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Movement-colour: moments in a deep time media epistemology

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Abstract
Color and movement present themselves as deeply different phenomena, yet an epistemological history of their concepts reveals how entangled they have been within the Western *episteme*. This appears not only in scientific or philosophical texts but also, and primarily, in the way specific devices, works of art, media and experimental protocols have been conceived and developed throughout history. This article proposes a deep time media epistemology based on the analysis of a few nodal apparatuses mobilizing both movement and color: Isaac Newton's optical experiments, Joseph Plateau's phenakisticope, and Charles Cros' mid-19th century projects for the recording of colour and movement. These will show how colour and movement have been thought *together* in Western culture.

Keywords
media technology; media epistemology; deep time media history; color science; optics

Color-movimiento: momentos en una epistemología de tiempo profundo de los medios

Resumen

El color y el movimiento se presentan como fenómenos profundamente diferentes, pero una historia epistemológica de sus conceptos revela lo entrelazados que han estado dentro del episteme *occidental. Esto aparece no solo en textos científicos o filosóficos, sino también, y principalmente, en la forma en que dispositivos concretos, obras de arte, medios y los protocolos experimentales se han concebido y desarrollado a lo largo de la historia. Este artículo propone una epistemología de tiempo profundo de los medios basada en el análisis de algunos dispositivos nodales que movilizan tanto el movimiento como el color: los experimentos ópticos de Isaac Newton, el fenaquistoscopio de Joseph Plateau y los proyectos de mediados del siglo* XIX *de Charles Cros para el registro del color y el movimiento. Estos mostrarán cómo el color y el movimiento se han pensado* juntos *en la cultura occidental.*

Palabras clave

tecnología de los medios; epistemología de los medios; historial de los medios de tiempo profundo; ciencia del color; óptica

Introduction

Colour and movement have a strangely entwined history within science as well as art. What I would like to do here is not really a cultural study of phenomena connecting the two, like color film, for instance. I'm more interested in a deep time (dis)entanglement of their conceptual enmeshing within the Western *episteme*.

This shift from a cultural to an epistemological perspective is not a move towards abstraction – tools and concepts are the same thing, Canguilhem said. In fact, these conceptual relations keep manifesting themselves through the materiality of viewing devices, shows, toys, scientific equipment, experimental protocols, works of art and measuring systems. These forms of media were not only the symptoms of a connection that was already perceived as real but also the epistemic engines that produced this connection until they gave it the status of a sort of cultural commonplace. A deep time media epistemology, extracting the "implicit conceptual structure" (Guillerme & Sebestik 1968, 28; Turquety 2024) historically materialized in visual apparatuses, can thus help us understand why and how movement and color have been so constantly intertwined within Western culture.

1. Colour through movement

At the heart of Newton's *Opticks*, published in 1704, lied an extraordinary epistemic machine. The objective of the English scientist was to prove the fifth proposition of Theorem IV in the second part of the first book, which was one of the most scandalous ideas in the text: "Whiteness and all grey Colours between white and black, may be compounded of Colours, and the Whiteness of the Sun's Light is compounded of all the primary Colours mixt in a due proportion" (Newton 1704, 98). According to this statement, white, grey and black would not be simple colours, and the sun's light would not be the most simple or primal of all. On the contrary, they would be complex, secondary in relation to primary colors which, comparatively, seem relatively arbitrary. To prove this assertion, Newton described several concrete experiments. The first one established the basis for the experiment's set-up: a "dark Chamber" in which the sun casts its image onto the opposite wall through a "little round Hole in the Window shut." This places us within the long and complex history of a device well-known by media archaeologists: the *camera obscura*. As Newton placed a prism right behind the hole, the image was coloured as a result. This entails a first deviation of the original camera obscura since the goal was not to observe an image of the world projected onto the wall through a hole, but rather an image of light itself, of its breakdown into what Newton called "rays." To this assemblage of a *camera obscura* and prism, the scientist added a mobile screen: he "held a white Paper" next to the projected spot so that it would be illuminated by the coloured light reflected from the wall, without intercepting the main beam coming from the prism. When this screen was moved around the luminous spectrum, Newton noticed that it changed colour depending on its position. In fact, it took on the hue of the colour spectrum to which it was closest. He also noticed that if the paper screen was equidistant from all colours and equally lit by each segment of the spectrum, then, it appeared white. This was the first step.

For his next experiment, Newton added another element on the light path: a converging lens. The sun's rays were no longer parallel but converged towards a specific spot: the focus of the lens. Newton, placing a white paper within the beam this time, related that modifications were caused by the distance between the lens and the paper screen. When located between the lens and the focus, a colored spectrum appeared on the screen. As the paper was placed increasingly closer to the focal point, the spectrum diminished in size, and the colours mixed more and more and diluted one another continually, as he wrote. At the focus point, all light was concentrated into a unique, perfectly white, small circle. Moving the paper screen further away from the focus, the spectrum reappeared but was now reversed. The physicist then placed the paper at the lens' focus, fragmenting the beam between the prism and the screen with his finger. When blocking the rays of one or several colours, he saw that the light circle acquired a hue combining the remaining colors. The next step involved movement more explicitly.

Newton built a comb-shaped instrument ("in fashion of a Comb") with sixteen teeth that he placed right behind the lens. Each tooth masked some of the rays, just as the finger had done. Thus, for each masked colour, the circular image became logically tinted with the complementary hues. But Newton set the comb in motion, and changed its rhythm:

> "I caused therefore all the Teeth to pass successively over the Lens, and when the motion was slow, there appeared a perpetual succession of the Colours upon the Paper: But if I so much accelerated the motion, that the Colours by reason of their quick succession could not be distinguished from one another, the appearance of the single Colours ceased. There was no red, no yellow, no green, no blue, nor purple to be seen any longer, but from a confusion of them all arose one uniform white Colour." (Newton 1704, 103).

Here, movement becomes more essential to the dispositive. It is no longer just about repositioning the screen or using a finger to interfere with the beam. In the first stages, the experiment worked through the intervention of a single mobile element, whether the finger or the screen, into a fixed set-up. But this mobility existed only to enable the comparison of distinct states of the device; observation took place only when all elements were still. However, the comb went beyond a simple change of position, and integrated movement per se; observation occurred then when the comb moved, and it was used to compare the effects of various forms of movement. It was a system of partial masking, of shutter (even if the term is anachronistic) whose very purpose was the production of motion in an alternating and systematic way, at an adjustable and possibly fast speed. The device, thus, produced a threshold effect: at low speeds, one can see the succession of colours. But at a certain speed, you see something completely different, namely a uniform white. Movement then disappears from the image, or rather manifests itself in the "confusion" created by the mix of all colours. Newton was not interested in the threshold effect in itself, but the comb allowed him to stress another important point:

> "Of the Light which now by the mixture of all the Colours appeared white, there was no part really white. One part was red, another yellow, a third green, a fourth blue, a fifth purple, and every part retains its proper Colour till it strike the Sensorium. If the impressions follow one another slowly, so that they may be severally perceived, there is made a distinct sensation of all the Colours one after another in a continual succession. But if the impressions follow one another so quickly that they cannot be severally perceived, there ariseth out of them all one common sensation, which is neither of this Colour alone nor of that alone, but hath its self indifferently to 'em all, and this is a sensation of whiteness. By the quickness of the successions the impressions of the several Colours are confounded in the Sensorium, and out of that confusion ariseth a mixt sensation." (Newton 1704, 103-104).

Immediately after this explanation, Newton wished to clarify his argument with the well-known phenomenon of the glowing coal that leaves behind a completely luminous track when brandied about. That phenomenon would later be the starting point of Chevalier d'Arcy's work on "the duration of the viewing sensation" in 1768, a foundational research for media history in the sense that it laid the grounds for what would then be termed "persistence of vision".

But Newton's concern here is not directly related to the issue of duration or of perception's weakness or failings. With the introduction of the moving comb, Newton displaced the site of synthesis. The "confusion" in a uniform white of colours that were initially quite distinct did not take place on paper anymore but in the viewer's "Sensorium." The scientist insisted on this point. Initially, one felt a succession of distinct sensations of colours, but the new sensation was a single and quite different feeling that "hath its self indifferently to 'em all," one of "whiteness" coming into perception without being anywhere else. The threshold in the comb's moving tempo initiates a qualitative step that makes movement disappear as such and transforms it into a force of perceptual integration – that is, into colour. The rapid movement of coloured segments before the viewer's eyes accomplishes the same thing as a painter who, in a different context, mixes pigments. That is all Newton needed for proof: "and so it is manifest by this Experiment, that the commixt impressions of all the Colours do stir up and beget a sensation of white, that is, that whiteness is compounded of all the Colours." (Newton 1704, 104).

This demonstration may seem a little strange as it oscillates between the objective and subjective realm, between whiteness and the sensation of white, and between the material combination of rays and its impressions. Yet, this is where I would claim that an important issue emerges. The prism is the device traditionally associated with Newton. Indeed, he showed that light is composite and that each colour is a specific light possessing its own refrangibility. But the prism was here integrated into a larger dispositive made up of a complex arrangement of pre-existing devices. Its basic structure was the *camera obscura* which produced the solar image through projection. With it, Newton set up a first displacement when he focused on the light beam that crossed the dark space, and not on the image proper. He then manipulated this beam by inserting the prism that permitted the analysis of the light and created the image that became the support for the experiment. Thirdly, the mobile comb device set up the tension between analysis and synthesis, and produced the effects of perceptual threshold; thus, it was at the heart of the experiment through its movement. This internal movement did not elicit a figurative movement on the screen. Rather, the movement appeared as translated into the continuous transformation of colour.

This complex experimental system is nodal in the framework of a historical media epistemology because it created a specific constellation of concepts, techniques and perceptual experiences. But it also was because it moved out of the laboratory. Modified, and simplified, it was offered to, and largely adopted by, the public. This triple device centred on the comb was relatively cumbersome, and was, therefore, later transformed into a simple, compact, low-cost and easy-to-use small machine: a spinning top. Although greatly reconfigured, "Newton discs" were popular scientific toys throughout the 19th century and were used in schools to demonstrate both the synthesis of colours and the phenomenon of "persistence of vision". The discs are each composed of cleverly placed coloured segments. They are attached to a spinning top that, when set in quick motion, produces the confusion of colours in the same way as the comb: at a certain speed, the colours mix and display only the resulting grey-white shade or another pre-determined result. In this spinning-top configuration, the projection, the screen, the flickering and the prism disappear, but the movement is more integral to the dispositive, being inscribed in the rotation of the viewing object. The same threshold effect reveals the parallel perceptual confusion that transforms the observed movement into the very agent of colour creation.

The dual form of Newton's dispositive, the comb and the disc, played an essential role in the further development of movement and colour-viewing machines.

2. Colour as movement

It can be argued that the 19th century truly started with Thomas Young's lecture "On the Theory of Light and Colours" at the Royal Society of London on 12 November 1801. Reviving the once-formulated but forgotten wave theory, the 28-year-old English physicist challenged Newtonian concepts. He associated differences in refrangibility as described by Newton with variations in wavelengths and, to demonstrate his propositions, displayed interference phenomena. He finally showed the relevance of this description by dealing with certain cases that had remained notoriously difficult when approached through traditional corpuscular theories. His text elicited heated reactions because it was seen as a critique to Newton's corpuscular conception of light. This new theory implied that light was vibration and, therefore, movement. In turn, perception itself was essentially movement: "The Sensation of different Colours depends on the different frequency of Vibrations, excited by Light in the Retina." (Young 1802, 18). For Young, the eye's retina is constantly animated by movement: each point in the world emits a coloured light with a particular wavelength, and the corresponding retina's reception point perceives the colour as it vibrates in unison with the same incoming wavelength. The scientist must then solve a problem:

> "Now, as it is almost impossible to conceive each sensitive point of the retina to contain an infinite number of particles, each capable of vibrating in perfect unison with every possible undulation, it becomes necessary to suppose the number limited, for instance, to the three principal colours, red, yellow, and blue […]" (Young 1802, 20-21).

Thus, Young posited the hypothesis that "particles" that are sensitive to the three primary colors are distributed on the retina, a hypothesis that would later be proven with a photographic dispositive.

This idea of an undulating light and of colour as characterized by a certain type of vibration, became deeply rooted in 19th-century culture. Progressively, it intermingled with the increasingly popularized molecular theories of matter, and of heat as linked to the intensity of these molecules' vibrating movement. Then the world changed. We can see the mark of this change in art, for example, in Baudelaire's work:

> "Let us imagine a beautiful expanse of nature where the prevailing tones are greens and reds, melting into each other, shimmering into the chaotic freedom where all things, diversely coloured as their molecular structure dictates, changing every second through the interplay of light and shade, and stimulated inwardly by latent heat, vibrate perpetually, imparting movement to all the lines and confirming the law of perpetual and universal motion." (Baudelaire 1972, 54).

The classical universe, which was characterized by the opacity of things and the stability of being, became an infinitely diverse and mobile romantic cosmos that deployed its formidable energy charge in all directions. Research on electricity and electromagnetism was central to the 19th century and it revealed invisible forces in the world. It is no surprise, therefore, that Baudelaire was also the poet of modernity and of scientific toys. At age 12, he wrote a letter to his brother Alphonse in which he described the phenakisticope, and then made it the focus of his "Morale du joujou" again some twenty years later (Baudelaire 1995).

That phenakisticope was described in 1833 by Belgian physicist Joseph Plateau:

> "As we know, the machine consists mainly of a cardboard disc slotted with little openings around its circumference, and adorned with painted figures on one of its sides. When the disc turns on its centre in front of a mirror, you can see the figures by reflection in the mirror through the slots. With any other viewing system, the figures would run into one another, creating confusion. But here they appear animated, executing distinctive movements, seemingly independent from the circle's rotation." (Plateau 1833, 305).

This dispositive[1] is not only the first one to enable the motion of a figure through the rapid succession of images that were slightly different from one another, rather, in Plateau's own words, it is a system that analyzes and then redistributes movement. In the *Annales* of 1833, Plateau explained the phenakisticope in one single sentence: "It is a perfectly natural consequence of the well-known phenomenon of the duration of visual sensations […]" (Plateau 1833, 305). This topic of the duration of retinal impressions, of their "persistence" after the disappearance of the object that produced them, was the subject of the Belgian scientist's research after he defended and published his dissertation, *Sur quelques*

1. I use the term in the sense defined by François Albera and Maria Tortajada (2012 & 2015).

propriétés des impressions produites par la lumière sur l'organe de la vue in 1829. The author started his dissertation with the classic example of the glowing coal that leaves a continuous light circle when whirling, an example that Plateau explicitly connected to the passage in Newton's *Opticks* that was analyzed earlier. The young physicist proceeded to try and precisely measure the duration of this sensation, from appearance to disappearance, through an experimental protocol. His work followed in the steps of Chevalier d'Arcy,[2] but he changed the stakes of the research when he proposed to "examine the impressions produced by the different colours on the basis of their duration, their energy, and the action they produce on one another" (Plateau 1829, 5).

Plateau framed the question of retinal persistence within a general reflection on colour perception, the central issue in his 1829 thesis. His purpose was to compare the intensity of the impression produced by each color on the human eye. From this proposition, his argument led him about halfway through his thesis to an analysis of movement-caused optical illusions from the perspective of retinal persistence. After studying the length of retinal impressions according to colours, he observed the "compar[ison] of sensations due to different colors in terms of their energy" (Plateau 1829, 25). His investigation then veered towards his other major subject of interest, "accidental colours." It asked why the prolonged contemplation of a coloured object produced a persistent image of the complementary colour on the mobilized retinal spot. In that section, Newton's disc takes center stage again. The scientist deployed a set of variables around this dispositive; for example, he calculated different ratios of fundamental colours to obtain specific hues.

The question that arises, within the scope of my own research here, concerns the connections between the problem of colour and that of movement. Should the development of Plateau's work, as it led to the creation of the phenakisticope be considered independently from the set of reflections dealing exclusively with color perception? The concept of "retinal persistence" seems to bring the whole into coherence. This very concept emerged from the intersection of two fields: firstly, optical illusions in the perception of movement, e.g. the whirling glowing coal, secondly "accidental colors," an idea that Plateau considered going back to Buffon at the very least (Plateau 1829, 25). There was also, it seems, an association of devices in Plateau's writings, a combination between Newton's revolving disc and Roget's spoked wheel where the segments seemed distorted when they travelled behind a picket fence. What appears central here is the transformation of Newton's mobile comb into a disc. Not only did this transformation involve an actual setting in motion of colours, but it also allowed a conceptual crystallization between the researches on colour perception and those on the perception of movement in relation to form, just as it was emerging in Roget's work. There remains, however, an important theoretical difference: the epistemological genealogy surfacing here around movement and form and linking Arcy, Roget, Faraday and Plateau, gets formulated in terms of optical illusions, whereas for Newton the synthesis resulting from the setting in motion of colours has nothing to do with illusion but, on the contrary, reveals the truth about both colour and perception.

3. Moving colours

The phenakisticope was not the only scientific toy of the 19th century. In fact, that era witnessed the deployment of many devices staging the movement of colours for enjoyment. Stellar among those is, undoubtedly, the kaleidoscope. In his *Treatise on the Kaleidoscope* (1819), its inventor David Brewster identified 1814 as the year of its origin, associating its creation to the work on light polarization that made his scientific reputation in 1815 (Brewster 1819, 1). It is common knowledge that the kaleidoscope enjoyed great success throughout the 19th and 20th centuries, as did Newton's discs and other forms of coloured spinning tops. The kaleidoscope is made up of a tube sporting a polygon of fixed mirrors and of a mobile set of coloured glass pieces. Its rotation deploys an infinite number of abstract multicoloured shapes that succeed each other discontinuously. Movement is as important as colour in this instrument, yet it is also unique since the continuous rotation produces a discontinuous series of transformations.

By the end of the 19th century, not only would colour move autonomously on the fabric wings of dancer Loïe Fuller but shows of "music of colors" and coloured organs began to appear at the beginning of the 20th century, lasting well into the 1920s (Roque 1990, 26; Turquety 2011). In 1995, Guy Fihman re-evaluated the beginnings of futurist cinema at the turn of the 1910s based on this music of colours, and drew a radical conclusion:

> "It is the very foundation of cinema which is at stake because, contrary to what is commonly believed, cinema is not image in motion to which additional characteristics might be added such as color or sound but, rather, it is the very movement of colors that makes the art of movement possible." (Fihman 1995, 323).

The conjunction of movement and colour asserted its power of crystallization as early as the very first endeavors that can be linked to what cinema would later become.

4. Movement through Colour

During its 2 December 1867 meeting, the French Science Academy received a sealed envelope from poet and inventor Charles Cros. It was not to be opened until he requested it, which he did in 1876. It contained

2. Plateau mentioned two predecessors for his research: Patrice d'Arcy whom he discussed at length, and Thomas Young, *A Course of Lectures on Natural Philosophy and the Mechanical Arts* (1807). On p. 6, he added: "To my knowledge, no other physicists have tackled this particular topic." Interestingly, Plateau failed to mention Goethe who brought up the same issue in *Theory of Colours* published in 1802. For the German writer, the duration of retinal impression depended first of all on "the powers or structure of the eye in different individuals" (Goethe 1840, 8), which took investigations in totally different directions.

a text dated 28 November 1867 entitled «Procédé d'enregistrement et de reproduction des couleurs, des formes et des mouvements».

There appear to be two distinct stages in Cros's machinery, one dedicated to movement and the other to colour. As with Plateau, it seems, initially, that these two aspects were conceived separately as two parallel theoretical lines. As it turns out, things are more complex. What is striking when first reading the document is the positing of a contrast; the core issue in the text is colour because movement is a relatively "easy" problem to solve. The reproduction of movement is practically a *fait accompli*: "The ability to record scenes in motion, and to possibly show them, is very easy to understand" (Cros 1970, 493). He added: "The toy invented by Mr. Plateau, named phenakisticope, demonstrates its principle and experimental application" (Cros 1970, 493).

This, for Charles Cros, basically solves the problem. He then only had to change the "hand drawings" (Cros 1970, 493) with photographs to obtain the expected result. A few material details remained to be settled, for example the fact that exposure had to be very short and the number of shots very high. But Cros had a solution to both issues: "the use of microscopic photography." (Cros 1970, 493). Indeed, a glass plate can contain over 10,000 photographs, which translates, according to Cros's calculations, into "a 1000-second scene, or 16,75 minutes if one assumes ten photographs per second." (Cros 1970, 493). Besides, we know that "emulsion speed increases with image reduction." (Cros 1970, 493). The size reduction of the "elemental images" (Cros 1970, 494) consequently enables both the reduction of exposure time and the multiplication of the number of views. Cros considered that everything else, namely the "mechanical setup needed to produce appropriate movement through the plate," (Cros 1970, 494) was of minor interest since it was "very easy to imagine," even though the poet admitted to not yet having a specific solution in mind.

The next step consisted in solving the core problem, i.e., the "recording and reproduction of hues in all visible things." (Cros 1970, 494). Cros's fundamental idea was to take "three photographs […] in succession of a single scene," with the assumption that for the first one "a red glass plate would be placed between the scene and the lens of the camera; for the second one it would be a yellow glass plate, and then a blue glass plate for the third one." Next, the positives of these three photographs would be overlaid while the same color rays that were used for the shots would be used again at projection time. In this way, "the multi-layered projection can represent a given scene with its true colors." (Cros 1970, 495). Cros then explained in detail the way this system worked; indeed, the principle of three-color separation was new at the time, and not easily understood. However, he raised another problem: "The superposition of the three positives' projections, each one traversed by red, yellow, and blue rays, seems to present some difficulties." (Cros 1970, 495). And it so happens that the solution he figured out was directly related to our enquiry: it was movement. "But these difficulties vanish if we replace the true superposition with a rapid succession of three projections that are variously colored in the same spot." (Cros 1970, 495-496). Cros did imagine using a colour photograph that would be affixed to a base; but this would mean depending on "the chemical process to obtain adequate coloring products." (Cros 1970, 496). By contrast, a mechanical solution would do away with such dependence. It involved setting up "the three projections in rapid succession." Cros then suggested a solution: "In the trajectory of the rays produced by the scene towards the camera, we could place a refractive prism able to turn on an axis that is parallel to its edges." (Cros 1970, 496). This prism, situated in front of the projector's lens, would follow the same movement as the filming. "This process ensures that the three images coincide with their corresponding segments, at a speed that is such that the successive retinal impressions blend into one another." (Cros 1970, 497).

In fact, Cros realized that this process could apply to the recording of movements, simply "by dividing each of the initial segments of the moving scene into three smaller segments." Cros inevitably concluded: "In this way, when setting in motion the prism as well as the positives resulting from the movements mirroring those that took place during the recording, one can reproduce anything that is visible: colours, forms, movements." (Cros 1970, 497)

However, some difficulties remained, such as the "limits to the impressionability of sensitive surfaces" due to the extreme brevity of exposures; another problem was the "uneven photogenic action of different colours," (Cros 1970, 497) most notably the emulsions' insensitivity to red at the time. But Cros felt that these mundane problems could be overcome, and he left them for others to figure out.

5. Colour = movement

This text by Charles Cros proposed a remarkable set of technical projects. The first part, about movement, is essentially a configuration of pre-existing devices, adding photography to the phenakisticope.[3] His contribution consisted in integrating the element that made it possible: microscopic photography. An elegant proposition that solved several problems simultaneously but didn't really break with Plateau's world.

But as soon as Cros considered the issue of colour photography, the whole scheme took another direction. He stopped using the phenakisticope as a model. In fact, he did not rely on any of its components, except for retinal persistence, which was its core concept and major conceptual invention. Fundamentally, the heart of his colour photography was overlay. Trichromy, which combined empirical pictorial techniques and scientific principles, provided the basis for his analysis. To reach the

3. Plateau had considered replacing drawings with photographs, but photography's long exposure delays only allowed him to think of having models take successive poses in order to get a series of images. He could not imagine recording scenes in motion (Plateau 1849).

needed synthesis, the three main images, or their visual impressions, had to be superimposed. Cros imagined a specific overlay fixed on a support, but he could not figure out how that would work. A solution based on chemical processes also eluded his conceptual imagination. He was more interested in another option, namely a superimposition through projection, and particularly through a rapid succession of the three partial images. That is when he involved a prism that turned synchronically along with the support.

In the end, Cros relied on retinal persistence to achieve colour synthesis, as he had done with movement synthesis in his first device. The transfer between the poles of movement and colour was possible, even obvious for Cros, because this circulation was precisely what had allowed the concept to emerge. If it was indeed through a reflection oscillating between colour and movement perception that the concept of "retinal persistence" was constructed, it was then logical that this same concept could solve problems in each of these fields, particularly the issue of optical synthesis. This is why technical systems started communicating immediately with each other. The equipment that enabled colour reproduction could also, with minimal modifications, reproduce movement at the same time.

However, to realize the apparatus, Cross seemed to rely on schemes and conceptual structures closer to Newton's than to Plateau's. The poet's projector with rotating prism looks more like the Englishman's *camera obscura* with prism and mobile comb than it resembles the phenakisticope. The technical schemes circulated not according to any direct historical influence, but along the lines drawn by the conceptual network they are a part of.

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