light and its role in revealing reality, enabling us to see the Shroud of Turin not just as a physical relic but as a phenomenon that articulates presence and absence, visibility and transcendence, inscription and survival. Thus, ontology, phenomenology, and iconology come together in interpreting the Shroud as luminous testimony—surviving relic and indicator of presence. The following is a synthesis of the main philosophical ideas about light,

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emphasizing their core features and possible links to the formation and meaning of the Shroud of Turin. The table aims to highlight this convergence among ontology, phenomenology, and semiology.

**TABELA 1**

| Philosopher | Conception of light | Main characteristics | Relation to the Shroud of Turin | Corresponding iconophotological category |
|---|---|---|---|---|
| **Heraclitus (c. 535–475 BC)** | Light as primordial fire, principle of continuous transformation | Unity of opposites; incessant flux (*panta rhei*); metamorphosis; creative tension | The emission of luminous energy upon body and cloth functions as an event of passage that transforms matter into a vestige; the negative manifests, in a dialectical way, the play between positive and negative | **Transformation**: light as process generating a vestige; image as *íchnos* (trace) resulting from a luminous metamorphosis |
| **Plotinus (c. 204–270 AD)** | Light as emanation of the One, transcendent principle | Transcendent negativity; vision as active participation; knowledge as unification with the luminous | The vision of the Shroud as participation in an originating light; the negative reveals presence without human mediation; the image as non-producible emanation | **Emanation**: luminosity that exceeds materiality and founds a vestige that is not artistic in origin |
| **Hegel (1770–1831)** | Light as dialectical negativity and movement of Spirit | Active negation; overcoming (*Aufhebung*); immanent negativity; truth as process | The negative image operates as a dialectical moment: a negation of traditional artistic representation, surpassed by scientific inquiry; tonal inversion as manifestation of truth | **Negativity**: the negative as an originary form of revelation |
| **Peirce (1839–1914)** | Light as indexical agent linking sign and object | Index; physical/causal contiguity; causal trace; triadic process | The Shroud as a pure index: physical trace of a body; image without aesthetic intention; direct | **Trace (*íchnos*)**: luminous physical inscription; existential sign (*sinsign*) |

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| Philosopher | Conception of light | Main characteristics | Relation to the Shroud of Turin | Corresponding iconophotological category |
|---|---|---|---|---|
| | | sign–object–interpretant | inscription of presence | |
| **Heidegger (1889–1976)** | Light as unveiling (*Lichtung*) | Ontological clearing; interplay of presence and concealment; appearing as letting-be | The Shroud as clearing: the cloth as a site of unveiling where the invisible shows itself; absence of the body converted into visible presence | **Clearing**: lacunar visibility; light as opening of the field of appearing |
| **Walter Benjamin (1892–1940)** | Light as fulguration and aura | Irreversible instant; singularity; historical testimony | The Shroud as auratic image: a unique vestige that "flashes up"; a presence that resists technical reproducibility | **Fulguration**: unique auratic trace; surviving luminous instant |
| **Merleau-Ponty (1908–1961)** | Light as medium of intercorporeal perception | Flesh of the world; intertwining of seer and seen; ambiguity of perception | The Shroud as an expression of intercorporeity: inseparability of negative and positive; image demanding active perceptual engagement | **Flesh of the visible**: intertwining of observer and vestige |
| **Roland Barthes (1915–1980)** | Light (photography) as proof of the real | "That-has-been"; testimony; *punctum*; temporality of loss | The Shroud as natural photograph: presence impressed without mediation; radical testimony of death; *punctum* that wounds the gaze | **Testimony**: impressed presence that attests existence and absence |
| **Jean-Luc Marion (1946–)** | Light as saturated phenomenon | Excess of meaning; donation; intuition surpassing concept; irreducibility to science and aesthetics | The Shroud as saturated phenomenon: exceeds scientific and artistic categories; a presence that imposes itself upon the gaze; visibility traversed by invisibility | **Saturation**: image as excessive gift that surpasses the gaze |
| **Georges Didi-Huberman (1953–)** | Light as ambiguous operation of the visible: | Tension between presence and absence; fissure; remainder; | The Shroud as lacunar visibility: an image that returns, survives, and interpellates; | **Survival (*Nachleben*)**: trace that insists and returns; image that sees the observer |

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| Philosopher | Conception of light | Main characteristics | Relation to the Shroud of Turin | Corresponding iconophotological category |
|---|---|---|---|---|
| | what reveals also conceals | survival (*Nachleben*) | spectral vestige that looks back at the observer | |

Main Philosophical Conceptions of Light and Their Relation to the Shroud of Turin
SOURCE: Jack Brandão/2025

**Negative and Positive: An Ontological Dialectic**

The invention of photography in the mid-19th century introduced a new way of seeing and, above all, believing in visibility, because our gaze began to depend on light not just as a medium but as proof of reality itself. The photographic image seemed to hold, at the moment of its creation, the very truth of the real, as if light performed the miracle of turning the fleeting into permanence. As Barthes notes, "photography always carries its referent with it" (BARTHES, 1984, p. 15); that is, it not only depicts the referent but also illuminates it, as though reality agrees to leave its own mark on the image. More than that, the photographic process involves a dialectic between negative and positive that, from a simple technical process, becomes an ontological metaphor. If the negative—shadow, absence, tonal inversion—keeps the invisible, and the positive—clarity, revelation, presence—reveals what was hidden, such an inversion of light resonates significantly with the Christian mystical tradition. When Pseudo-Dionysius the Areopagite, in the Mystical Theology, describes the soul's ascent to the divine, he states that true light shines "in the heart of the darkest obscurity," for excessive brightness appears as darkness to the human eye (PSEUDO-DIONYSIUS, 2004, p. 129). This suggests that while light reveals, it can also blind; hence, the paradox where its brilliance becomes darkness to those unprepared to see. This highlights the importance of images, because through them we can see within such darkness. That is why St. John Damascene said that "the attributes of God, since the creation of the world, become visible through images" (DAMASCENE apud BRANDÃO, 2023, p. 601). Scripture, he points out, never presents the invisible directly but "vests it in flesh," providing believers with a visible way to understand what, by nature, cannot be seen. Therefore, visibility is always part of a spiritual economy: a passage between darkness and clarity. It is precisely this kind of inversion—where excess light appears as shadow—that sets the stage for understanding the photographic negative, which is also paradoxical: what seems like obscurity is often the accumulated testimony of light that the eye is not yet able to discern.

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**The Photographic Dialectic: Light, Inversion, and Latency**

The photographic negative captures this ambiguity: light records reality on a sensitive surface, but the first result of this interaction is a reversal. In this tonal mirror, brightness becomes darkness, and shadows are lit. The negative is not just an intermediary between the real and its image; it is the foundation where the visible remains in a latent state, waiting for a new burst of light to transform into its positive form. In this way, if light is the fundamental principle of the image, the negative embodies its inherent paradox. In the photographic process, the negative is the inverted support, a mirror of reality that holds the world in its opposite form. As Xavier, recalling Bazin, notes, photography is objective not because it copies the real, but because the object itself leaves its imprint on the film through natural laws (XAVIER, 2005). The negative is not merely a simple intermediary; it records the luminous impact directly—an inverted presence, the trace of the light event that occurred, the base from which the positive will emerge. This inversion also carries a deeper symbolic meaning. It signifies the realm of the invisible, of potentiality; the positive, on the other hand, is the realm of manifestation and evidence. Between them, light functions as a mediator, revealing what was previously hidden when it strikes the paper. Philippe Dubois expands this idea by stating that photography is a physical trace left by light—an index, in Peirce's sense, of something that was there (DUBOIS, 2006). The negative thus preserves the original mark: everything the positive later reveals is just a development of this initial imprint, this luminous contact that forms the foundation of the image itself.

**The Shroud as Indexical Image and Luminous Matrix**

In this sense, the Shroud of Turin can be seen as the peak of indexical logic. Unlike iconic images, which are products of mimesis, the sindonic image does not come from pigments or brushwork but from a possible physical connection between the body and the cloth. There is, therefore, an ontological contiguity: a body was present, and it left a trace that surpasses technique and artistic intention. Consequently, the Shroud is more than just a representation; it becomes a revelation of what was hidden beneath darkness but has become visible, similar to photography—its modern counterpart. This idea suggests that the negative contains a luminous mystery in potential, as the photographic process has always carried this tension from the start. Although they belong to different realms—one theological, the other photographic—both reveal the hidden: photography by turning the invisible into the visible through the negative; mystical tradition by demonstrating that all intense light initially

appears as darkness. This is especially clear in the negative–positive process, which best exemplifies this ambiguity, as the phenomenon can both reveal and hide, illuminate and obscure.

Researchers like Jackson and Jumper (1982, 1984) have proposed that the image formation on the Shroud might have been caused by an emission of radiant energy (the "radiant energy hypothesis"), suggesting a direct photonic inscription on the cloth—completely different from medieval painting techniques. Within this indexical framework, the Shroud extends beyond merely being a relic to become a photonic manifestation, where light not only reveals an absent body but also transforms it into evidence of an indexical and ontological presence. It functions as a radical index of presence—a trace of a liminal event between death and life—where the body disappears, yet its image, illuminated by light, endures as a vestige.

It therefore becomes an absolute negative: an image that does not merely depict but manifests itself; that does not just translate but radiates; that cannot be fully explained by human means but testifies to the transition from visible to invisible through light—making it indexical. Yet the Shroud surpasses the photographic index because in photography, full meaning only appears through chemical processing; in the Shroud, the negative already contains the essence of the positive. Science aims to uncover its mechanisms, but the cloth holds a core of mystery, as if presence is conveyed through its very absence.

**Revelation, Absence, and the Theology of the Negative**

When Secondo Pia photographed the cloth and saw, emerging in the photographic negative, a clear and distinct face, he realized that the linen itself acted as a sensitive plate. The technical breakthrough thus became symbolic, as if the negative of the human presence there revealed the positive of the divine being—faint and almost invisible to our eyes—echoing a central principle of Christian theology: revelation through absence.

In Christianity, the cross, the empty tomb, and the abandoned Shroud are all negative signs pointing toward another presence—that is, toward what is unseen yet forms the basis of belief. Ideas from Pseudo-Dionysius the Areopagite, later adopted by Hans Urs von Balthasar, affirm that glory manifests itself in kenosis, splendor in shadow, light in night (VON BALTHASAR, 1961).

In this way, photography and the Shroud share a similar structure of revelation: the real reveals itself only through the negative, using light as a catalyst. The technique merely reproduces, on a material level, what Christian

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mystery had already expressed theologically: the transformation of absence into presence. In this sense, the negative is not deprivation but potential— the invisible in a state of latency, awaiting revelation.

By presenting a negative before the positive, the photographic process established a regime of inversion that is more symbolic and philosophical than technical. Therefore, Barthes describes photography as the "that-has-been" (ça-a-été) (BARTHES, 1984, p. 115), the trace of an irretrievable moment whose truth lies in a past persisting through absence. It is, then, in the negative that this absence becomes materialized, as it is there that the real transforms into a specter—where the photographic act, as a ritual of death, ensures the permanence of appearance, testifying that something was once present but no longer is (DUBOIS, 2006).

In the Shroud, this same logic appears even before photography was invented; what Secondo Pia revealed suddenly became a form of presence:

> After nineteen centuries, he was the first man able to contemplate the face of Jesus, who, despite His mortal sleep, still conveyed serenity and majesty... From that day, May 28, 1898, that linen shroud would never again be seen as merely a superstitious object created, according to some, to deceive simple and ignorant people... Historians, archaeologists, physicians, biologists, physicists, chemists, art critics, exegetes; skeptics and believers... all sought, throughout the new century about to begin, to uncover its origins, understand its creation, expose any fraud, demystify its divine aura, and confirm its authenticity. (BRANDÃO, 2020, pp. 30–31)

**Photography, Detail, and Revelation**

The fact that photography reveals details is, as we've seen, almost inherent to its nature, as many theorists have pointed out. Since its inception, it has been "accused of omitting nothing, of sacrificing nothing [...], free to choose what suits it and reject what does not" (ROUILLÉ, 2009, p. 41). Brassaï, for example, observed that "Proust was convinced of the valuable contribution of photography in revealing an architectural detail diluted within the whole or too distant from the ground to be easily seen by the naked eye." (BRASSAÏ, 2005, p. 47) Benjamin likewise affirmed that photography "inaugurates [...] imagistic worlds hidden within the small detail, sufficiently meaningful and concealed to find refuge in states of reverie, but now become large and meaningful." (BENJAMIN, 1991c, p. 222) Following this, Sontag wrote that "everything the camera records is a disclosure—whether it be something imperceptible, fleeting fragments of movement, or an order of things that natural vision is incapable of perceiving [...]" (SONTAG, 2004, p. 137). The Shroud, like photography, omits nothing—on

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the contrary, it exposes. There is no modesty in revealing what no medieval image would dare show, except perhaps in private collections, yet never with the detailed anatomical precision present there. In the Shroud's negative image, new evidence, new nuances, and new forms emerge far beyond what would be expected from a simple artistic work—especially in a period characterized by a collective worldview such as the medieval one, with its rigid, pre-set models. At this point, it becomes impossible to ignore the anachronism in specific modern interpretations, such as Moraes (2024), who claims that medieval artists could have made an image like the Shroud using mimetic conventions, bodily modeling, or planar techniques. Such a view completely overlooks the iconographic rigidity of the period: hieratic frontality, symbolic symmetry, erasure of traumas, lack of tonal variation, and indifference to realistic anatomy. The medieval image of Christ was not based on the body but on theophany; it aimed not at gesture but at dogma; it originated not from light but from Scripture. The Shroud contradicts all of this: it shows the absence of contours, smooth gradations, bodily asymmetries, and unmistakable traces of trauma. Its structure of densities doesn't match projected shadow or mechanical contact; it's a luminous inscription that crosses isolated fibers. For this reason, as Vignon already warned in 1902, no painter in the Middle Ages could have created such a perfect image, much less any sort of pictorial negative (VIGNON, 2002). The very idea of a "negative," as he notes, is a modern concept:

> The very term "negative" has had meaning only since the discovery of photography. Men of the fourteenth century had no reason to suspect the possibility of inversions of lights and shadows produced by the action of light on a sensitive plate; but was not all this knowledge indispensable before anyone could conceive of inverting, upon a piece of cloth, the normal position of lights and shadows? (VIGNON, 2002, p. 114)

Thus, it becomes clear that the very concept of inverting lights and shadows—the basis of what we now call a negative—was entirely absent for people in the fourteenth century. Such a process only became understandable with the development of photosensitive methods in the nineteenth century, when light began to be seen not just as illumination but as an agent capable of creating tonal inversions and latent inscriptions. Any attempt to interpret the Shroud using medieval techniques therefore ignores the fact that the technical and conceptual framework needed to conceive of a "negative" simply did not exist in the fourteenth century—there was no idea whatsoever of tonal inversion or luminous inscription comparable to modern photography.

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One must remember that in the early days of nineteenth-century photography, Fox Talbot realized that to capture the world on a support like a sheet of paper, it had to be coated with light-sensitive materials; light would then react chemically to form a latent image. However, the result still would not be a fixed image of reality because the image appeared inverted—as was known from the camera obscura—and the light gradation was also reversed relative to the original: the more intense the light, the darker the image, and vice versa. Talbot was the first to call this initial image a "negative." Additionally, from this pre-image, one could produce endless copies by performing the inverse process: passing light through the negative onto another light-sensitive sheet, thus correcting the previous inversions and creating what eventually became known as the positive.

This negative–positive consciousness is therefore a product of the nineteenth century, of industrial society, of expanding cities, of monetary economy, and of the transformation of space and communication time. "All this, combined with its mechanical character, made photography [...] the image of industrial society, the one most suited to documenting it." (ROUILLÉ, 2009, p. 16) Everything that had prevailed in art and the world of images for centuries faltered before the new paradigm introduced by photography, when the artist's hand was replaced by the machine (ROUILLÉ, 2009, p. 59) and transcendence by immanence. Such a shift did not happen without resistance, as seen in the case of Baudelaire.

**The Nature of the Photographic Image: From Negative to Pixel**

If the image on the Shroud of Turin can, in some way, be compared to a photographic negative—that is, to the analog paradigm of photography—could it also be compared to its digital counterpart? Or, more broadly, is there any link between the Shroud and both systems? It's important to note that the difference between analog and digital photography goes beyond technological progress; it involves a fundamental paradigmatic and ontological shift in how reality is captured, recorded, and transformed into an image. What's at stake is the specific relationship among light, equipment, and support—namely, between the presence of the real, its visual representation, and the process that mediates this. In analog photography, image recording occurs through a chemical process: the photographic film is coated with a light-sensitive emulsion, usually made of silver halide crystals (such as silver bromide, chloride, or iodide) suspended in a layer of gelatin. When light hits the film, photons interact with these crystals, reducing some of the ionic silver ($Ag^+$) to metallic silver ($Ag^0$), a reaction that directly correlates with the light's intensity (ROGERS, 2007). The initial result

is a latent image, invisible to the naked eye, which becomes visible only after chemical development, when reducing agents (like metol or hydroquinone) amplify this reaction, selectively transforming the exposed silver salts into opaque metallic silver. The final product is the photographic negative, in which the brightest areas of the scene appear dark and the shadows are light—an inversion later reversed on photographic paper. This negative acts as the clearest indicator of the real in the Peircean sense: there is physical contiguity between the referent and the trace, since it is the light reflected from the body or object that strikes the film, producing a material change. For this reason, Barthes notes that photography is always "a certificate of presence" (BARTHES, 1984, p. 129): something that departs from the referent and literally reaches the support. Physically, then, the negative is a continuous analog matrix where each point of the image corresponds to a real, continuous variation of luminous intensity: there is no discretization but rather a smooth modulation of light on the photosensitive material, since the silver grain—the minimal unit of the image—has a physical and probabilistic, not digital, nature. With digital photography, this direct relation between light and matter is replaced by an electronic and numerical translation, as light no longer imprints a physical trace on the support but is converted into electrical information and, subsequently, into binary data. The electronic sensor of a digital camera—either CCD (Charge-Coupled Device) or CMOS (Complementary Metal–Oxide–Semiconductor)—comprises a two-dimensional matrix of photodiodes, each corresponding to a pixel. When a photon strikes a photodiode, it generates electron–hole pairs within the semiconductor material (generally silicon), in quantities proportional to the received luminous energy. This charge is then converted into an electrical signal, amplified, and quantized by an analog-to-digital converter (A/D), which assigns numerical values to each intensity of captured light (HOLST; LOMHEIM, 2011).

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**TABELA 2**[1]

| Technical & Symbolic Aspect | Photographic Film (Analog) | CCD Sensor | CMOS Sensor |
|---|---|---|---|
| **Operating principle** | Light sensitizes silver-halide crystals, producing an irreversible photochemical reaction proportional to luminous intensity. | Light generates electric charges in each pixel, transferred sequentially to a single A/D converter. | Each pixel converts light into charge and performs local A/D conversion, allowing parallel readout. |
| **Nature of luminous inscription** | Chemical: direct reaction between light and matter, fixing the physical trace of light. | Electrical: light is converted into charge, maintaining a certain physical continuity. | Digital: light is converted into numerical information – an abstraction of luminous presence. |
| **Temporality of capture** | Continuous in perception, physically discretized in the grain; each exposure is unique. | Sequential transfer of charges, preserving processual temporality. | Almost instantaneous: parallel readout reduces perceptible temporal delay. |
| **Noise and granularity** | Photographic grain: aesthetic element of light's materiality. | Low noise; smooth, homogeneous image. | Variable electronic noise; more artificial texture, compensated digitally. |
| **Dynamic range** | High, depending on film type. | High, balanced tonal gradation. | Initially lower; now comparable with dual-gain and HDR technologies. |
| **Signal-to-noise ratio (SNR)** | Naturally high; grain is part of the physical structure. | High, with low read noise. | Variable; depends on architecture and internal processing. |
| **Energy consumption** | None (chemical process). | High (sequential transfer). | Low (local processing). |

[1] A tabela busca diferenciar a continuidade e a ruptura do regime técnico da imagem. No filme, a luz toca a matéria: trata-se de um ato físico-indicial que deixa um vestígio direto da presença luminosa; o negativo funciona como superfície sensível na qual o real se inscreve. No CCD, a luz percorre o sensor e é convertida em carga elétrica, preservando certa continuidade processual entre luz e registro, uma transferência de informação luminosa em forma energética. Já no CMOS, a luz é quantizada: cada pixel realiza a leitura local e a imagem resultante é reconstruída computacionalmente, sinalizando a predominância da visibilidade informacional, na qual o real se apresenta como dado processável, não mais como contato físico. Essa transição implica uma mudança ontológica da imagem: no filme preserva-se o gesto da luz, no CCD conserva-se seu fluxo transformado em energia, e no CMOS obtém-se sua tradução numérica. Em cada um desses processos revela-se uma etapa da metamorfose da luz em linguagem.

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| | | | |
|---|---|---|---|
| **Readout speed** | Limited by exposure and film advance. | Slow (serial readout). | Fast (parallel immediate readout). |
| **Chromatic reproduction** | Organic, dependent on film chemistry and ambient light. | Natural, smooth, approximates analog. | Intense, precise, dependent on demosaicing algorithms. |
| **Durability / stability** | Limited; susceptible to chemical degradation. | High; stable digital data. | High, but dependent on long-term format legibility. |
| **Relation with light** | Light reacts chemically with matter – leaving a direct, material trace. | Light accumulates as electrical charge – an energetic physical presence. | Light is translated into code – an informational presence. |
| **Resulting aesthetics** | Living texture, aura, unpredictability of grain. | Smoothness and continuous tonal density. | Sharpness, contrast, digital cleanliness. |
| **Symbolic analogies** | Inscription / trace; light touches and engraves. | Transmission / flow; light travels and orders. | Calculation / data; light is processed and quantified. |
| **Technical & Symbolic Aspect** | **Photographic Film (Analog)** | **CCD Sensor** | **CMOS Sensor** |
| **Operating principle** | Light sensitizes silver-halide crystals, producing an irreversible photochemical reaction proportional to luminous intensity. | Light generates electric charges in each pixel, transferred sequentially to a single A/D converter. | Each pixel converts light into charge and performs local A/D conversion, allowing parallel readout. |

Technical and symbolic comparison between analog and digital systems
SOURCE: Jack Brandão / 2025

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In a Bayer-matrix digital sensor, each photosite captures only one color component (red, green, or blue); full color information is reconstructed through algorithmic interpolation (demosaicing). The resulting digital image is a matrix of discrete values, with each point representing a quantified fragment of light. This discretization causes an ontological break: the image no longer exists as a physical trace but transforms into mathematical code. While the negative still maintains a causal connection to the real world, the digital file now exists within a regime of simulation, where the image is no longer an imprint of reality but its algorithmic reconstruction.

Therefore, from a physical perspective, the key difference between analog recording—through material transformation—and digital recording—via transduction and quantization—is fundamental. Scientifically, this difference leads to measurable effects: dynamic range, innate noise (grain versus electronic noise), behavior under compression or editing, and resolution limits (optical versus sampling).

From an iconophotological perspective, however, what matters is not just the technical process, but the type of bond each system forms with reality. In the analog system, the negative serves as a true index: there is causal and material contiguity between the referent and its inscription, even when modifications occur (development, reticulation); the physical link remains intact. The negative then becomes a testimony: the image inscribed on it is a trace that can be measured, since the silver grain has statistical and physical properties (distribution, size, texturization) that can be analyzed through microscopy and densitometry.

In contrast, in the digital system, the relationship with the referent shifts from being indexical to processual: what we see is not simply the inscription of light but its algorithmic reinterpretation, as the connection between referent and image passes through multiple operations (phenomenon → electron → number) and through algorithmic filters (white-balance, Bayer interpolation, compression). The pixel is thus an intermediate representation of the phenomenon, not a direct luminous trace on matter. Its texture is constructed, not inscribed.

Digital images involve decisions that are completely non-human (demosaicing, denoising, sharpening), performed automatically, which leads to two implications: a) delegated authority – firmware or software settings can significantly change the actual look of an image without leaving visible signs; b) verifiability of manipulation – it requires access to the RAW file and its processing history; without this, the image loses part of its value as evidence.

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**TABELA 3**

| Technical Parameter | Analog Photography (film) | Digital Photography (sensor) | Iconophotological Analysis |
|---|---|---|---|
| **Physical principle** | Photochemical reaction of silver-halide crystals to incident light. | Photoelectric conversion of light into electrical charge and subsequent binary encoding. | In the analog process, light acts directly upon matter, leaving a physical trace (index). In the digital process, light is transduced into information, losing direct contiguity with the real. |
| **Elementary unit** | Silver grain (material, irregular, continuous). | Pixel (abstract, discrete, numerical). | The grain is corporeal and unpredictable, resulting in singularity; the pixel is quantified, regular, and tends toward image homogenization. |
| **Resolution** | Depends on film granularity (approx. 10–20 million grains per cm², equivalent to ~80–100 MP). | Defined by pixel density of the sensor (12–100 MP, depending on the model). | Analog resolution is organic and continuous; digital resolution is finite and modular, imposing geometric limits upon the visible. |
| **Dynamic range** | High (up to 14 EV in professional films). | Variable according to the sensor; average between 12 and 15 EV in modern sensors. | Both negotiate the tension between light and shadow, but digital systems compress and algorithmize light, mediating the luminous experience. |
| **SNR (signal-to-noise ratio)** | Noise governed by grain and optical density; tends to increase in underexposure. | Electronic noise (thermal and read noise) increases with high ISO and low light. | Analog noise is part of the material texture of the image; digital noise is an algorithmic defect, not a sign of the real. |
| **Spectral behavior** | Sensitivity varies according to emulsion (orthochromatic, panchromatic, infrared). | Fixed filtering by Bayer matrix (RGB) or Foveon; uniform and standardized spectral response. | Analog film captures singular nuances of light; digital sensors translate light within a standardized chromatic system, culturally codified. |
| **Tonal depth (bit depth)** | Theoretically infinite, limited only by the optical density of the negative. | 8 to 16 bits per channel (256 to 65,536 color levels). | In the negative, light displays continuous gradations; in the pixel, light is quantized and |

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| Technical Parameter | Analog Photography (film) | Digital Photography (sensor) | Iconophotological Analysis |
|---|---|---|---|
| | | | fractioned – light is calculated, not embodied. |
| **Indexicality** | Physical contiguity: light touched the support. | Mediated encoding: light is interpreted by the sensor. | Analog photography is a direct luminous index; digital photography is an indexical simulacrum – an image that has lost the touch of light. |
| **Preservation and degradation** | Susceptible to oxidation, fungus, and chemical aging; degradation is physically visible. | Susceptible to technological obsolescence and data loss; degradation is invisible (bit rot). | The negative carries time in its material body; the digital file loses time, for it is eternally rewritable, without physical history. |

Technical-scientific comparison between analog and digital photography from an iconophotological standpoint
SOURCE: Jack Brandão / 2025

**Comparative technical-scientific analysis between analog and digital photography from an iconophotological perspective**

From an iconophotological perspective, Table 3 shows that analog photography embodies an ontological regime of presence, where light, when it inscribes itself onto the medium, creates an embodied image. Digital photography, however, functions within a regime of absence, as light is converted into data – that is, phōs becomes lógos (information). In this manner, the pixel acts as a symbolic unit of light rather than its direct inscription.

It becomes evident that, in digital photography, light no longer reveals the real but instead simulates it. The index yields to code, and the physical body of the image dissolves into algorithmic logic. Consequently, the focus of luminous expression shifts from physical presence to informational reconstruction, marking the transition from the sphere of phainómenon (what appears) to that of sýnthesis (what is artificially created).

Accordingly, both negative (analog photography) and pixel (digital photography) represent two distinct ways of understanding phōs:

a) In the analog system, light acts directly on matter, leaving a physical mark – a luminous wound, as Barthes (1984) would say;

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b) In the digital system, light is transformed into electrical energy and then converted into numbers, losing its physicality and acquiring an informational nature.

The silver grain is continuous and random, influenced by the entropy of light; the pixel is discrete, regular, quantized, normalized, and adjusted through interpolation and compression algorithms. From a phenomenological perspective, Marion (1997) suggests that, in the negative, there is a saturated presence – light presents and imprints itself, going beyond mere representation; whereas, in the digital file, presence is reduced to numerical data, mediated by symbolic systems.

Therefore, the digital image, by breaking its direct connection to the real world, initiates a post-photographic universe where the photographer no longer reveals presence but instead programs visuality.

From a scientific point of view, analog and digital photography differ in three key aspects:

1. Physical nature of recording:

a) analog: photochemical reaction between photons and silver halides;

b) digital: electronic conversion of photons into signals and then into binary data.

2. Nature of information:

a) analog: continuous, depending on optical density and grain variability;

b) digital: discrete, quantized, and prone to information loss (quantization noise).

3. Type of mediation:

a) analog: direct and causal contiguity;

b) digital: algorithmic and symbolic mediation.

These differences carry ontological implications for the photographic image: the negative is a trace; the pixel, a representation. The former is an index; the latter, a symbol. Thus, the shift from negative to pixel signifies the move from an image of presence to an image of information.

Analog and digital photography are not just technically different but also embody two distinct ways of understanding the relationship between the visible and the real. In the analog image, light literally imprints on matter; in the digital image, it is translated into code. While the negative remains a physical record of light — an index of an event — the pixel is a mathematical reconstruction of that event, a representation without physical contact. This difference redefines both the status of the gaze and the nature of the image:

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previously, we observed the trace of the world; now, we interpret its electronic form.

**Application to the Shroud of Turin**

Applying the analytical categories established in Table 3 to the Shroud of Turin—distinguishing the analog regime based on luminous-material indexicality from the digital regime founded on numerical-informational representation—enables us to propose two separate levels of analysis:

a) Material reading

This involves direct observation of the cloth, its fibrils, and stratigraphy, as meticulously performed by STURP in 1978. At this level, iconophotology restores the most immediate indicator: the Shroud is seen as the physical evidence of an event, where the materiality of the linen itself bears the trace of a bodily presence. There is no mediating representation—only contact, transfer, and material inscription.

b) Imagetic reading

This relates to indirect access through historical and contemporary photographs. Analog images preserve grain, density, and chemical attributes that reflect how light interacts with photographic film; digital images offer an expanded dynamic range and multispectral analysis but, due to their discretizing nature, involve layers of algorithmic interpretation. At this level, the observer no longer perceives the Shroud itself but its technical transcodification: initially photochemical, then photoelectronic, and ultimately digital.

Therefore, integrating both modes is essential for iconophotological research: using digital photography for spectral analyses and analog photography to verify continuity and materiality. This combined approach provides a more comprehensive understanding of the main features of the Shroud of Turin.

**Photographic Enlargement (Analog and Digital) and the Sindonic Image**

The analysis of how analog and digital images behave when enlarged reveals key differences in their physical makeup and how they represent information.

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These differences go beyond technical factors and also involve ontological and phenomenological aspects, especially when viewed through an iconophotological lens that sees the image as a site where light inscribes and manifests the real within a specific spatial and temporal context.

In the case of analog photography (figs. 2–3), made from photosensitive film, enlarging the image means enlarging the grain of the emulsion—that is, the silver-halide crystals that record light. When enlarged, the observer does not see discrete units; instead, the grain appears as a continuous, textured surface caused by the physical spreading of these crystals across the film. Despite increased graininess, tonal transitions remain smooth, creating a natural, gradual loss of detail without abrupt breaks in the image. The quality of enlargement depends on the film's sensitivity and development process: lower-ISO films (like ISO 50 or 100) allow large enlargements without losing detail, while higher-ISO emulsions produce more noticeable grain.

Conversely, in digital photography (fig. 4), the image consists of pixels—discrete numerical units that store color and brightness information. Each pixel maps to a specific point in a fixed grid (for example, 4000 × 3000 pixels). When the image is enlarged beyond its resolution limit, pixels become visible as small colored squares, replacing the smooth tonal transitions seen in chemical film. Excessive zooming results in pixelation, characterized by jagged edges and a loss of smoothness. Unlike photographic grain, a pixel has no physical variation; it contains only discrete numerical data that software can interpolate to create a semblance of continuity without adding actual information.

In essence, extreme digital enlargement exposes the pixel grid, while enlarging a photographic film—or, by analogy, the Shroud—reveals a continuous material texture rooted in physical units (grain, fibril) that connect to the luminous or material event that produced them.

Thus, the following comparison can be made:

**TABLE 4**

| Type of Photography | Minimal Unit | What Appears Under Enlargement | Nature of the Image |
|---|---|---|---|
| **Analog** | Silver-halide crystals | Grain (organic texture) | Continuous |
| **Digital** | Pixel (numerical value) | Colored squares (pixelation) | Discrete |

Behavior of analog and digital images under enlargement
SOURCE: Jack Brandão, 2025

**FIGURE 2**

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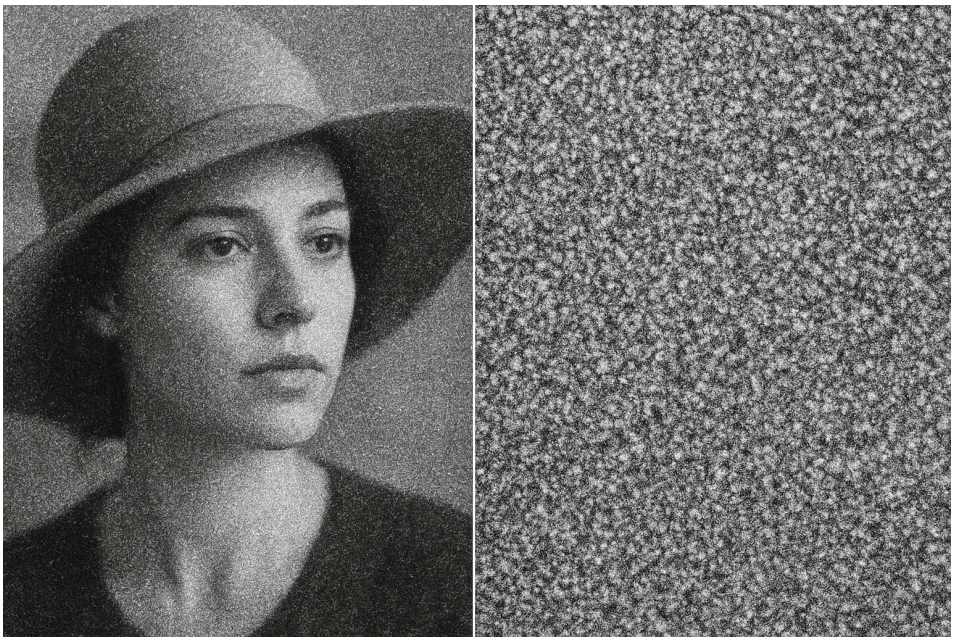

*Comparison of enlargements in analog photography.*
Left: portrait obtained on film with visible grain. Right: enlarged detail of the photosensitive emulsion, revealing the structure of silver-halide crystals responsible for image formation.

**FIGURE 3**

Comparison between a sharp analog photograph (left) and the same image enlarged (right), showing grain resulting from the silver crystals that make up the photographic film.

**FIGURE 4**

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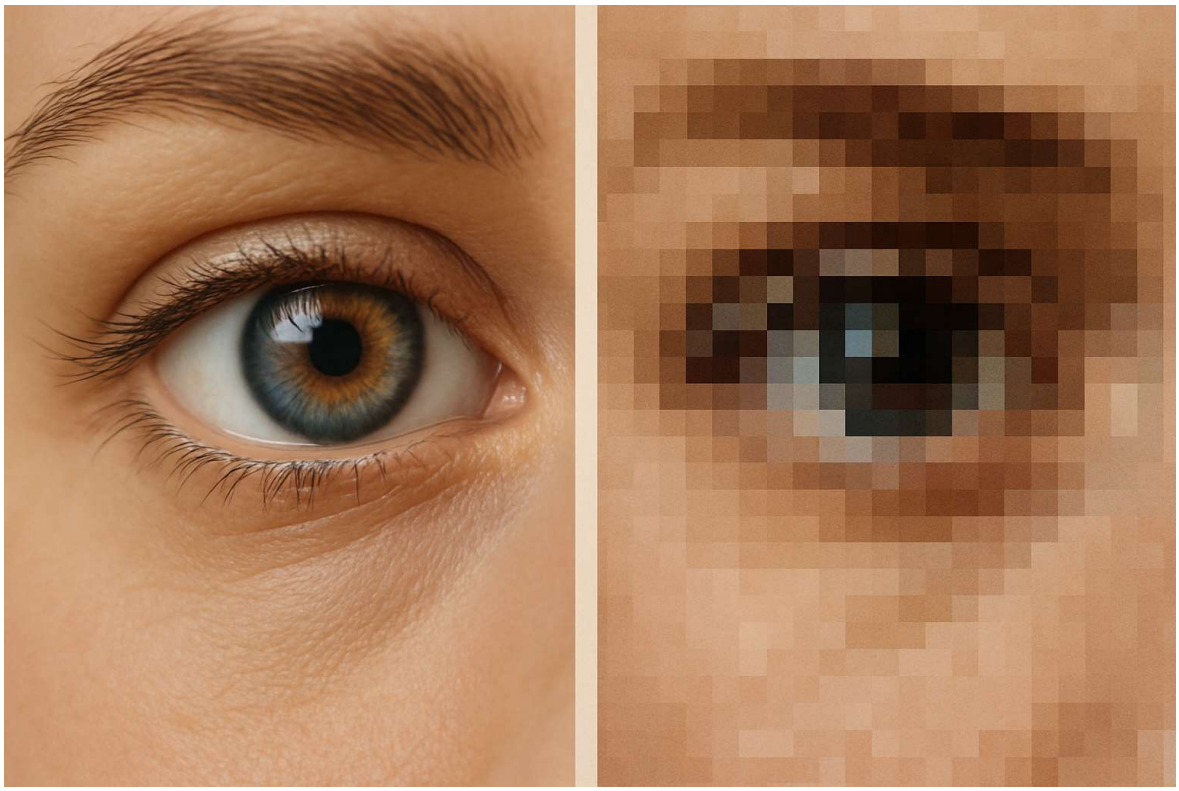

Comparison between a sharp digital image (left) and the same image enlarged (right), revealing the pixel structure that composes the digital photograph. The enlargement makes evident the discretization of light

The microscopic photographs of the Shroud of Turin taken by Mark Evans (figs. 6/7) reveal, with remarkable precision, the structural complexity of its physical support. At 32× and 64× magnification, one can clearly observe the linen threads woven in a herringbone pattern, formed by individual fibrils whose ridges—measuring on the order of tens of micrometers—correspond to the minimal units effectively altered in the image-forming process. These fibrils exhibit extremely subtle and discontinuous superficial oxidation, restricted to the outer layers of the filament, with no penetration in depth and without any trace of pigment, dye, or material deposit that might suggest manual intervention—corroborating the conclusions of the 1978 STURP investigation.

From an iconophotological standpoint, the isolated fibril plays, in relation to the body, a function analogous to that of the silver grain in relation to the photographic negative: in both cases, presence is inscribed in minimal material units which, when viewed together, produce macroscopic tonal continuity.

**FIGURE 5**

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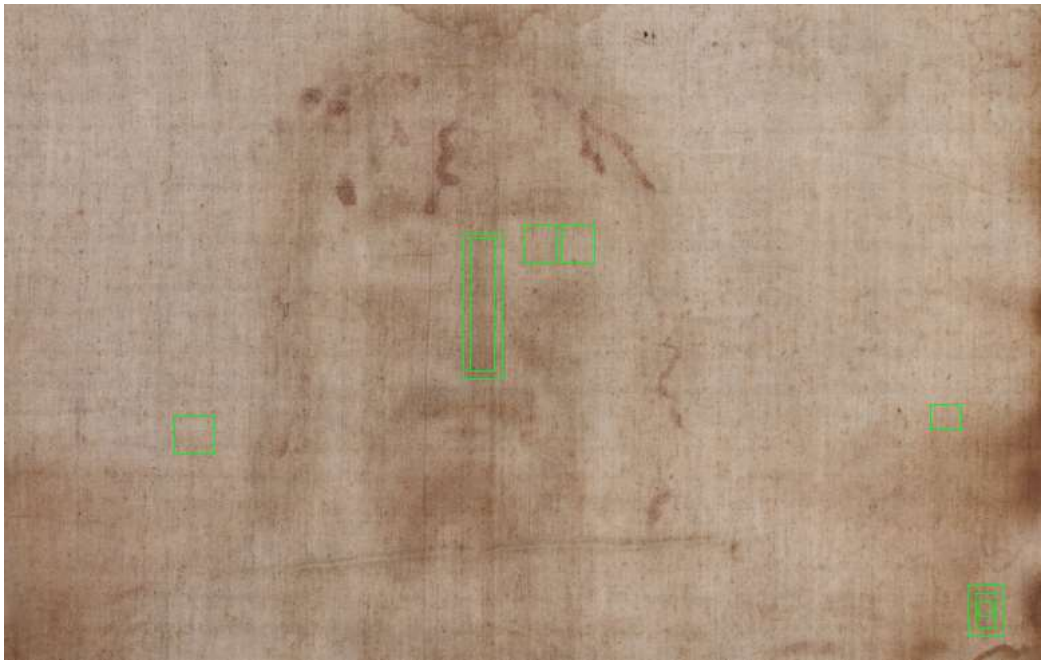

Image of the face on the Shroud of Turin, highlighting the nose region from which the following microphotographs were taken, Photo by Durante, 2002
SOURCE: https://www.sindonology.org/photomicrographs.shtml

**FIGURE 6**

Microphotograph ME-14 of the nose, 32× magnification, Photo by Mark Evans, 1978
SOURCE: https://www.sindonology.org/photomicrographs.shtml

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**FIGURE 7**

Microphotograph ME-29 of the nose, 64× magnification, Photo by Mark Evans, 1978
SOURCE: https://www.sindonology.org/photomicrographs.shtml

When we contrast these microstructures with the macroscopic visualization of the region (fig. 5), the emergent character of the phenomenon becomes evident: what, under the microscope, appears as localized and discontinuous alterations in isolated fibrils, at the perceptual level integrates into continuous tonal gradients, forming the characteristic photographic negative of the Shroud. From an iconophotological standpoint, the isolated fibril performs, in relation to the body, a function analogous to that of the silver grain in relation to the photographic negative: in both cases, presence is inscribed in minimal material units which, when aggregated, produce the tonal continuity of the visible.

This mismatch between structural micro-selectivity and macro-tonal continuity constitutes a unique feature among all known images and reinforces the hypothesis that the artifact does not result from the application of pictorial material, but from a physicochemical process of superficial action, operating selectively upon the outermost fibrils of the cloth.

**Shroud: Correspondences with Analog and Digital Photography?**

From a perceptual-material standpoint, the Shroud of Turin appears to constitute the earliest known example of an image exhibiting negative behavior—an inversion of light and dark—long before the advent of

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photography. Although it is not a negative in the technical-chemical sense (since it involves neither silver salts nor chemical development), its tonal structure and its mode of formation approximate, in striking ways, the photochemical principles that would, centuries later, give rise to the photographic negative.

In the analog system, the latent image is formed by the reduction of ionic silver ($Ag^+$) to metallic silver ($Ag^0$) in proportion to the intensity of incident light; it is then chemically developed and fixed. In the Shroud, although no silver is present, an analogous phenomenon occurs: a superficial oxidation and dehydration of the cellulose fibrils of the linen, restricted to the outermost layers (≈0.2 μm in depth), producing the yellowish coloration that constitutes the image (JACKSON; JUMPER, 1984).

Thus, the Shroud may be understood, in a certain sense, as a superficial photochemical negative, in which the very material of the support—the linen—reacts to a probable energetic emission of luminous, thermal, or corpuscular nature, whose action is indicial. It is essential to stress, however, that this similarity is functional, not chemical: in analog photography the reduction of silver occurs in three-dimensional grains of the emulsion; in the Shroud, by contrast, oxidation is confined to the extreme surface of individual fibrils, with no structural penetration.

Yet the microscopic structure of the Shroud's image exhibits a selective behavior among individual fibrils, since certain crests are oxidized while others remain unaltered. This pattern—though not properly binary in the strict digital sense—suggests a micromodulation across minimal units (fibrils), whose statistical distribution generates a continuous appearance at the macroscopic level. Each fibril, therefore, contributes locally to the formation of overall tonal density, functioning as a minimal unit of luminous inscription—conceptually analogous to a digital pixel—though without the electronic or algorithmic mediation characteristic of digital imaging. Here, the analogy with the pixel must be understood in a strictly conceptual and phenomenological sense, never a technological one, avoiding any suggestion of mechanical equivalence between the systems.

Whereas analog photography depends on photochemical continuity and digital photography on the electronic quantization of light, the Shroud occupies a position between the two: continuous at the macro level (global, unaided vision) but discrete at the micro level (microscopic, fibrillar structure). In other words, if we consider these two observational scales of the sindonic image:

a) **Macro level:** the image appears continuous, with smooth transitions between light and dark areas. This smoothness resembles analog photography,

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in which silver density varies gradually, forming intermediate tones; the general perception is one of continuity, with no immediately perceptible granular units.

b) **Micro level:** under microscopic observation, each fibril may or may not be altered—that is, it may show oxidation to varying degrees or none at all. Thus, there is a fibrillar selectivity expressed in localized oxidation patterns. At this level, the image is no longer continuous but formed by discrete points that resemble digital pixels: each fibril can be understood conceptually as a minimal recording unit, functionally analogous to a digital pixel, though without electronic mediation; each fibril locally records energetic intensity and constitutes a minimal unit of luminous information, analogous to a pixel—even though, to the naked eye, the image appears continuous.

Therefore, when comparing the overall perception of the image (continuous gradient) with its microscopic structure (discrete), we perceive that the Shroud combines characteristics of both the photographic negative and digital logic. In addition, the density of these points is proportional to the distance between body and cloth, giving the image tridimensional properties confirmed by computational topography analyses (JACKSON; JUMPER, 1990).

The analogy may be further deepened in terms of the image-formation pipeline: in analog photography, light passes through an optical system, strikes the chemical emulsion, generates a latent image, and is then developed and fixed; in digital photography, light is converted into electrical charge within the sensor's photodiode (CCD/CMOS), processed by firmware, and quantized into bits, forming a digital file (HOLST; LOMHEIM, 2011). In the Shroud, in turn, some kind of energetic emission—whose nature remains under debate—would have acted directly upon the fibrous "sensor" of the linen cloth, producing a latent oxidation perceptible only through visual examination. Whereas photography, whether analog or digital, depends upon a technical mediation pipeline, the Shroud presents no process but an event: its formation does not follow operational stages but manifests itself as a direct physical occurrence.

This energetic chain—support, registration, and coding—appears in all three systems, differing only in their specific means of conversion. In the case of the Shroud, according to certain physical hypotheses, the body would have acted simultaneously as energetic source, object, and recording agent: the energy forming the image, the negative, and the revelation coincide in the same physical phenomenon, granting the Shroud an imagetic status that escapes the usual ontological categories of technical images, placing it in a liminal condition between physical inscription, indicial registration, and luminous manifestation. This coincidence between emitter, referent, and support—the body as energetic

source, represented object, and agent of inscription—finds no parallel in any known imagetic technology, reinforcing the singular character of the sindonic phenomenon.

**Analog and Digital Photography and the Shroud of Turin: An Iconophotological Analysis**

Without dwelling on the topological concepts of mathematics, we may say that every scientific object should resemble a closed circle, insofar as, enclosed within itself in compact form, it prevents its points from escaping into infinity. In this way, the scientist can devote attention to it, apprehend its full extent, formulate hypotheses and, through an appropriate methodology, confirm or refute the proposed hypothesis—thus creating, or not, theories pertinent to the study without becoming lost in it.

However, we could not say the same if the object were an open circle, for its ends—precisely because they are not closed—would allow its points to extend into infinity, leading the researcher to search aimlessly, since countless paths and outcomes would be possible, not always desirable.

It is precisely this situation, or crossroads, in which we often find ourselves when confronted with certain objects of research whose ends—no matter how much we wish otherwise—do not close. Such a condition opens the way to innumerable conjectures, but offers little usefulness to science, for reaching a verdict would require considerable time and effort, and the result—given the lack of consensus and conclusive final reports—may ultimately prove inconsequential.

As discussed throughout this essay, the study of image formation involves not only technical and physical aspects, but also philosophical, epistemological, theological, iconological and, ultimately, iconophotological dimensions, since its primary source – light – circulates through various fields of human knowledge. Thus, among all the images created by humanity, photography occupies, evidently, a special place, due to the profound revolution it produced not only in the nineteenth century, the period of its genesis, but also in its developments throughout the twentieth century and, in a very particular way, in the twenty-first century, with the unrestrained spread of digital technology.

Starting from this premise, we have seen how analog and digital photography represent distinct paradigms of light recording: while the former records luminous incidence directly onto a chemical support, the latter converts light into discrete data processed by electronic systems. It is precisely within this tension between photochemical continuity and electronic discretization that the Shroud of Turin is situated as a third regime, neither fully analog nor fully

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digital. Its iconophotological singularity lies precisely in its operation as a threshold between both, articulating physical inscription and numerical legibility, since it combines, in a certain way, characteristics of both processes by presenting a continuous inscription at the macroscale and a discrete one at the microscale.

This essay, therefore, by proposing a comparative analysis, from an iconophotological perspective, between the three types of recording – the analog (photochemical), the sindonic and the pixel-based – took into account several technical aspects, which were brought together in Table 5 and then examined individually. Our aim was to highlight the fact that the Shroud of Turin can be positioned between both regimes, while, of course, preserving its particularities.

**I. Sensitive Support**

a) The support determines the ontological nature of the recording. In analog photography it is a gelatin emulsion containing silver halide crystals (AgBr, AgCl, AgI), whose microscopic arrangement allows the direct inscription of light, that is, a classical indexical impression in the Peircean sense.

b) The Shroud, in turn, is composed of cellulosic linen, an organic material without photosensitive agents, but which underwent superficial chemical modifications (oxidation and dehydration) in its fibrils – a singular phenomenon in the known history of technical images, since it did not depend on pigments or emulsions and was probably interpreted by some researchers as an energetic action of the body upon the cloth (JACKSON; JUMPER; ERLICHER, 1984).

c) The digital sensor (CCD/CMOS), meanwhile, is based on silicon semiconductors whose function is not to react chemically but to convert photons into electrons, that is, to transform light into a measurable signal. Thus, whereas film is an object affected by light, the sensor is an instrument that measures it. Unlike film, the sensor does not retain any material inscription of light: it only records measurable values, not physical traces. For this reason, its ontology is not indexical but metrological.

**II. Principle of Formation**

a) Film produces an image through chemical reduction: light transforms silver ions ($Ag^+$) into metallic silver ($Ag^0$) in the development process.

b) On the Shroud, one observes thermal oxidation/dehydration of the fibrils, not their reduction. This reaction suggests an energetic emission from the inside outward – perhaps radiant, photochemical or thermal in nature (ROGERS, 2008). It is probably a self-imprinting process in which the body is, at the same time, the source and the object of the impression – something without parallel in photochemical images, which always depend on an external capturing apparatus.

c) The digital sensor, in turn, performs a photovoltaic conversion: photons generate electron–hole pairs in each photodiode, and the number of accumulated electrons determines the pixel value (RAY, 2002). The principle here is metrological, not chemical.

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**III. Type of Recording and Minimal Unit**

a) Film is continuous: its optical density varies gradually according to luminous intensity. Each silver grain (≈1 μm) functions as a continuous recorder of the incident luminous intensity, translating it into optical density.

b) The Shroud, although also continuous at the macroscale (the image is smooth and without artificial edges), proves to be discrete at the microscale: coloration occurs only in isolated fibrils, 15–40 μm in diameter, with no penetration into deeper layers, showing a behavior analogous to a "natural pixel" (SCHWALBE; ROGERS, 1981). This analogy, however, remains conceptual and functional, never structural: the fibril does not calculate; it merely reacts.

c) The digital sensor is intrinsically discrete: each pixel (≈1–10 μm) records a single numerical value, and this artificial discretization represents the greatest epistemological leap between chemical and digital photography, namely, the passage from a continuous trace to quantized data.

**IV. Luminous Encoding and Tonality**

a) On film, silver density is proportional to luminous intensity.

b) On the Shroud, the degree of oxidation correlates with the distance between body and cloth, resulting in a photo-spatial encoding: the smaller the distance, the greater the tonality (JUMPER et al., 1984).

c) In digital photography, tonal value derives from electronic quantization, subject to the sensor's response curve and the firmware, which implies a symbolic encoding that is reversible and manipulable by software.

**V. Dimensionality and Origin of Energy**

a) Film and digital sensors both depend on external light, which makes them passive records with respect to illumination.

b) The Shroud, on the contrary, appears to result from an internal emission, an energy originating from the body itself. This feature places it in the category of the absolute index: the body not only reflects light but emits it, becoming the agent of its own inscription. Moreover, whereas conventional images are bidimensional, that of the Shroud preserves three-dimensional information, revealed by topographic analyses (JACKSON, 1984) – something absent from conventional bidimensional photographs, except in artificially generated digital relief simulations.

**VI. Indexical Nature and Discretization**

a) The photographic negative is a physical index, a direct effect of light upon matter.

b) The Shroud is the absolute index, for it is the referent (the body) that imprints its presence without instrument, lens or pigment. It is the highest degree of indexicality: the real making itself image by itself. In this sense, the Shroud represents not merely an index, but a luminous autography in which emitter, referent and support coincide.

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c) The digital image, although still grounded in luminous traces, would be a numerically mediated index, reconstructed from discrete data.

**VII. Discretization as Criterion of Distinction**

In this sense, discretization distinguishes the three:

a) In film, it is natural, since silver grains are irregular and organic; b) In the Shroud, likewise natural, but limited to the oxidized fibrils; c) In the digital image, artificial, since the pixel grid is geometrically regular and imposed by the design of the sensor.

These differences may be synthesized in the comparative chart below, which organizes the three regimes according to physico-chemical, optical, energetic and iconophotological criteria.

**TABELA 4[2]**

| Technical Aspect | Analog Photography (Negative) | Shroud of Turin | Digital Photography |
|---|---|---|---|
| **Sensitive support** | Gelatin emulsion with silver halides (AgBr, AgCl, AgI) on a plastic or glass base | Linen cloth (cellulose) with fibrils of 15–40 μm | Semiconductor sensor (CCD/CMOS) with silicon photodiodes |
| **Principle of formation** | Photochemical reduction of silver salts to metallic silver ($Ag^0$) by the action of photons | Thermal and photochemical oxidation/dehydration of superficial fibrils | Photovoltaic conversion of light into electrical charge |
| **Type of recording** | Continuous (tonal density) | Continuous at the macro level; discrete at the micro level (fibrils) | Discrete (pixel quantization) |
| **Minimal unit of information** | Metallic silver grain (0.2–2 μm) | Yellowed fibril (≈15 μm) | Pixel (≈1–10 μm) |
| **Luminous encoding** | Silver density proportional to luminous intensity | Degree of oxidation proportional to distance and energetic intensity | Digital value proportional to electrical charge |
| **Tonality** | Negative (light/dark inversion) | Photographic negative when observed under diffuse light | Direct positive (or reversible by software) |
| **Dimensionality** | Two-dimensional | Three-dimensional (relief map) | Two-dimensional, with simulated relief |
| **Origin of energy** | External light (solar or artificial) | Possible internal energetic emission hypothesized by | External light (ambient, flash, LED) |

[2] Os termos **índice absoluto**, **autoimpressa** e **emissão interna** neste estudo pertence ao domínio teórico da iconofotologia e não implica uma conclusão definitiva sobre o mecanismo físico da formação da imagem, logo não são afirmações físicas conclusivas.

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| Technical Aspect | Analog Photography (Negative) | Shroud of Turin | Digital Photography |
|---|---|---|---|
| | | certain studies (JACKSON et al.) | |
| **Indexical nature** | Physical index (direct action of light) | Absolute index (in the iconophotological sense defined in this study) | Mediated index (electronic signal) |
| **Discretization** | Natural (silver grain) | Natural (oxidized fibrils) | Designed (pixel-based) |
| **Final result** | Developed chemical image | Image produced by an autographic process | Electronic image processed numerically |

Technical-scientific comparison between analog photography, the Shroud of Turin, and digital photography
SOURCE: Jack Brandão, 2025

The table thus synthesizes three distinct paradigms of recording light and presence: the photochemical (negative), the sindonic (Shroud of Turin) and the photoelectronic (digital). Each of them constitutes a specific stage in the history of the technical image and, from an iconophotological point of view, manifests different degrees of immediacy, mediation and codification of light. Thus, in iconophotological terms, film represents the relative index, since there will always be technical mediation, such as that of the apparatus that allows the incidence of light in its interior, where it reacts with silver salts; in the Shroud we have the absolute index, in the iconophotological sense defined here, since there is no instrumental or intentional mediation; and in the digital regime the index is artificial. We therefore have three successive levels of luminous presence: the contact of light, the trace of the bodily interaction with the cloth and the numerical datum.

It should be emphasized that, from an iconophotological perspective, the Shroud of Turin stands out for articulating two regimes traditionally dissociated in image production: on one hand, photochemical continuity, visible in the tonal gradation that recalls analog processes; on the other, a luminous regularity so stable that it allows its computational discretization, as demonstrated by its three-dimensional characteristics. This convergence – rare among technical images – grants the Shroud a singular status with no known parallel, for it moves between the continuous logic of physico-chemical impression and the discrete logic of numerical reading, opening a hybrid field that resists easy classification within modern models of image formation.

This means that, although it brings together features typical both of photochemical continuity and of the possibility of luminous discretization, this

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statement must be situated precisely. The image impressed on the cloth presents continuous gradation – analogous to analog processes; moreover, its notable regularity allows it, when submitted to reading devices such as the VP-8, to be converted into discrete values and numerically arranged, revealing three-dimensional information. Such a property does not imply that the Shroud possesses, in its original formation, any intrinsic mechanism of discretization – a technical process proper to the digital era – but only that its exceptional tonal structure lends itself to this computational transposition.

In this sense, precisely because it does not fully fit traditional models of image production, the Shroud occupies, as we have seen, a hybrid status that is particularly relevant for an iconophotological approach. This coincidence defines what, in this analysis, may be understood as an original iconophotological paradigm in which light not only reveals the image but founds it. From this perspective, the Shroud may be understood as an archetype of the modern technical image, as its ontological prototype, and yet it goes further, since in it light, referent and support seem to coincide in the same creative act – something that could be described as a physical autofotography, in the sense of a luminous self-inscription of the body upon the support, that is, into the very weave of the linen.

**The Entry of the Shroud into the Digital Era (JPL)**

Such characteristics—the tonal continuity and the possibility of numerical discretization—did not remain merely as theoretical speculation; they were effectively verified when, in 1976, the Shroud was subjected to a pioneering analysis at NASA's Jet Propulsion Laboratory. From that moment on, the image, previously limited to optical observation, came to be interpreted through digital reading instruments, allowing a matrix-like translation of its luminance and opening the way for hypotheses related to radiation and the energetic intensity responsible for the impression of the image on the cloth.

If in 1898 the Shroud ceased to be an almost forgotten relic and became an object of scientific study, in 1976 it entered the domain of computer science and applied physics, following pioneering analysis conducted at the Jet Propulsion Laboratory (JPL) of NASA (fig. 8). From that point on, various image-processing techniques were employed in its study—methods originally used for reading and analyzing spaceborne data.

Thus, in July 1976, scientists Jean Lorre and Donald Lynn, from the JPL Image Processing Laboratory, applied to the Shroud the same algorithms used to process images sent by the Viking probes to Mars. This procedure was

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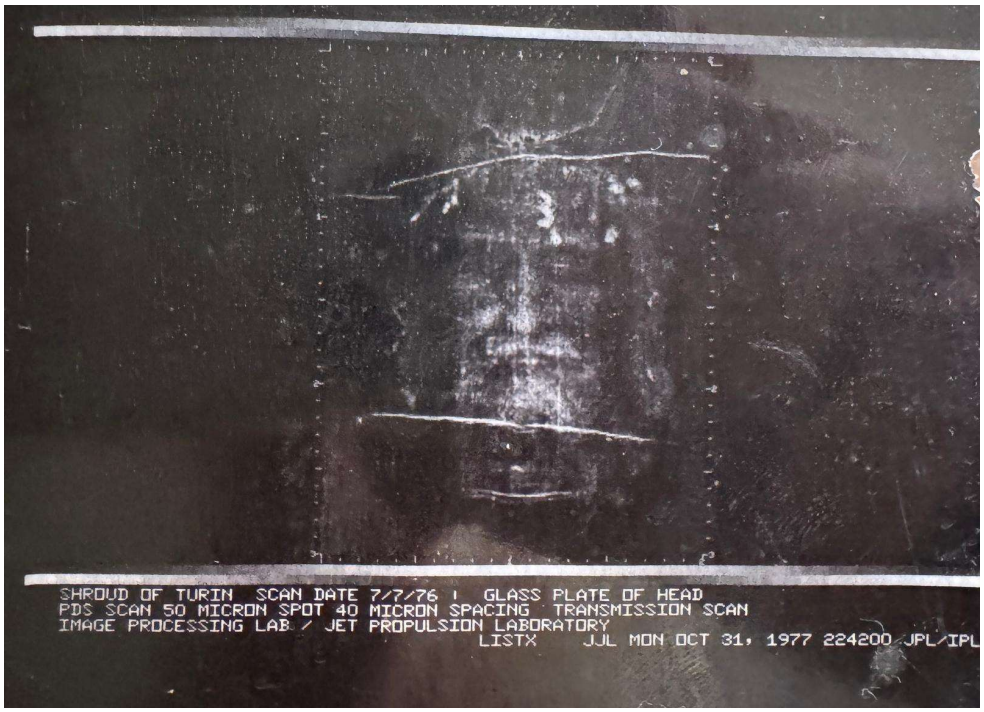
equivalent to scanning the Shroud photograph from top to bottom, one line at a time. The computational report produced in this context was a printout of raw data (fig. 9), containing columns of numbers corresponding to the brightness intensity of each point (pixel) in the photographic image of the Shroud. Each value represented the luminance level of a specific point on the cloth, ranging from dark tones (low intensity) to light tones (high intensity). The image could therefore be translated into a numerical matrix of luminance intensity, which could be digitally reconstructed.

Each number in the column LINE (from 1 to 50, continuing on other pages) indicates a horizontal line of the digitized matrix. The numbered columns (1, 3, 5, 7… up to 29) correspond to the pixel position along that line. SAMP is the abbreviation of *sample*, indicating not the pixel itself, but the numerical value associated with it—that is, the luminance intensity that pixel recorded. In simple terms: the pixel is the position in the digitalized matrix of the photograph; the SAMP value is the numerical expression of the luminance registered at that position. Thus, each number (for example, in line 1, sample 1, value 21) represents the brightness level photographically recorded at that point.

**FIGURE 8**



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Photographic negative of the face on the Shroud of Turin, digitized by the Jet Propulsion Laboratory (JPL) on July 7, 1976
Source: image kindly provided by Franz Habsburg

In computing, grayscale images are represented by a matrix of numbers, where each number defines how light or dark a given point is. In 8-bit-per-channel encoding, used in most digital images, level 0 indicates total absence of luminance (black), whereas 255 corresponds to maximum luminance (white). Values between 1 and 254 express grayscale tones proportionally quantized according to the sampling and quantization process of the signal. By assembling all these data, the photographic image of the Shroud could be digitally reconstructed on a computer, pixel by pixel. For instance, in line 1 the luminance of the first pixel is 21, the third pixel is 26, and so forth. After completing line 1 and moving to line 2, the process is repeated, filling the luminance values for each pixel in that line.

The numerical results obtained by the JPL would later provide the empirical basis for the formulation of the radiation hypothesis and the application of the inverse square law—both examined in the following section.

**FIGURE 9**

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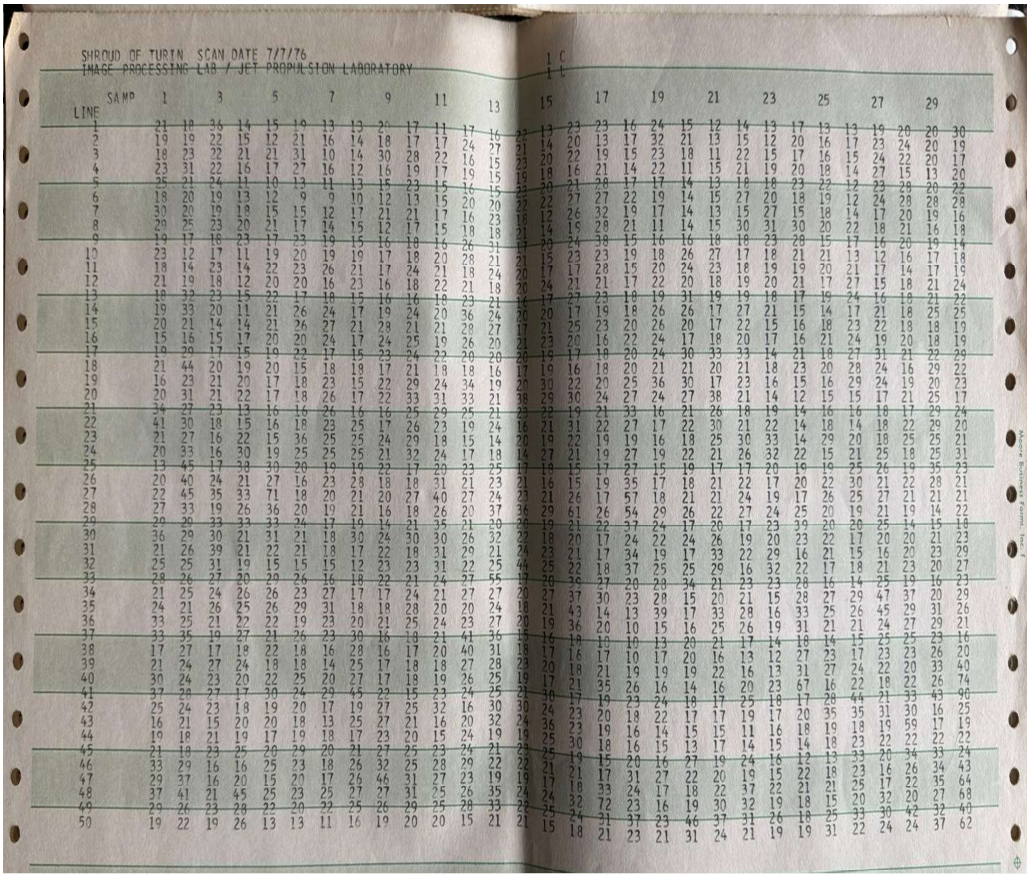


Raw data report from the digital processing of the Shroud of Turin image, performed by the Jet Propulsion Laboratory (JPL) on July 7, 1976
Source: image kindly provided by Franz Habsburg

**The Numerical Matrix and the VP-8**

When applying the VP-8 Image Analyzer, a device capable of converting brightness variations into topographic heights, researchers observed something extraordinary: the luminance values of the Shroud revealed a pattern compatible with a hypothesized relationship between tonal intensity and three-dimensional distance between the body and the cloth. This study yielded unprecedented results, for when processed, the Shroud image—already known to be a photographic negative—was shown to contain mathematically consistent three-dimensional information, a feature not found in known paintings or flat photographs.

**FIGURE 10**

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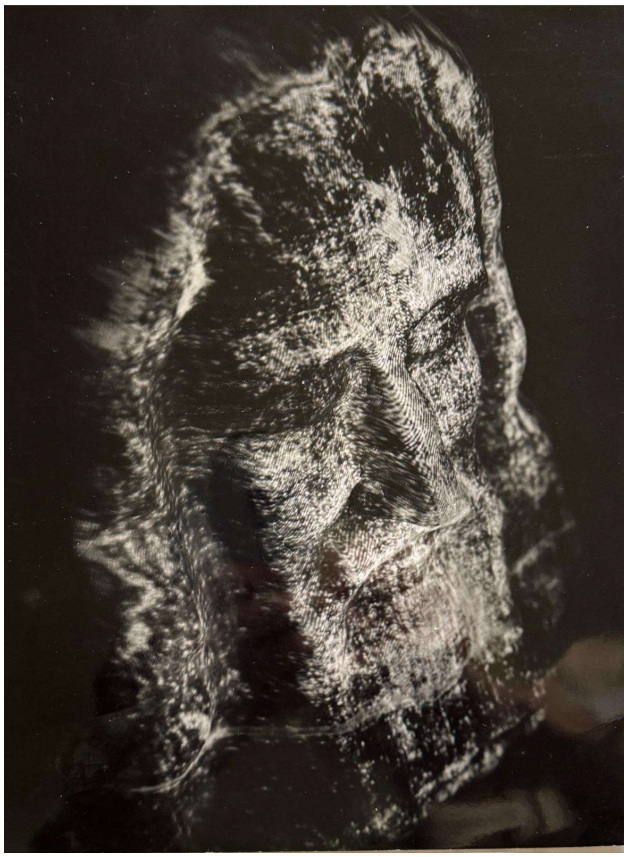

Three-dimensional (3D) digital reconstruction of the face on the Shroud of Turin, *Leo Vala, 1967*
Source: image kindly provided by Franz Habsburg

It must be stressed that Leo Vala's reconstruction (fig. 10) is merely illustrative and does not represent the processing performed by the VP-8. The VP-8 does not generate an anatomical 3D model, but a topographical surface derived solely from luminance, with no facial reconstruction or anatomical interpretation.

The tonal variation of the Shroud image—more intense in regions where the cloth was closer to the body and weaker where the distance was greater—exhibits behavior compatible with the physical inverse square law, according to which the intensity of an energetic emission decreases rapidly as distance increases. If the image were produced by some form of radiation or luminous emission, then the areas of greatest proximity (such as the nose and forehead) would receive higher intensity, while more recessed zones (such as the eye cavities) would register lower intensity.

Digital analysis confirms this pattern: the highest pixel values are concentrated in regions of maximal proximity, while lower values correspond to more distant areas. Some researchers interpret this coherence between distance

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and intensity as a physically plausible model for image formation—without requiring direct contact or pigment—and it helps explain why the Shroud produces three-dimensional data when processed by devices like the VP-8. It must be emphasized, however, that this compatibility is mathematical and photometric in nature; it does not constitute causal proof that the image was produced by actual radiation. What is verified is merely that the tonal variation can be modeled by functions analogous to the inverse square law.

This hypothesis does not aim to establish a definitive causal relationship between radiation and image formation, but to explore the compatibility between the available numerical data and the proposed physical model. It thus remains phenomenological, since no known form of radiation produces images with such properties under controlled laboratory conditions. This approach aligns with the iconophotological care to distinguish between the material indexicality of the image and the interpretative inferences derived from it.

**The Inverse Square Law and Iconophotological Articulation**

The so-called Inverse Square Law establishes that any form of energy propagating through space—light, heat, or radiation—distributes itself in such a way that its intensity rapidly decreases as distance from the emitting source increases. Small changes in distance therefore produce large differences in recorded intensity. Figure 8 illustrates this physical behavior, showing how energy disperses and how intensity decays proportionally to the square of the distance:

a) a point source of energy $P$ emits energy uniformly in all directions;
b) the energy spreads forming a sphere whose surface area is given by $4\pi r^2$, where $r$ is the distance from the source;
c) the intensity $I$ is the amount of energy (power) passing through a given area.

The formula $I = P / (4\pi r^2)$ shows that intensity is the source power divided by the total area of the sphere. Thus:

a) at distance $r$, intensity is $I$;
b) at $2r$, the area is four times larger and intensity drops to $I/4$;
c) at $3r$, the area is nine times larger and intensity becomes $I/9$.

Therefore, doubling the distance from a source does not halve the intensity—it reduces it to one quarter. This explains, for example, why a lamp appears weaker as one moves away from it, or why radiation becomes rapidly less dangerous with distance. The inverse-square decay of intensity is observed in

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diverse phenomena: light and sound propagation, radioprotection, and 3D optical sensing systems such as LiDAR and structured light.

From the JPL studies onward, new technological and scientific approaches expanded not only the interpretation of the Shroud image, but also its potential modes of formation, revealing a possible correspondence between principles of radiation physics and its three-dimensional structure. In this context, the inverse square law constitutes the fundamental physical axis for understanding this hypothesis.

**FIGURE 10**

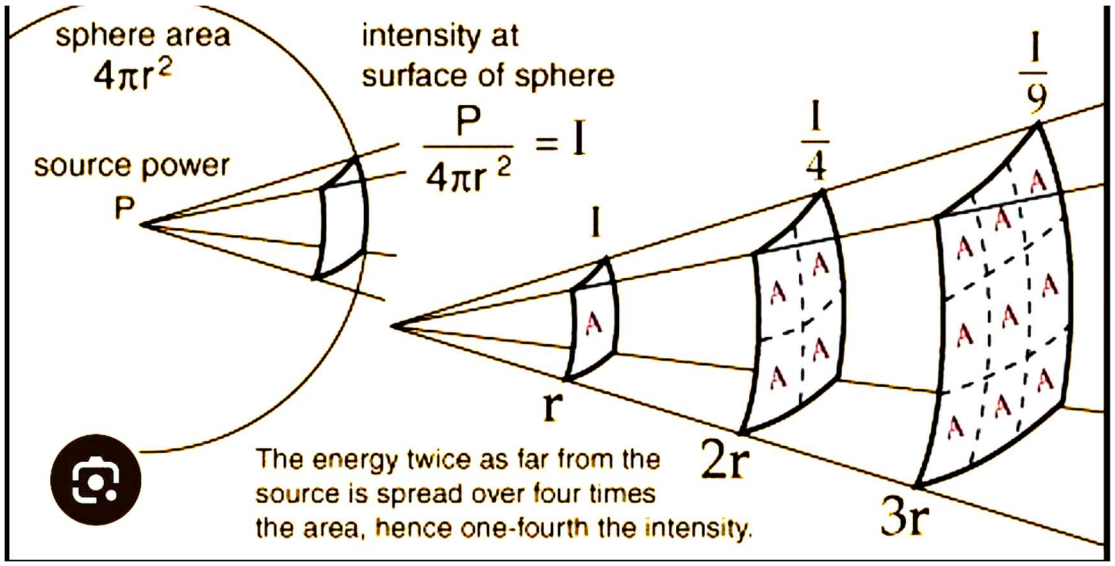


Diagram Demonstrating the Inverse Square Law

Applied to the context of the Shroud, this principle acquires an unprecedented dimension, for the radiation hypothesis proposes that its image was not generated by direct contact—as in a painting, print, or stain—but by a brief and intense pulse of energy emanating from the body wrapped in the linen. If such energy behaved like light, it would have obeyed the inverse square law, distributing itself proportionally to distance. The linen would therefore have functioned as a sensitive support similar to a photographic film exposed to a luminous source.

Imagining a body covered by the cloth (fig. 11): the forehead, nose, and chin were closest to the surface; the eye sockets and sides of the face, more distant. The intensity of the supposed radiation would have been greatest at points of

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contact or minimal distance, and progressively weaker in more distant zones. Thus, areas of higher luminous intensity would have caused slight oxidation or dehydration in the linen fibrils, producing the visible mark. This variation in intensity—governed by the inverse square law—would be responsible for the tonal gradation of the image, forming a true encoded distance map.

**FIGURE 11**

A 3D recreation of Jesus in the tomb, from the documentary "The Real Face of Jesus"
Source: **History Channel**, 2010

This coding explains why, when analyzed by the VP-8 Image Analyzer in 1976, the Shroud image produced a three-dimensional topography consistent with human features. The VP-8 does not generate a physical topography of the cloth, but a 3D interpretation derived from the mathematical coherence of luminance. Moreover, no painting or ordinary photograph contains such spatial information encoded in brightness. The results showed that brightness variation in the Shroud corresponds precisely to the distance between the body and the cloth: darker parts (in the photographic negative, lighter) represent areas closest to the body, while lighter parts correspond to more distant areas.

The Shroud therefore behaves as a three-dimensional image in which each luminance value translates a physical interval of distance. It is as if the cloth

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had instantaneously recorded the presence and absence of the body through a scale of luminous intensities, demonstrating behavior compatible with the physical law of energy dispersion. Yet this hypothesis extends beyond physics into the epistemology of the image.

Understood as a form of indexical mark, the Shroud is simultaneously trace and representation—an index of an event and a sign of an absent presence. This reading reinforces the Shroud's iconophotological status: the variation of intensity is not merely a physical datum, but the manifestation of a presence inscribed on the support according to a logic that transcends known technical models. Radiation, in this context, functions as the mediator between corporeal and incorporeal, event and material inscription. Light, while revealing, also consumes; and in this act of revelation, it produces an image that is not a mere reflection, but testimony to an extreme instant.

Expanding this reflection to analog photography, the analogy becomes even clearer: in the photo-chemical process, as we have seen, light strikes a sensitive surface (film), triggering chemical reactions in silver-halide crystals. Light intensity determines the density of reduced metallic silver, generating the negative—that is, the direct inscription of luminous presence on the support. From this perspective, the Shroud could be seen as a natural photograph in which the body would have functioned—under this hypothesis—simultaneously as emitting source and subject of exposure. As in a photographic negative, tonal inversion grants the image its paradoxical truthfulness: the negative reveals what direct vision cannot apprehend.

With the advent of digital photography, the image becomes mediated by electronic sensors (CCD or CMOS), which convert photons into electrical signals and subsequently into quantized numerical values. Each pixel corresponds to a sample of captured luminous intensity—a discrete value composing a data matrix. This is precisely the kind of matrix obtained by JPL scientists when analyzing the Shroud: a numerical sequence of brightness levels which, when processed, revealed the relief of the human face. In this sense, the Shroud anticipates—completely anachronistically—the logic of the digital image: a matrix of intensities that contains, in its numerical distribution, the three-dimensional form of the object.

From an iconophotological viewpoint, the passage from photochemical to digital imagery represents the transition from direct physical trace to calculated trace, mediated by algorithms. The Shroud, however, appears to occupy a threshold zone between these two orders: it is not a product of human intervention, nor is it a simple physical vestige. Its energetic constitution

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suggests a luminous registration prior to any technical device, as if the body itself had acted as a photoactive emitter.

This reading does not seek to reduce the mystery to technique, but to show how the phenomenon of the image throughout history has been inseparable from the materiality of light, hence the philosophical framework introduced earlier in this study. In this context, the inverse square law becomes not merely a physical equation but an ontological principle of visibility: everything that manifests does so in gradations of intensity and distance. In the Shroud, this relation is taken to its extreme, for presence becomes image through the attenuation of energy, through distance, through the fading that preserves the form of the absent. From this perspective, the Shroud may be understood, in Marion's terms, as a saturated phenomenon—an apparition that exceeds ordinary perceptual and technical frameworks.

**Final Considerations**

The iconophotological analysis of the Shroud of Turin, conducted in light of its physico-chemical, optical, and phenomenological dimensions, allows us to situate it as a threshold object within the field of images, whose singularity derives precisely from the fact that it cannot be reduced to any of the traditional regimes of image production. From a strictly physical-descriptive point of view – that is, limited to the observable behavior of the image as a distribution of luminous intensity – the sindonic image manifests a tonal continuity characteristic of photochemical processes: the extremely limited and superficial oxidation and dehydration of the fibrils obey regular intensity gradients, a behavior that brings it, structurally, closer to analog photography as a direct indexation of light on a support. The technical-computational analyses initiated in 1976 and subsequently correlated with the hypothesis of a radiative model proportional to distance according to the inverse square law, far from offering a definitive causal explanation, highlight the need to broaden the conceptual repertoire with which we think the image and its genesis.

In this context, its spatial organization and the functional linearity between distance and intensity – evidenced both by the STURP analyses and by computational models based on the inverse square law – allow the extraction of stable discrete values. It must be stressed that this discretization does not constitute an intrinsic mechanism of the Shroud in its historical genesis, but rather a form of contemporary reading retroactively applied to the object, revealing its structural compatibility with digital analysis procedures and

exhibiting a sampling pattern that, although not original, proves compatible with contemporary criteria of numerical discretization.

This ambivalence between physico-material continuity and measurable discretization does not constitute an arbitrary hybridism, but reveals a particular mode of indexicality. Acknowledging the multiplicity of referential regimes possible, one may affirm, in the Peircean sense, that the index implies an immediate causal link – without claiming that such a framework exhausts the object's phenomenology – and, in an expanded sense within contemporary image theory, that certain visual records operate as material traces whose function exceeds formal iconicity. The Shroud tensions both senses: on the one hand, it preserves concrete vestiges of material body-cloth contact; on the other, it presents a phenomenon whose distribution of intensity does not correspond to the expected patterns of strictly tactile processes. The absence of penetration, the uniformity in the depth of the marked fibrils, and the derivable three-dimensionality constitute indicators of a non-conventional energetic process, whose intensity decreases with distance in a manner compatible with radiative emission models and not with printing processes.

Contributions from the philosophy of light and phenomenology clarify this threshold condition. In Heideggerian terms, the Shroud does not behave as a manufactured product but as a form of *unconcealment* (*Entbergung*): not the production of an image, but the emergence of an inscription that renders visible what, in its originary character, cannot be reduced to a technical artifice. Thus, in the Heideggerian ontological horizon, the Shroud emerges as an unconcealment that sets into work a truth of the absent body; whereas, under the media-theoretical framework of Flusser, the question shifts to the nature of image-producing apparatuses – an essential displacement for understanding, by contrast, the absence of any device in the sindonic case.

Flusser's critique of technical images – understood as products of programmatic apparatuses – illuminates, precisely, the sindonic anomaly: its genesis does not depend on a device, a predictable operational chain, or a prior codification. What is observed is rather a physical event without an external operator, in which body, light, and support coincide in a structurally unprecedented way, escaping the programmatic regimes of technical images.

It should be noted that the hypothesis examined here does not aim to establish a definitive causal relationship between radiation and image formation, but to explore the compatibility between the available numerical data and the proposed physical model. What is at stake, therefore, is not the affirmation of a single mechanism of image generation, but the recognition that

the indexical behavior of the Shroud exceeds conventional models of tactile, pigmentary, or luminous inscription.

Independent of religious interpretations, and maintaining the analysis on a phenomenological and material plane, the Shroud constitutes an image that exceeds modern categories of representation. It brings together, in a single artifact, photochemical continuity and discrete intelligibility; contact-based indexicality and distance-dependent spatial modeling; non-directional luminous organization and the absence of pigment; banal textile materiality and exceptional optical behavior. Taken together, these elements render the Shroud an epistemically disruptive object: not a precursor of photography, nor a digital artifact *avant la lettre*, but a limit-image capable of reconfiguring the ways we understand the status of technical images, the phenomenology of light, and the very relation between presence, recording, and revelation.

At this point, the issues raised at the beginning of this essay by the theoretical tradition of the image also return. In the Benjaminian horizon, the Shroud challenges the modern opposition between auratic uniqueness and technical reproduction: it is an image whose presence exceeds any apparatus and whose singularity does not stem from religious cult but from its own phenomenotechnical condition. From the perspective of Didi-Huberman, its remaining, anachronic, surviving structure inscribes the Shroud within the regime of *Nachleben*, in which the trace of the absent body becomes that which still looks at us and summons us. The sindonic image, in this sense, belongs not only to the history of techniques but to the history of visual survivals, instituting a temporal and material interval that escapes both the domain of the photochemical and that of the digital.

For this reason, the study of the Shroud is not limited to describing a historical or religious phenomenon but implies a critical revision of the categories that ground our contemporary understanding of the visual. It not only escapes established classifications: it forces us to recognize that the very notion of image, as it is usually conceived, is insufficient to account for phenomena whose formativity emerges from the rare convergence of body, energy, and support. Iconophotology, in this sense, proves particularly apt for addressing the Shroud, for it allows us to grasp that it is not merely an image but an inscribed event – a luminous event that becomes a material trace, simultaneously challenging technique, theory, and perception.

In light of this trajectory, it becomes evident that the Shroud is not merely an object of analysis but an epistemic operator: it forces a revision of the very notion of the technical image and of the categories that sustain it. Iconophotology, as

employed here, does not simply describe a phenomenology of the visible but understands the image as an energetic and indexical event, articulating light, matter, and presence. Thus, the Shroud does not constitute merely a historical curiosity or an optical anomaly, but an ontological archetype – in the sense of instating a mode of imagetic inscription in which body, energy, and support coincide without technical mediation – one that precedes known models, exceeds available categories, and suggests that the image, in its origin, may be less a product and more an emergence; less fabrication and more revelation.

Ultimately, the investigation conducted here does not aim to resolve the historical-material enigma of the Shroud, but to demonstrate that it requires – and simultaneously inspires – an expansion of the epistemological models of the visible. Iconophotology, by articulating the continuous and the discrete, the index and presence, light and support, shows that the Shroud is not merely something we see, but something that interrogates us as a horizon of possibility for thinking the image. In this sense, it returns to image theory the inaugural question that traverses modernity: in what way does light, in inscribing itself, become a presence that exceeds any apparatus and inaugurates a new way of seeing?

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