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« Realities of illusion »

Perceiving and understanding cinematic motion

or a few destinies of an illusion

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Abstract

Since its inception in the 1830s, the cinematic motion of animated images has been achieved through the rapid succession of still images, creating a peculiar effect that shows motion, or different kinds of motion. Almost two centuries after its discovery through graphic methods, drawings and animated engravings, its principle has remained yet diversified through its applications in the fields of photography, electronics and digital technology. Therefore, its status has shifted from that of mere optical illusion in the 19th century to a universal technique used in the 21st century to show animated images of all kinds and in every setting. Nowadays, it is fixed somewhere between an artifact and the authenticity of the motions that it reveals. The evolutions of this status are analyzed in relation to a dual shift: on the one hand the shifts in the notions of illusion and perceptive effect of synthesis to its representations, including through photographic cinema; on the other hand, the various statuses ascribed to the cinematic synthesis of motion, in relation to its different cinematic uses or modes: representative, illusionistic, animation, experimental.

Keywords: cinematic synthesis of motion, optical illusion, cinema, animation, experimental cinema, special effects

Full text (PDF file)

Since its inception in the 1830s, the cinematic motion of animated images has been achieved through the rapid succession of still images, creating a peculiar effect that shows motion, or different kinds of motion. In line with the observations and experiments made on visual perception by Michael Faraday, Joseph Plateau and Simon Stampfer between 1831 and 1833, this particular effect was then considered as a new optical illusion, or even a *new kind of optical illusions*.[1] This scientific innovation is structurally distinct from the former fixed or mobile imaging techniques, as well as from any type of former optical plays or illusions. Almost two centuries after its discovery through graphic methods, drawings and animated engravings, its principle has remained yet diversified through its applications in the fields of photography, electronics and digital technology. Therefore, its status has shifted from that of mere optical illusion in the 19th century to a universal technique used in the 21st century to show animated images of all kinds and in every setting. Nowadays, it is fixed somewhere between an artifact and the authenticity of the motions that it reveals.

The dialectics of the real and illusory nature of images is indeed quite old. However, as far as cinema and animated images are concerned, beyond their propinquity, hybridization or relationship with such and such other tradition, art form, technique or show, we will consider their creation from the specific perspective of their guiding principle and its durability: the synthesis of motion.

We should consider these issues in light of a twofold evolution: on the one hand, the shifts in the various acceptations of the notion of "illusion," as applied to animated images; on the other hand, the evolutions of the status of the cinematic synthesis of motion. In other words, we should understand how this truly astonishing optical illusion has come to be used strictly as a subliminal technical tool to represent the filmed product and its special effects, or to be designed as an esthetically valuable and productive feature in the fields of animation and experimental filmmaking, which have been the main theoretical and practical sources for this particular issue.

Varied optical illusions

In their descriptive writings, the inventors of cinematic motion at once presented it as "a new kind of optical illusions"[2] designed in such a way that "the most varied optical illusions would be visually perceived as coherent movements and actions."[3] allowing for "the incredibly faithful representation, not only of the motion of all kinds of machines, such as cogs or power hammers, shifting cars or balloons ascending in the air, but also the infinite

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1 Title of Joseph Plateau's letter, dated 20 January 1833 and describing his invention, published in Quetelet's *Correspondance mathématique et physique*. In Jacques Deslandes, *Histoire comparée du cinéma*, Tournai, Casterman, 1966, t. 1, "De la cinématique au cinématographe."

2 Joseph Plateau's letter dated 20 January 1833, in Jacques Deslandes, *Histoire comparée du cinéma*, Tournai, Casterman, 1966, t. 1, "De la cinématique au cinématographe."

3 Simon Stampfer, "Privilegium 7 May 1833," *Jahrbuch Polytechn. Inst Wien*, t. 19, p. 406 *sqq*. We would like to thank Laurent Gibert for his translation.

variety of animal and human movements and actions."[4] In 1853, Baudelaire described the phenakistoscope in his *Morale du joujou*, emphasizing both the "fantastic precision" of the impression of motion it produced and the ability of scientific toys to "instill in the children's brains the taste for marvelous and surprising effects."[5]

Plateau ends the description of his invention with the following sentence: "I will not insist on the variety of strange illusions that we are able to produce by this means: I will leave it to those who are willing to conduct these experiments to make the most of this invention,"[6] pointing out that the "variety of these illusions" remains to be experimented on, thus broadening scientific experimentation to cinematic experimentation.[7] Men of science who have become animators, Plateau and Stampfer will conduct these experiments by producing a set of discs, some of which skillfully represent human, animal and mechanical movements, while others explore new opportunities for the experimental viewing of color movements. Among other devices, they designed: a spiral of colorful circles switching from white to blue, green, yellow, orange, red (Plateau), or parts of an image seemingly flickering to recreate letters or geometrical forms[8] (Stampfer), as well as several paradoxical movements of graphic motifs, such as simultaneous forward and backward movements, spiral and dynamic volume effects, etc.

Optical illusions and the logic of sensation: seeing made visible

The invention of animated images by Plateau and Stampfer almost occurred accidentally (in the sense that it was not stated as a scientific objective[9]) in the context of researches conducted since the late 18th century on the processes inherent to human vision as a physiological phenomenon inducing visual effects *per se*. These effects include: duration and intensity of the composition of light impressions, optical illusions and accidental colors, occurrences of immobility and paradoxical apparent movements of mobiles, flying gnats, glares, vertigos, according to an *entoptic*, a productive thickness of the corporeity of the human visual system made visible, therefore distinct from traditional optics. The observations made by Rotget, Faraday, Plateau and Purkinje in the early 19th century—which involve dynamic visual phenomena—are described, analyzed and sometimes modeled in the form of reproducible scientific experiments. In his *Contribution to the knowledge of*

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4 Simon Stampfer, "Privilegium 7 May 1833," *Jahrbuch Polytechn. Inst Wien*, t. 19, p. 406 *sqq*. Translation: Laurent Gibert.

5 Charles Baudelaire, "Morale du joujou," *Le Monde littéraire*, 17 April 1853, quoted in *Baudelaire. Œuvres complètes*, text established, presented and annotated by Claude Pichois, Paris, Gallimard, "Bibliothèque de la Pléiade," 1976, t. 1, p. 786.

6 Joseph Plateau's letter dated 20 January 1833, in Jacques Deslandes, *Histoire comparée du cinéma*, Tournai, Casterman, 1966, t. 1, "De la cinématique au cinématographe."

7 While the word "cinematic" is anachronistic in this context, we use it nonetheless as a generic term designating the product of animated images.

8 These first effects of flickering images/image parts is the stroboscopic "rerun" of previous experiments, such as Purkinje's, see *infra* and note 11.

9 An example of the superiority of fundamental research over applied or programmed research in order to find applications.

vision in its subjective aspect[10] written in 1819, Purkinje described and drew the complex figures—colored stars, spirals, tartans, squares, hexagons—one can perceive when waving one's hand with the fingers spread (like a dynamic shutter) between the sun and closed eyes, which he named "shadow and light figures."[11] In 1829, before he invented the phenakistoscope, Plateau built an *anorthoscope* using two contra-rotating discs, one acting as a shutter to the other, so as to dynamically adjust anamorphic images. These experiments immediately preceded the invention of animated images and produced complex entoptic images through the dynamic shuttering of images or vision. In this context, the discovery of the graphic synthesis of motion appeared to be a new kind of optical illusion, which generated apparent motion through a series of drawn figures. This is how Jacques Deslandes titled the first chapter of his comparative history of cinema "From optical illusions to the illusion of motion."[12] This is an important point, as it raises the issue of the differences between and potential overlapping of these two types of illusion, consequently questioning the meaning of illusion and motion.

According to scientists, this *illusion* is the manifestation, under certain conditions, of a logic of perception and visual thinking, rather than a magical or misleading phenomenon. On the contrary, it is the concrete expression of the authenticity of the senses, for which experimentation is but a way to *make the act of seeing visible.*

As far as *motion* is concerned, the former experiments would indeed produce different outcomes than those of the synthesis of discontinuous images—shifting, apparent sliding or changes in the shape of lines and figures—other *motion qualities*, such as flashes, pulses, colors, motifs, distortions, resulting from intermittence, the discontinuity of light impressions, which will be further taken over by certain types of experimental and animation filmmaking.

For the time being, let us just remember that one is confronted with a great variety of illusions of motion. We shall keep this in mind for later. On the one hand, we find motion-*induced* illusions, in the sense that they are produced by motion, *result from motion*, such as the complex shapes generated by the visual system through the quick alternation of light and obscurity, among other processes. On the other hand, there are illusions *of* motion, in the sense of apparent movements in space generated by the series of still images, which is inherent both to the representation of animated images and the invention of all kinds of new syntheses of motion. This latter and new illusion derives from and

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10 Johannes Purkinje, *Beiträge zur Kenntnis des Sehens in subjektiver Hinsicht*, Prague, Vetterl, 1819 and Calve, 1823. English translation in Nicholas J. Wade and Josef Brozek *Purkinje's Vision. The Dawning of Neuroscience*, Mahwah, Lawrence Erlbaum Associates, Inc., 2001.

11 Johannes Purkinje, *Beiträge zur Kenntnis des Sehens in subjektiver Hinsicht*, Prague, Vetterl, 1819 and Calve, 1823. English translation in Nicholas J. Wade and Josef Brozek *Purkinje's Vision. The Dawning of Neuroscience*, Mahwah, Lawrence Erlbaum Associates, Inc., 2001, p. 42 and p. 68-69. See below for the relation between these experiments and Peter Kubelka's *flickers* in his film *Arnulf Rainer*.

12 Jacques Deslandes, *Histoire comparée du cinéma*, Tournai, Casterman, 1966, t. 1, "De la cinématique au cinématographe."

embraces the opposite one, obtained by Faraday in 1831, namely the *illusion of apparent immobility* of a spinning wheel.[13]

In this way, the set of optical illusions and/or illusions of motion offers at this precise moment various states of relations between motion and immobility. It is indeed possible to generate both shapes, through the simple alternation of light and obscurity, as well as apparent motion or immobility through a series of still images.

Invented motions, imitated motions

Thus, animated images fall within texts and works, in the sense that they allow to *invent* and produce various motions or visible motion qualities, or to *represent* diverse motions with "amazing accuracy," "fantastic precision." However, the effects of representation are based on the purely synthetic and perceptive effects of motion induced by stroboscopy. In other words, first and foremost there is truth in the various stroboscopic effects, which otherwise rules some of the truthful effects of animated representations that they are able to generate. The latter are peculiar, in that they appertain both to the observing subject's reality or perceptive truth—hence this subject's physical or mental involvement when confronted with animated images—and to the new reality or truth of the visible world's motions as they are represented and transformed by the spectator's equipped vision. The two realities or truths inextricably intertwine in the case of the representation of known motions (Plateau's frogs and snakes for instance) and all the more so in the case of animated chronophotography, which will later serve as a basis for photographic cinema.

As far as the new types of visible motions thus obtained are concerned, it is more important to remember that they are likely to be built, adapted and reproduced—both in the sense of representation and repetition—exactly to the image or fraction of a second, than to focus on the issue of their concrete or illusory nature. Moreover, they allow to isolate or sort out certain qualities, such as changes in color, shape, direction or speed, which "natural" perception—i.e. non-stroboscopic perception—usually combines, as well as to reveal their possible interplays in a previously unseen way, subsequently qualified as illusory, although it is real. The motions of animated images are therefore motion *programs* put before the spectator's eyes and derived from hypotheses on the potential qualities of the moving visible spectrum. If these motions are consequently "preserved" in the series of still images that constitute its substance and its "score," the experience is yet always renewed in the present time of viewing. It is always in the making, since the mechanical synthesis and the visual and mental participation of the spectator constitute both the realization and true substance of this experience.

Illusion and shock

Whatever their system, be it experimental or mimetic, these first animated images are perceived and described as marvelous and surprising effects, because they convey that same peculiar and striking sensation to the observer, that perceptive and mental involvement in the perception of "fantastically precise" motions.

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13 Plateau expressly explained the thought process that led him from the Faraday Wheel to animated images.

Characteristically, an illusion—etymologically derived from *illudere* (to play with, to deceive), deceives of our senses and gives us the opportunity to play with them—is designed to surprise and shock us, to appear as paradoxical. Shock and astonishment are its hallmark, along with the realization that what is seen is different from, overflows or goes beyond what is really presented. Optical toys, such as the phenakistoscope and its spin-offs, allowed to really experience this contrast through the direct, physical relation between the device and the paradoxical effect it would generate. The observer, whose attention is required in quite a peculiar way, must stand still and focus one eye on the slightly luminous motion of animated graphics through the slits in the stroboscope, which occurs in the observer's visual cortex as he/she perceives it in the mirror and as his/her hand controls the projection.[14] In hindsight, focus, stillness, immersion and shock may appear as the prototype for the spectator's attachment to various types of animated images, as well as their wish to be gripped by them.

From illusions of vision to illusions of life

The names chosen by the inventors and first publishers of animated discs and their follower Émile Reynaud (from 1877 onwards, in the context of his series derived from the Praxinoscope, up until the patenting of the Lumière Cinematograph), were all based on the expression "illusion of motion," used throughout their descriptions and patents together with fantastic and magical connotations. In the same way, the declensions of the verb *to animate* are more and more frequent. This verb was increasingly used as the works focused on the reproduction of human and animal motions, initiated by Reynaud in 1877 with his Praxinoscope.[15]

While Plateau does not name his invention, it is later commercialized in England by publisher Ackermann under the name *Phantasmascope*, then as the *Fantascope*[16], whose instruction manual is titled "Fantascope or optical delusions", before being successively known as *Phénakisticope*[17] and *Phénakistiscope*, all linguistic roots referring to the notion of illusion, apparition, trickery. Stampfer gives it two names: *Stroboscopic discs*[18] *(Stroboscopische Scheiben)* and *Magical optical discs (optische Zauberscheiben)*. Besides, he also mentions *animated images (belebten Bilder)* in the description of his invention.

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14 For more information on the phenakistoscope, see also Jonathan Crary, *Techniques of the Observer*, Cambridge, MIT Press, 1990, p. 112, and Dominique Willoughby, *Le Cinéma graphique,* Paris, Textuel, 2009.

15 All of Reynaud's tapes represent human and animal actions (*praxis*), except one (*La Rosace magique*) that represents geometrical and chromatic effects.

16 From the Greek *phantasm*: apparition, vision, illusion; an image presented to the mind by an object, appearance; spectre, ghost, celestial phenomenon, and to give the appearance, the illusion of (*in* Danielle De Clercq, *Étymons grecs et latins du vocabulaire scientifique français*, Centre de documentation pour l'enseignement secondaire et supérieur, Louvain-la-Neuve, p. PCXLVII, no date).

17 A name probably invented by French publisher Giroux, from the Greek *phenakisti* (φ ε ν α κ ι ́ ζ ω), to deceive, and *scopos, scope*: the one who observes (*in* Danielle De Clercq, *Étymons grecs et latins du vocabulaire scientifique français*, Centre de documentation pour l'enseignement secondaire et supérieur, Louvain-la-Neuve, p. PCXLVII, no date).

18 From the Greek *strobos*, whirl, whirling, and *scope*.

Émile Reynaud's introductory statement to the patent of his praxinoscope (1877) indicates that "the specific aim of this invention is to create the illusion of motion using drawings that represent the successive phases of an action. Therefore, the aim is the same as Mr. Plateau's instrument […] since the well-known optical illusion will present these images as a single drawing, thus facilitating the ANIMATED ILLUSION by representing the successive phases of any action on the drawings."[19] An advertisement for the praxinoscope bears the following subhead: "Optical toy creating the illusion of motion" and the following description: "Based on a brand new optical combination, the PRAXINOSCOPE brings drawings to life, so to speak, without harming their delicacy or their color."[20] In 1880, an advertisement for the Praxinoscope-Théâtre reads as follows: "The Praxinoscope-Théâtre, through a very simple device, creates singular animated scenes, in which the illusion of relief and appealing scenery add up to the illusion of motion."[21]

Animated photographs and photographic cinema

Plateau came up with the idea of animated photographs as early as 1849,[22] idea that would then be put into practice by Reynaud.[23] In the same way, a few experiments on animated photographs were conducted throughout the 1850s and 1860s, among which Purkinje's disc generating a rotating self-portrait. However, it is the works of Muybridge and Marey which, from the late 1870s, and with the help of the increase in sensitivity and speed of photographic emulsions, initiated the chronophotographic method for the sampling at short and regular intervals of the photographed phases of animal and human movements, as well as aquatic and gaseous ones in the case of Marey. These works aimed to decompose motion, to stabilise it in successive phases, so as to analyze it and measure it in time and space. At the same time, they defined the elements of their reanimation or dynamic synthesis through devices derived from the inventions of Plateau, Stampfer and Reynaud. As early as 1880, Muybridge screened his reanimated sequential photographs with the Zoopraxiscope (or Zoogyroscope). The combination of all these inventions, synthesis of motion and chronophotographic analysis allowed Edison, and later the Lumière brothers, to design shooting and projection industrial devices, namely the Kinetograph, Kinetoscope and Cinematograph in 1894 and 1895.

The Lumière brothers' patent indicates that it is a "Device designed to shoot and watch chronophotographic prints." The description on the patent starts like this: "It is a known fact that chronophotographic prints give the illusion of

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19 "Description of an invention by Mr. Émile Reynaud [30 August 1877]", reproduced and quoted by Jacques Deslandes, *Histoire comparée du cinéma*, Tournai, Casterman, 1966, t. 1, "De la cinématique au cinématographe," p. 303-307, capitals by Reynaud.

20 Advertisement for the Praxinoscope, *ca* 1890. Collections de la Cinémathèque française, reproduced *in* Dominique Willoughby, *Le Cinéma graphique,* Paris, Textuel, 2009, p. 25.

21 Advertising sticker *ca* 1890, reproduced in Dominique Auzel, *Émile Reynaud et l'image s'anima*, Paris, Du May, 1992, p. 43.

22 "Troisième note sur des applications curieuses de la persistance des impressions de la rétine," *Bulletin de l'Académie royale des sciences de Belgique*, no. 7 in Jacques Deslandes, *Histoire comparée du cinéma*, Tournai, Casterman, 1966, t. 1, "De la cinématique au cinématographe," p. 73.

23 By using it as a model in one of praxinoscope tape entitled *L'Amazone ca* 1879, based on Muybridge's sequential photographs published in *La Nature*, and later for his animated photographs-paintings presented from 1896 to 1900 at the Grévin Museum.

motion by presenting before the observer's eyes a quick succession of photographs shot at short intervals and representing objects or characters in motion."[24] While the expression "illusion of motion" is used, the reference to the inventions by Plateau *et al.* is absent, replaced by the reference to chronophotographic prints, without further indication on their inventor, Étienne-Jules Marey.

The paradigm of the synthesis or *illusion* of motion takes on another meaning with the use of chronophotography and the development of the Cinematograph. Its applications structurally focus on the reconstitution and representation of filmed motions, through the animation or synthesis of the series of chronophotographic snapshots. In this sense, they hybridize the ontology of photography[25] (as an event optically set in the emulsion) with the entoptic paradigm of the illusion of motion, which seems better expressed in the term *animated*. The expression "animated photographs,"[26] as well as the term "animated scenes" are then frequently used to refer to photographic cinema until the early 20th century, as well as the words *animated pictures* in English or *lebende Bilder* in German. They still coexist for some time with the notion of *illusion*, before the meaning of the latter changes and gets associated with life rather than vision. The first spectators' descriptions[27] refer to "all the illusion of real life… of a marvelous truth," "life itself, motion taken from life,"[28] "this translation of life, this transfer of beings who come and go, breathe… onto the screen,"[29] "shot with such accuracy that the spectator is struck and overcome by the feeling that it is real."[30] This new illusion yet arouses mixed feelings and some hesitations. It wavers between the paradoxical impression of life—through animated images—and its spectral loss, somewhere between a pro and a con of reality, which therefore hints at the emergence of *another* (new) *reality* of visible motions.

There are strictly stroboscopic effects too, as confirmed by the recurrent criticisms on the instability, irritating shaking, tiresome flashing of the images. However, they are also considered as technical flaws that can be reduced to achieve a total, or at least more comfortable, illusion. However, one might question the link between those first impressions and their nature (noticeably permeated with stroboscopy) in the reward for the optical and mental effort required to comprehend them, as in the uncanny feeling they arouse, strengthened by their monochrome and silent—even spectral—nature, which has been observed numerous times.

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24 13 February 1895 patent, in Jacques Deslandes, *Histoire comparée du cinéma*, Tournai, Casterman, 1966, t. 1, "De la cinématique au cinématographe," p. 309.

25 *Cf.* André Bazin, "Ontologie de l'image photographique," study quoted in *Problèmes de la peinture,* [1945] in *Qu'est-ce que le cinéma ?*, Paris, Cerf, 1993. English translation: "Ontology of the photographic image," *What is Cinema?*, essays selected and translated by Hugh Gray, Oakland, University of California Press, 2004, vol. 1, p. 11-16.

26 Term suggested by astronomer Janssen at the 1895 Congrès des sociétés françaises de photographie to describe the showcased Lumière brothers' invention.

27 See the selection published by Daniel Banda and José Moure, *Le Cinéma: naissance d'un art 1895-1920*, Paris, Flammarion, 2008.

28 *Le Radical, La Poste* [30 December 1895], in Daniel Banda and José Moure, *Le Cinéma: naissance d'un art 1895-1920*, Paris, Flammarion, 2008, p. 39-41.

29 Jules Claretie, "Le spectre des vivants" [1896], in Daniel Banda and José Moure, *Le Cinéma: naissance d'un art 1895-1920*, Paris, Flammarion, 2008, p. 42.

30 Luis Gonzaga Urbina, "Le sentiment de la réalité," in Daniel Banda and José Moure, *Le Cinéma: naissance d'un art 1895-1920*, Paris, Flammarion, 2008, p. 45.

As a result, the dialectics of true and false, illusion and reality, shifts from the perceptive phenomenon of the synthesis of motion to the objective or deceitful nature of snapshots, the new touchstone of *illusion*, which paradoxically took on the meaning of *authentic reconstitution*: "Oddly, when the scene is staged, for instance when we are shown two friends arguing… or a kid stepping on a gardener's garden hose, the feeling of the real vanishes. To seem real, animated photographs have to show life as it is, rather than make it up. The smallest artifice and all illusion is lost!"[31] Animated images and cinema will still be considered as worlds of illusions and artifice, though no longer on the basis of their perceptive structure, but as forms of representation based on the artificial aspect of their construction: story, scenario, fiction, direction, performances, lighting, framing, scenery, editing. Eventually, this leads to all the quarrels about cinematic realism.

The shot or series of photograms

While from a theoretical point of view the cinematic *shot* was then ultimately regarded as a film constituent (together with its articulations in editing), as the figurative unit of the *duration of a shot*[32], thus relegating the perceptive unit of the synthesis of motion to a position of subliminal technical use, the latter immediately reappeared as a productive principle in terms of special effects and animation.

In the case of Méliès, the very first trick or special effect[33] pertains to the artificial synthesis of the shot in the sense of the "trick at a standstill" or replacement trick. The top-hole effects of sudden disappearances, appearances and transformations all rely on the discontinuous nature of the cinematic process. The aim is no longer to smooth and link the original continuous movements, but rather to surprise, amaze or throw the spectator's vision and intelligence off balance, by resorting to new uses of the original illusion of the synthesis of motion, this time in the *illusionistic* tradition of Méliès. These effects occur in the dialectic between illusion and truth, *live* and *tricked*, and only occasionally during a film, introducing breaking points or points of pseudo-continuity of the filmed subject, from one image to the next, at specific moments within the filmed continuities.

Spreading the replacement trick to almost all images of a film, Émile Cohl rediscovers the illusion or original process of synthesis of motion in 1908, with his cartoon *Fantasmagorie*, for which he designs a new frame-by-frame camera. The return of the graphic synthesis within the cinematic apparatus will result in a series of inventions ultimately leading to what is now commonly named animation, or in other words, every kind of film captured frame by frame rather than shot live. The original method is back to form a synthetic branch of cinema, which is no longer labeled "illusion" but trick (initially),

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31 Jules Claretie, "Le spectre des vivants" [1896], in Daniel Banda and José Moure, *Le Cinéma: naissance d'un art 1895-1920*, Paris, Flammarion 2008, p 43.

32 "For the first time, the image of things is also that of their duration and constitutes the 'mummy' of change." André Bazin, "Ontologie de l'image photographique" [in *Problèmes de la peinture,* 1945], in *Qu'est-ce que le cinéma ?*, Paris, Cerf, 1993, p. 14.

33 In *L'Escamotage d'une dame chez Robert Houdin*, 1896.

artifact or process allowing to build and invent the most imaginative and striking movements, thus partly reviving the original graphic tradition.[34]

The paradigm of the re-animated chronophotographic sampling, widely spread by the Cinematograph, with all its effects of "transfer of the object's reality onto its reproduction"[35] provided by the "truth" or scientific objectivity of the recording of shapes and movements, will focus the original synthesis or illusion of motion back onto the function of the isomorphic animation of shots, which will in turn be promoted to the rank of standard or essence of the apparatus, according to an analysis-synthesis symmetry. The reversal will consist in reassessing the strictly productive and synthetic functions of the first stroboscopic experiments and their former graphic forms, partly updated in Cohl's first cartoons, against this new standard, for which they are most often considered as derogatory. In this way, a dividing line is drawn between "natural" illusions or artifices, in other words the plausible reconstitution of filmed movements, and "artificial" illusions or artifices, special effects, animation, and later on experimental cinema.

Illusion, artifact, synthesis

This "naturalization" or progressive objectification of the cinematic phenomenon goes together with new developments, "one ceases to consider it as a mere attraction and starts to respect it as a fully-fledged show […]. In order to celebrate the new rites, we must now build temples"[36] such as concert halls and theaters. The projector is concealed from the spectator's eyes and ears in a booth and the idealized moving images it projects appear on the screen as distinct from any device, accompanied by musical arrangements, songs and orchestras.[37] It is also at this time that labels such as *animated photographs*, or even *Cinematograph* are replaced with the term *cinema*. The expression *illusion of motion* becomes rarer and rarer, to eventually disappear from the names and descriptions of this new type of show, as the effect of novelty fades and the projected synthesis of chronophotographs improves and becomes commonplace via *animated views* and then *cinema*. In Russia, the word *illusion*[38] at first refers to the cinema of the turn of the century, before it rapidly evolves: "The word *illusion* was neither very convenient, nor very understandable, since at the time this new and atypical show was established, its names would change every year: illusion, *bioscop, biograf, sinématograf, kinematograf,* until we found the most simple and convenient term-*kino*."[39] The latter is now considered as a particularly appealing show, based on artifacts

34 On these issues, we take the liberty of referring to our work *Le Cinéma graphique*, Paris, Textuel, 2009.

35 André Bazin, "Ontologie de l'image photographique" [in *Problèmes de la peinture,* 1945] in *Qu'est-ce que le cinéma ?*, Paris, Cerf, 1993, p. 14.

36 Jacques Deslandes and Jacques Richard, *Histoire comparée du cinéma*, Tournai, Casterman, 1968, t. 2, p. 491.

37 Remember that Émile Reynaud met these conditions as early as 1892 and until 1900 with his *Pantomimes lumineuses* exhibited at the Grévin Museum.

38 "иллюзион", *cf.* Alexandre Alexeïeff, "Reflections on motion picture animation" in *Film Culture*, no. 32, New York, Spring 1964, p. 28-29. "In Russia where I was born, the motion picture was called 'Illusion'; we used to say: 'tonight we are going to the illusion.'"

39 Leonid Utesov, "Spasibo serdce !", Moscow, Vserossijskoe teatralnoe obscestvo, 1976. [Online] http://www.lib.ru/MEMUARY/UTESOW/serdce.txt [accessed 22 July 2015]. We would like to thank Eugénie Zvonkine for this reference and her translation into French.

confined to the backstage,[40] studios and projection booths, which—with the exception of movies based on special effects—is no longer the focus of critics and spectators. They have become a *technique*, which now calls for an *art form*.[41]

However, as cinematic forms were intended to be *more artistic* and offered new possibilities in terms of construction, the peculiar nature of their founding artifact, consensually relegated to the technical field, could not go without practical, visible or sensitive consequences. As far as tricks and special effects are concerned, this nature mostly operated through the transition between images or the transfer of the technical and perceptive process of synthesis to "the illusion of the filmed," according to which it served as an illusionistic insert partaking in the exchange between realism and the fantastic. It would then constitute the fundamental technique of animation, a know-how offering multiple possibilities, despite partly evolving towards certain imitations of the filmed.

Cinematic synthesis was to be used in various ways by the avant-gardes, from the absolute films of the 1920s-1930s to the experimental films of the 1960s-1970s, following new modes and relations between duration, intermittence, synthesis, relieved of illusionistic or animation-related connotations of the filmed and the animated, breaking with the prevailing narrative and representative modes. Survage's *Rythme coloré* project (1914) was based on notions such as pure changes in and evolutions of colors and shapes. In the same way, films directed by Ruttmann, Eggeling, Richter or Fischinger in the 1920s produced visual experiences consisting of moving lines, surfaces, tonality, dimensions, directions, spaces, in a truly constructivist sense, shot image by image.

The synthetic[42] and discontinuous structure of cinema and film, the notion of interval, this time ascribed with a production value, appear in the first theories on editing (for instance in Vertov's), yet *between the shots*. The latter are sometimes limited to a few photograms in the fast-paced editing of Eisenstein and the likes, or in Len Lye's 1930s works, who relies on very short and rhythmic editing and methods such as *jump cut* or the elision of certain parts of a shot, internal elliptic cuts based on leaps, and every method effectively bringing the editing effects and theories closer to those of the frame-by-frame synthesis. During the 1950s, the production value of cinematic intervals, which Alexeïeff describes as essentially mental and calls "the other half of the film," becomes Norman McLaren's *motto*: "What happens *between* each frame is much more important than what exists *on* each frame. Animation is therefore the art of manipulating the invisible interstices that lie between

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40 On the concealment of the device in Robertson's *Fantasmagories* see also Tom Gunning, "Phantasmagoria and the Manufacturing of Illusions and Wonder: Towards a Cultural Optics of the Cinematic Apparatus", in André Gaudreault, Catherine, Russell and Pierre Veronneau (eds.), *Le Cinématographe, nouvelle technologie du XXᵉ siècle / The Cinema, A New Technology for the 20th Century*, Lausanne, Payot, 2004.

41 In 1908 in Florence, Ricciotto Canudo published *Trionfo del cinematografo*, which regards cinema as an art. Simultaneously, Le Bargy establishes the production company *Le Film d'art* and directs *L'Assassinat du Duc de Guise*.

42 In 1952, filmmaker Alexandre Alexeïeff suggests the term "synthetic film" in his article "La continuité," *L'Âge du cinéma*, no. 6, 1952.

frames."[43] Other examples can be found in works by Peter Kubelka, Robert Breer and Jonas Mekas. In the 1960s-1970s, filmmakers such as Marie Menken, Stan Brakhage, Tony Conrad, Paul Sharits, Claudine Eizykman, invest the productive aesthetic values of the discontinuous photograms series by taking on the discontinuities and intervals of the technical components of the film and screening process—light, color, focus, shapes, speed, exposure time—both during the shooting and editing. In the burst-shots of photograms, in the shooting-editing of the camera, in the metric micro-editing and the flickering films or *flickers*, the notions of motion, stillness and interval are questioned and claimed as specific to a constructive art of cinematic vision. The broadening of the technical, perceptive and aesthetic modalities of the synthesis of motion in cinematic experimentation, along with its overcoming of or indifference to the modes of fiction or illusion, are revealed in the diversity of the devices used for its presentation, which range from the frequent presence of the projector (or several projectors in the case of *expanded cinema*) with the audience, to Peter Kubelka's *invisible cinema*, which hides both the projector and the spectators, including installations and regular movie theatres.

During the 1970s-1980s, Claudine Eizykman made movies based on series of photograms merging into one another at various speeds,[44] thus proposing an intervallic model of cinema considered as the interaction between various types and series of intervals: differences between the successive images and intervals between the latter, alternation between light and obscurity, intermittent unreeling of the film. In an analysis including these experimental films, she notices during a viewing of Kubelka's *Arnulf Rainer*—which consists of a series of entirely black and white frames—that "what is felt beyond the figuration of alternating black and white frames […] confronts us with cinematic structural mobility, slight movements, outlines of lines, textures, movements, scansions resulting from the specific speed at which black and white images alternate. The series itself generates mobility. Therefore, each series of intervals […], because it is a series, produces a pure medium for mobility."[45] This model and the films based on it combine the simultaneously continuous and discontinuous, mobile and fixed dimensions of cinema, beyond their traditional oppositions, including the one between illusion and reality. They broaden the spectrum of the qualities of apparent movement and stillness of Plateau's, Stampfer's, Purkinje's pioneering experiments and works, by ensuring that the aesthetic and technical principle of cinematic synthesis remains open.

One would still need to examine how the different comprehensions of the continuous and discontinuous, fixed and mobile, nature of cinematic visuals, developed from optical toys to silver film (the latter having its own technological characteristics, such as luminous pulsing, irregular grain, discontinuous unreeling of film) would now potentially evolve according to the new conditions of the digital transformation of animated images. Although this

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43 Quoted by André Martin, in "i x i ou le cinéma de deux mains," *Cahiers du cinéma*, no. 79, Paris, January 1958, p. 6.

44 Notably *VW Vitesses Women* (1974), *cf.* [online] http://www.cinedoc.org [accessed 22 July 2015].

45 Claudine Eizykman, "Faire penser le cinéma," in Jean-Paul Aubert, Claude Bailblé, Guy Chapouillié, Claudine Eizykman, *et al.*, *Du cinéma selon Vincennes*, Paris, Lherminier, 1979, p. 176-177.

transformation retains the principle of the succession of discontinuous images before the spectator's eyes, it has obliterated the intermittent movement of the film in the camera, printer and projector, as well as the shuttering of the light beam, replacing them with other devices, from the light modulations induced by the liquid crystals of flat screens, to the high-frequency vibrations of digital projectors' micro-mirrors. The frequency spectrum or speed of analysis and synthesis of successive series of images has extended both upwards and downwards. In its compressed forms, the extremely distorted sampling leaves it to algorithmic calculation to reconstitute the missing phases, thus generating new and sometimes uncontrolled artifices. At the high end, the use of high-speed sampling and projection conveys new sensations leaving less room to intermittence and the "other half of the film" that Alexeïeff describes as "dreamed" by the spectator.[46] For the time being, the engineers and designers of algorithms also play the roles of theorists and experimenters, as the synthesis has now become a universal technique to present animated images through a variety of devices of all dimensions, in every place.

From all these perspectives, it appears that the cinematic synthesis of motion, whether in its experimental, representative, illusionistic, or animation uses, represents a specific visual field that should neither be reduced to the other visual modes, whether natural or pictorial, nor to any other illusion of vision, life or reality. The recurrent issues related to the illusory nature of cinematic visuals and animated images would be the remnants or the symptom of this difference, or in other words a kind of theoretical illusion.

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46 "We dream of the other half of the film, according to the landmarks shown by the visible half of the film," Alexandre Alexeïeff, "L'autre moitié du film," *Le Disque Vert*, no. 2, 1st year, May-June 1953, p. 73-76.