

AESTHETICS AND THE METHODS OF VISUAL ENQUIRY IN THE PHOTOGRAPHY OF ÉTIENNE-JULES MAREY

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Cultural historians have long recognized the major contributions made to cinema by the nineteenth-century French physiologist and inventor Étienne-Jules Marey. Marey's wide-ranging studies of animal locomotion brought him to develop highly sensitive instruments of measurement — graphing machines, dynamometric devices, and most significantly, an astonishing series optical arrays for use in high-speed photography. Accordingly, many cinematic genealogies underscore Marey's technical innovations but do not generally concern themselves with the aesthetic implications of the striking 'chronophotographic' images that he and his *préparateur* Georges Demeny created at the 'Station physiologique' on the outskirts of Paris in the 1880s and 1890s. For those interested in cinema history, Marey's work is often viewed as the penultimate link in the story of the invention of moving pictures, or it represents an aesthetic dead-end, a relic of nineteenth-century positivist methods of visual enquiry. Critics such as Georges Sadoul, for example, have hypothesized that Marey's unwavering frontal perspectives and synthetic deconstruction of movement directly inspired the short-lived aesthetic of Louis Lumière's 'scientific cinema', whose mode of seeing, like Marey's, is 'clearly inscribed in the image itself'.¹ Likewise, Gilles Deleuze's 'Thèses sur le mouvement' place on equal footing the 'analytical' realism that informs Marey's photographs and the Lumière brothers' moving pictures.² For Deleuze, their aesthetic production marks the nascent period of cinema before the genre was liberated by the techniques of *montage* and *travelling*.³

In stark contrast to cinema histories, Marey's studies of motion have been shown to have had a decisive influence on painting, photography, and the graphic arts. Art historians regularly cite the scientist's profound impact on both modernist and avant-garde art in the forms of French post-impressionistic painting, cubism, Italian futurism, and photodynamism. 'Ironically', Marta Braun comments, 'his imagery, so grounded in positivism and so rigorously analytical, served those very artists who vociferously rejected positivism and its claims to a higher

¹ Georges Sadoul, *Le Cinéma français (1890–1962)* (Paris: Flammarion, 1962), p. 15.

² Gilles Deleuze, 'Thèses sur le mouvement: premier commentaire de Bergson', in *Cinéma*, 1: *L'Image mouvement* (Paris: Minuit, 1983), p. 4.

³ 'L'évolution du cinéma, la conquête de sa propre essence ou nouveauté, se fera par le montage, la caméra mobile, et l'émancipation de la prise de vue qui se sépare de la projection' (*ibid.*, p. 3).

form of knowledge.⁴ For this group, Marey's images might represent a visual rhetoric of modernity.

Why did these very same chronophotographic images come to be seen as synonymous with the historical avant-garde's pictorial canon, while simultaneously being marginalized as an ephemeral vein of scientific naturalism in cinema? On one hand, avant-garde art frames its consecration of speed, time, and movement as a clever *détournement* of the unconscious aesthetic of bourgeois science. On the other hand, cinema, from Georges Méliès onward, endows the technologically determined object with a 'soul' through the notions of auteurism and technical intentionality. Thus, in the case of the former, science and technology might be seen to become the object of an aestheticization, and, in that of the latter, of a kind of fetishism. But what of the aesthetic assumptions held by the inventors and technicians who created these things in the name of science?

In the quest to understand the place that chronophotography holds in the history of art, one important perspective has been frequently overlooked: that of Marey himself. This is not such an easy problem to unravel, as the physiologist demonstrated a general unwillingness to frame the body of his work in the context of the aesthetic debates of the day, even when promoting the unprecedented accuracy of his photographic studies to artists. As will become clear, part of Marey's reluctance can be attributed to his desire to insulate his scientific claims from the murky cultural questions of art. Still, it is difficult to understand how the scientist might have remained so distant from the aesthetic implications of his own work. Why did he disqualify himself from any aesthetic expertise, even in his pronouncements on the potential artistic applications of chronophotography?⁵ And why was he so insistent that his method might be limited in its usefulness to correcting inaccuracies in the fixed poses of traditional sculptural or painterly representations?

If it is impossible to extrapolate from Marey's vast body of work a conventional system of judgement on matters of beauty of taste, we might ask if a Mareysian aesthetics emerges nonetheless from the framing of scientific purpose as a function of an idealized optics. Marey's insistence on the inherent legibility of his graphic method signals an important shift in the scientific understanding of visual phenomena, but also that of visual culture. In the nineteenth century, what these fields hold in common is an underlying belief that knowledge (whether it be experiential or transcendental) might be immanent in the image itself. The shared fascination with the nineteenth-century machine cult, with the aestheticization of techniques, and the 'constructivist and productivist attitudes' towards modern visual experience, drew artist and scientist alike towards a profound belief in a kind of revelatory aesthetics.⁶ Marey was one of the first proselytizers of the idea that

⁴ Marta Braun, *Picturing Time: The Work of Étienne-Jules Marey (1830–1904)* (Chicago: University of Chicago Press, 1992), p. 277.

⁵ For example, when he writes: 'nous ne sommes pas qualifiés pour parler ici d'esthétique'; Étienne-Jules Marey, *Le Mouvement* (Paris: G. Masson, 1894), p. 165.

⁶ Such attitudes are the subject of Andreas Huyssen's *After the Great Divide: Modernism, Mass Culture, Postmodernism* (Bloomington: Indiana University Press, 1986), p. 9.

new forms of data were emerging that were made immediately knowable by groundbreaking technologies such as his own. This perspective serves to collapse the categories of the expert and novice; it also points to a profound co-mingling of disciplines and epistemological categories.

Marey's desire to produce a kind of spectacular knowledge, whose principles are founded in the immediacy and immanence of its own visual production, intersects with the cultural field in ways that reveal a shared set of representational problems. Chronophotography, we know, was caught up in a polemic that wasn't all that dissimilar from the debates that raged in the cultural field over the subjects of verisimilitude and realism.⁷ While experts at the Académie de médecine and the Académie des sciences may have ostensibly quarrelled over modelization practices and the opticokinetic limits of the human eye, they were also asking a larger question about forms and the truths they might impart about the world.

Beset by critics and hostile colleagues who questioned the scientific validity of his experiments, Marey obsessively compartmentalized various aspects of his experimental regime, seeking at first to maintain the integrity of his science by isolating it from questions of art and aesthetics. Yet to reprise these debates and the framing discourses that the physiologist invented to explain and justify his endeavour is to reveal the extent to which the highly aestheticized image of the male nude in motion stands problematically at the nexus of the empirical and the aesthetic, of science and art. In what follows, I would like to revisit Marey's work in order to assess the extent to which his chronophotographic method might actually be informed by aesthetic canons, and in turn to ask what effect these might have had on his scientific project. In what ways, for example, does Marey's science rely on unstated aesthetic assumptions, and how do these assumptions relate to the analytical aspirations of the inventor? To what extent is his scientific project dependent upon or conflicted by these canons?

In this, the present essay builds on the scholarship of researchers such as Marta Braun, Thierry Lefebvre, and Laurent Mannoni, whose work has been instrumental in contextualizing Marey's science. I am specifically indebted to Braun's meticulous restitution of Marey's process of invention and, ultimately, of the litany of technical difficulties that he encountered when trying to perfect his camera. From Lefebvre and Mannoni, I reprise elements of their compelling assessment of Marey's scientific project and recreation of the academic debates in which the physiologist became embroiled as his theoretical assertions were confronted with the data set produced by his instruments. Indeed, I would like to use these perspectives to test the idea that the larger methodological and technical difficulties that Marey encountered in his quest to reveal the invisible mechanisms of biomechanics might point to the intervention of a deeply aestheticized ordering of bodies. 'Il n'est rien qui puisse échapper aux moyens d'analyse dont nous

⁷ French realism, Lawrence Schehr reminds us, was driven by the 'need to record and preserve the surrounding phenomena of the real and its causes'; Lawrence Schehr, *Subversions of Verisimilitude: Reading Narrative from Balzac to Sartre* (New York: Fordham University Press, 2009), p. 4.

disposons', boasts Marey in the Introduction to his 1873 *La Machine animale*.⁸ Yet, when considered through the lens of his high-speed cameras, does the Mareysian body reveal itself to be the source of objective knowledge, or the site of a beautiful unveiling?

Marey's language of movement

In his 'Salon de 1859', the poet and essayist Charles Baudelaire famously mocked the public's fascination with photography: "Puisque la photographie nous donne toutes les garanties désirables d'exactitude (ils croient cela, les insensés!), l'art, c'est la photographie." À partir de ce moment', Baudelaire continues in his own voice, 'la société immonde se rua, comme un seul Narcisse, pour contempler sa triviale image sur le métal'.⁹ It is unlikely that Marey would have been ruffled by Baudelaire's call to consign photography to the archival, to reportage, and to the mnemonic, as his early studies of animal dynamics are devoid of aesthetic claims. Rather, Marey saw his photographic apparatus as belonging to a class of recording and graphing instruments that he and fellow physiologists were developing to measure bodily phenomena. Thus, his project seems to fall well within the boundaries of the strictly utilitarian possibilities of photography. Moreover, if the events that Marey undertook to observe were not germane to debates on natural vision, it was because, as the scientist would point out, they were already outside of its purview: either they were internal functions or, in the case of movement, happened too quickly and were too complex to analyse without technological intervention and methods of interposed observation.¹⁰ In his 1878 *Méthode graphique*, Marey underscores the necessity of overcoming these impediments: 'La science a devant elle deux obstacles qui entravent sa marche: c'est d'abord la déféctuosité de nos sens pour découvrir les vérités, et puis l'insuffisance du langage pour exprimer et pour transmettre celles que nous avons acquises'.¹¹

Marey believed that chronophotography solved this twofold dilemma: not only did it correct natural vision, but it also transformed phenomena into a transparent graphic system, evoking what Deleuze might call a 'pure semiotics', that is, a kind of 'pre-verbal intelligible content' that Marey argued was a natural product of the chronophotographic process.¹² Indeed, the inventor promoted his devices for

⁸ Marey, Introduction to *La Machine animale: locomotion terrestre et aérienne* (Paris: Librairie Germer Baillière, 1873), pp. v–x (p. ix).

⁹ Charles Baudelaire, 'Salon de 1859', in *Œuvres complètes*, ed. by Claude Pichois, 2 vols (Paris: Gallimard, 1975–76), II (1976), p. 617.

¹⁰ In effect, Marey is claiming to extend the limits of natural vision beyond what was possible for the preceding generation of photographers and, in doing so, to free the viewer from conventional modes of seeing. This perspective, as Jonathan Crary underlines, was mainly dependent on "naturalistic" pictorial codes: 'Photographs seemed to be a continuation of older "naturalistic" pictorial codes, but only because their dominant conventions were restricted to a narrow range of technical possibilities (that is, shutter speed and lens openings that rendered elapsed time invisible and recorded objects in focus)'; Jonathan Crary, *Techniques of the Observer: On Vision and Modernity in the Nineteenth Century* (Cambridge, MA: MIT Press, 1992), pp. 135–36.

¹¹ Marey, *La Méthode graphique dans les sciences expérimentales et principalement en physiologie et en médecine* (Paris: G. Masson, 1878), p. ii.

¹² In the preface to the English edition, Deleuze identifies this 'pre-verbal intelligible content' with the nature of cinema; Gilles Deleuze, Preface to *Cinema, 1: The Movement-Image*, trans. by Hugh Tomlinson and Barbara Habberjam (London: Athlone Press, 1986), pp. ix–x (p. ix).

their capacity to transcribe animal biometrics into a succinct visible language that he recalls in these terms in his 1894 treatise on movement:

Autant le langage est lent et obscur quand il s'agit d'exprimer des rapports de durée et de succession, autant la représentation graphique est claire et facile; c'est vraiment l'expression naturelle de ces rapports. En outre, les notions que nous donne ce genre de représentation s'adressent à la mémoire des yeux qui est ordinairement la plus fidèle.¹³

For Marey, animal dynamics thus represented a set of larger visual and linguistic problems that photography was destined to solve. His claim to detect and convey the true nature of phenomena stemmed from his camera's ability to arrest movement by isolating the 'infinitely small' slivers of time when bodies in motion occupy a given space.¹⁴ In the groundbreaking *Vol des oiseaux* (1890), the scientist contends: 'Avec la chronophotographie les infiniment petits du temps n'échappent pas à nos investigations. [...] Elle représente ainsi l'animal dans ses différentes attitudes et dans les différentes lieux de l'espace qu'il occupait à des instants connus.'¹⁵ The foundational concept of Marey's natural language of movement is based on the idea that these infinitely divisible slices of time-space constitute an equally infinite number of unambiguous signifying agents, which he calls 'les instants visibles' or 'positions of visibility'.¹⁶ For Marey, then, the notion of a pictorial language is not metaphorical but a tangible and objective product of chronophotography.

Yet if the scientist's inscriptions of juxtaposed bodies in motion can be imagined to make up the transparent signs of his visual language, so the relational system imposed by the photographic apparatus — its grammar — never ceases to be a problem for the physiologist.¹⁷ Here Marey wasn't so much concerned with the idea that the body subjected to his camera's strict visual regiment was perhaps overdetermined by the technology that produced it — that, in other words, the subject had become nothing more the privileged object onto which technology was projected. He was concerned by the idea that this projection might, in fact, produce something utterly unintelligible. In an 1886 letter written to Demenÿ from his winter home in Naples, Marey comments on the difficulty he continued to encounter in deciphering the chronophotographs his *préparateur* would regularly forward from Paris: 'J'ai collé et classé les photographies de squelettes et je les regarde avec plus d'intérêt que de succès; jusqu'à ici, je ne conclus pas grand-chose.'¹⁸

¹³ Marey, *Le Mouvement*, p. 2.

¹⁴ By juxtaposing successive images, one might hope to 'forcer la lecture des phénomènes vivants' which had been previously invisible to the naked eye; Michel Frizot, *É.-J. Marey, 1830/1904: la photographie du mouvement* (Paris: Centre Georges Pompidou, Bellamy et Martet, 1977), p. 25.

¹⁵ Marey, *Le Vol des oiseaux* (Paris: G. Masson, 1890), pp. x–xi.

¹⁶ Marey, *Le Mouvement*, p. 174. 'Positions of visibility' is the term chosen by Marey's original translator, Eric Pritchard: E.-J. Marey, *Movement*, trans. by Eric Pritchard (London: William Heinemann, 1895), p. 177.

¹⁷ As Braun explains, Marey's camera was designed to divide movement into precise segments. His fixed plate camera, for example, 'functioned precisely because each new location of the subject in space was captured on a new location on the plate: the shutter was left open for the duration of the movement, and as the subject crossed the black stage it was frozen into precise segments by the rotating slotted-disk shutter' (*Picturing Time*, p. 46).

¹⁸ Marey, *Lettres d'Étienne-Jules Marey à Georges Demenÿ, 1880–1894*, ed. by Thierry Lefebvre, Jacques Malhête, and Laurent Mannoni (Paris: Association française de recherche sur l'histoire du cinéma, 1999), 9 December 1886, p. 203.

The ‘skeleton’ series (Figure 1), produced by placing white strips and silver buttons along the appendages of a model draped in bodysuit of black velour, are an anomaly in the corpus, as they fall into a surprisingly small group of images for which Marey would eventually propose a detailed biometric reading. In this case, they become one of the centrepieces of his hypothesis concerning the muscular forces employed in jumping, running, and walking.

The skeleton series notwithstanding, Marey was discovering that technical inconsistencies plaguing his project continued to undermine the very principles he proposed for the structuring of visual phenomena. In a study that accompanies the edition of Marey’s correspondence, Lefebvre resituates the physiologist’s impact more in terms of genius *bricoleur* than groundbreaking scientist:

Car la chronophotographie — comprenons-le bien —, ce n’est déjà plus de la science, quoi qu’en dise son concepteur pour justifier son financement. Cette machine à explorer l’indicible opère chez Marey comme une révélation au sens pratiquement métaphysique du terme. [...] Il assoit une réputation liée à sa démarche originale plutôt qu’aux résultats effectivement produits.¹⁹

Marey’s *bricolage* is nowhere more apparent or more significant than in his efforts to perfect his apparatus. From 1881, when he began to develop his photographic rifle for capturing the movement of birds in flight, the physiologist worked exhaustingly to solve the technical problems associated with measuring visual phenomena. Barriers to interpretation were numerous and varied, but many of his setbacks came from inconsistencies stemming from the timing mechanism of his camera, which made it difficult to distinguish with mathematical certainty the successive phases of an action. These difficulties are evident even in his most advanced cameras such as the 1891 *chronophotographe à double usage*, which accepted both fixed-plate and moving film. In March of 1891, Marey writes to Demenÿ:

Je vous autorise à faire paraître la série des escrimeurs à la canne qui n’est pas mauvaise, mais arrêtez-vous, car je ne voudrais pas épuiser l’intérêt de ces études et voudrais publier les épreuves du nouvel appareil qui s’annoncent supérieures à tous égards. Malheureusement je n’arrive pas pour toutes les vitesses à avoir des intervalles rigoureusement égaux entre les images. Ma préoccupation principale est de les empêcher de chevaucher.²⁰

As Mannoni has painstakingly documented, Marey’s colleagues had been quick to signal these and other problems in his method.²¹ In 1883, the same year as the skeleton series, Félix Giraud-Teulon, author of the influential *Principes de mécanique animale, ou Étude de la locomotion chez l’homme et chez les animaux vertébrés* (1858), pointed out major discrepancies between the graphic analysis of figures running and their corresponding chronophotographs. For Mannoni, many of these criticisms might be attributed to internecine rivalries brought on by scientists

¹⁹ Thierry Lefebvre, ‘La Chronophotographie à l’aune des médias’, in Marey, *Lettres*, ed. by Lefebvre, Malthête, and Mannoni, pp. 17–27 (pp. 22–23).

²⁰ Marey, *Lettres*, 16 March 1891, p. 331.

²¹ See, for example, the section ‘Nouvelles Polémiques sur la machine animale’, in Laurent Mannoni, *Étienne-Jules Marey: la mémoire de l’œil* (Paris: Cinémathèque française, 1999), pp. 196–202.

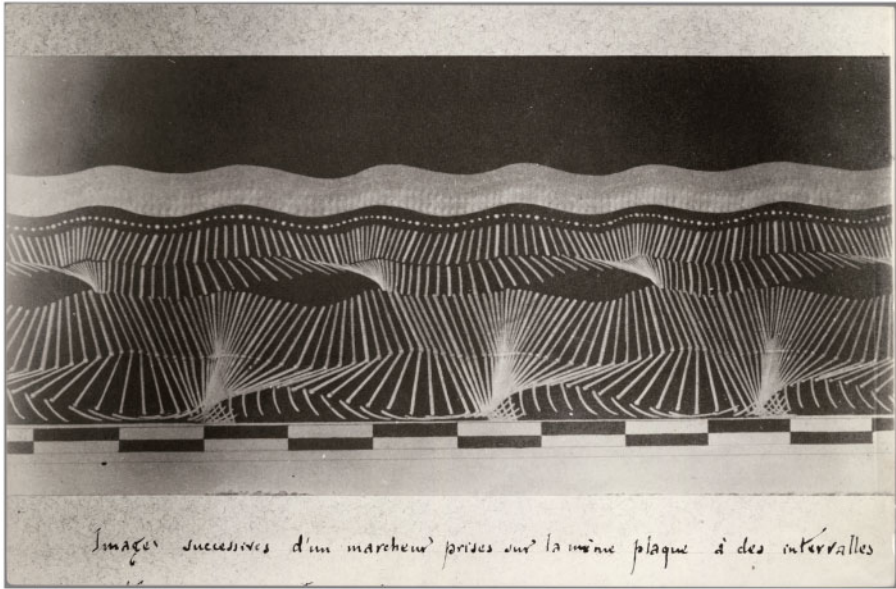


Figure 1 Étienne-Jules Marey, *Marche: schémas géométriques*, 1883. Cinémathèque française (Paris).

whose approaches had been superseded by the advent of the graphic method.²² Yet if the work of Marey's critics was condemned to obsolescence, that of Marey, Braun reminds us, could only approximate the revolution that was underway: 'Although in May he wrote to Demeny [*sic*] that he believed he had found "the solution for a perfect camera which will make equidistant images"', it seems that the ideal instrument remained just beyond his reach.²³

Ultimately, Marey was forced to retract many of the discoveries he had attributed to his photographic method, namely his capacity to derive from it a general dynamic theory of bodies in three-dimensional space. In a letter to Demeny, written at the height of the *affaire*, Marey describes the main lines of the public defence he would present at the Académie de médecine:

Je ne donnerai pas de théorie de la locomotion, voulant seulement montrer les méthodes employées et donner une idée de leur précision; de cette manière, j'espère clore la discussion et me donner tout le temps d'étudier avec vous tranquillement tout ce qui est à notre programme.²⁴

²² 'Giraud-Teulon, comme Beau et Colin, a vu émerger avec inquiétude ou hostilité la méthode graphique, seule apte à enregistrer très précisément des mouvements rapides ou invisibles' (Mannoni, *Étienne-Jules Marey: la mémoire de l'œil*, p. 196).

²³ Braun, *Picturing Time*, p. 170.

²⁴ Marey, *Lettres*, 13 September 1883, p. 105. Marey's presentation, given at the Académie de médecine, took place on 25 September 1883.

His official pronouncement is equally unambiguous: ‘Oui, l’article que j’ai publié dans la *Machine animale* serait tout à fait insuffisant, même pour constituer une définition didactique de la locomotion humaine.’²⁵

An aesthetics of discovery

Beset by technical problems that called into question chronophotography’s value to science, Marey appears to have been no less at ease with the aesthetic import of his invention. A vast number of chronophotographs that do not lend themselves to detailed scientific analysis, such as the many series of ‘Draperies’ or ‘Cavalier arabe’, to name two examples, were made but subsequently excluded from his scientific work; when such images figure into his public pronouncements on art, as they do in the important chapter in *Mouvement* dedicated to the ‘Locomotion de l’homme au point de vue artistique’, Marey rules out the notion that these images might have an independent aesthetic value, seeing them instead as models for the production of Académies, figural studies produced by aspiring artists with the aim of mastering form and perspective.²⁶

The scientist’s position on the aesthetic value of his work was long in the making. When, in 1885, the famous porcelain manufacture at Sèvres enquired about obtaining chronophotographic proofs, Marey dismisses the idea of reproducing his images, suggesting instead that they serve only as a demonstration of the technology’s potential. He voices these concerns in a letter to Demenÿ: ‘On me demande de la Manufacture de Sèvres des épreuves photographiques artistiques. Avez-vous quelque chose? Les étoffes flottantes les intéresseraient peut-être, non qu’elles soient à reproduire mais pour leur donner l’espérance de succès futurs et prochains.’²⁷ Likewise, when Demenÿ is approached in the same year by the editor Goupil with what appears to be an offer to publish an album for artists, Marey again hesitates to release his work: ‘Quant à la proposition Goupil, on peut attendre mon retour, car nous n’avons pas encore à offrir aux artistes tout ce que je rêve pour eux.’²⁸

Always quick to encourage his entourage to ‘saisir toutes les occasions de faire connaître ce qu’on fait à la Station’, here one has to wonder why Marey is so reluctant to satisfy popular demand for chronophotography.²⁹ This attitude is, after all, quite unlike those exhibited by scientific contemporaries such as Demenÿ and the medical photographer Albert Londe, who enthusiastically embrace the commercial potential of the technology. Both Demenÿ’s efforts to develop his talking-picture phonoscope and Londe’s fascination with the acrobats of the Hippodrome and tightrope walkers of the Nouveau Cirque point to the rapid transfer of

²⁵ Marey, *Lettres*, p. 107, n. 4.

²⁶ Marey is especially concerned with harmonizing the uncanny effects of chronophotography with existing aesthetic canons: ‘Dans l’infinie variété des attitudes que montre la Chronophotographie suivant les phases d’un mouvement, il en est certainement plusieurs que les artistes pourraient accepter sans enfreindre les lois de l’esthétique’ (*Le Mouvement*, p. 168).

²⁷ Marey, *Lettres*, 1 July [1885], p. 155.

²⁸ Marey, *Lettres*, 13 January 1885, p. 146.

²⁹ Marey, *Lettres*, 13 January 1885, p. 145.

scientific technology to the realm of art and popular entertainment.³⁰ As concerns Marey, his publications on the subject consistently demonstrate that his interest in artistic photography is mostly limited to the correction of pictorial inaccuracies brought about by the deficiencies of natural vision:

Le physiologiste familiarisé avec la succession des mouvements de la locomotion humaine éprouve parfois, devant certaines représentations artistiques de marcheurs ou de coureurs, une fâcheuse impression. C'est quelque chose d'analogue à ce qu'on ressent devant les paysages peints à une époque où les lois de la perspective étaient moins observées qu'aujourd'hui. On s'explique la difficulté que doivent éprouver les artistes à représenter l'homme et les animaux en action, quand on sait que les observateurs les plus exercés se déclarent incapables de saisir les phases successives des mouvements de la locomotion. À ce titre, la photochronographie semble appelée à rendre des services aux Arts comme à la Science, puisqu'elle analyse les mouvements les plus rapides et les plus compliqués.³¹

Neither his scientific publications nor his personal correspondence provide any definitive clues as to the nature of his dream for the art community.³² Ultimately, it is not until 1893 that Marey and Demeny finally release one short fascicule destined for artists, the eight-page *Études de physiologie artistique faites au moyen de la Chronophotographie*.³³ The *Études* were initially planned as a multi-volume series containing 'peu de texte et beaucoup de figures'.³⁴ It is likely its makers thought to broaden the range of movement studies currently available to the public and thus to rival Eadweard Muybridge's famous *Animal Locomotion* of 1881, which assembled many of the Englishman's images of equine kinesis.³⁵

Surprisingly, an inspection of the *Études* reveals a collection of chronophotographs that fails to incorporate most of the images whose aesthetic character had previously been determined, images such as the draperies or the Arab horseman series. Instead, the book's contents reveal a newly restricted and far more rigorously defined set of studies — notably those depicting male subjects performing acts of work. Why might Marey eschew the very images that he had previously identified as 'artistic' in favour of those that had been specifically attached to the

³⁰ Tom Gunning writes of Mlle Barenco's tightrope act that 'the sequence also anticipates the strong link that early cinema, as a popular art, will forge with vaudeville, circus and the attractions of popular culture'; Tom Gunning, 'In Your Face: Physiognomy, Photography, and the Gnostic Mission of Early Film', *Modernism/Modernity*, 4 (1997), 1–29 (p. 17).

³¹ Marey, 'Représentations des attitudes de la locomotion humaine au moyen des figures en relief', *Comptes rendus des séances de l'Académie des sciences*, 106 (1888), 1634–36 (p. 1636).

³² Marey was, however, keenly interested in collaborating with individual artists in order further his scientific project. He ardently sought to produce models that could point to the experimental import of his pictorial findings. In 1887 he helped Georges Engrand produce a sculptural figure of a single phase of the run and in the same year worked with an Italian art caster to create a series of three-dimensional sculptures depicting the flight of a pigeon.

³³ *Études* is divided into six *planches* as follows: I. *Un coup de bâton* (eighteen images); II. 'Agrandissement des nos 4 et 13 d'un coup de bâton' (two images); III. *Lancer et recevoir un boulet* (twenty-one images); IV. *Efforts successifs de traction* (fifteen images); 'Images successives d'un même sujet (Chronophotographe sur plaque fixe)'; V. *La Marche* and *La Course rapide* (two images, 1 × 5 and 1 × 4); VI. 'Agrandissement de la quatrième planche', *Traction* (two images).

³⁴ Marey, *Lettres*, 28 November 1890, p. 296.

³⁵ Braun notes that 'Demeny [*sic*] was responsible for preparing the portfolio for the publisher, and it is clear that he wanted to capitalize on the market for Muybridge's early work', suggesting at one point that they employ Muybridge's title, a proposition that Marey would reject (*Picturing Time*, p. 268).

scientific project?³⁶ Might the answer lie not in Marey's refusal of any expertise on most things artistic but rather in his struggles to propose a viable accounting of animal kinetics?

In the years since its inauguration, the Station physiologique had become the privileged site of a clamorous parade of bodies at work: athletes running and jumping, infantrymen conducting drills, and tradesmen (house-painters, blacksmiths, sawyers, and delivery men), all performing on Marey's velvet-lined stage. The resulting archive of images was designed to reveal and measure the conventional gestures of these professions and, in doing so, to determine, as Marey would boldly claim, 'la série des actes qui se produisent dans la locomotion humaine avec ses différents types [. . .], mesurer le travail dépensé, afin de chercher les conditions les plus favorables à l'utilisation du travail'.³⁷ Yet if Marey's images ostensibly document these acts of labour, the corresponding body of research remains persistently speculative.

For example, in this roughly contemporaneous image (see [Figure 2](#)), a naked man, seen from behind, can be observed holding a rope that is affixed to a large block that rests on the stage of the Station physiologique. Sunlight streams in from the top of the scene on the left to illuminate the man's pronounced musculature. In the first few images, the man elongates his body, plants his left foot behind his right, and leans forcefully away from the mass. Next he lifts his right foot to spread the leg wide and drop his hips, taking a powerful, low stance. The shadows that outline the muscles in the forward arm and leg grow deeper, lending a sense of anticipation and drama to the act. And yet the impression of work, of the action and effort that the body is to impart as scientific data, is brought into question by the very gestures whose truthfulness the apparatus proposes to reveal. Neither does the athlete displace the block nor is the experiment designed to measure the force exerted through the rope on the object.

In the end, this image makes obvious something altogether different from the exactitude and specificity of pulling a block: the scientific usefulness of these gestures is less important than the *possibility of discourse* that Marey's technology is able to produce about them. In the scientific materials that frame such images, the physiologist almost invariably fails to calculate work in the manner prescribed by his discipline, that is, as the result of the measurement of force operating through a distance whereby energy is transferred from one system to another (for example, from a subject to an object being pulled). This suggests that Marey's model is decidedly less an experimental proof of work than it is an evocation of its aesthetic canons. His image effectively says, 'This is what pulling on a rope should look like.' Indeed, the image has less in common with the scientific studies of his peers than it does with the *académies* of the classically trained artists whose products he was intent on correcting. This might explain why, in his initial efforts to produce

³⁶ Marey instructs Demeny to reprise images depicting acts of labour: 'Il serait bon de refaire quelques unes de nos anciennes attitudes', he writes in letter of 23 July 1892, suggesting several series including 'l'homme qui tire sur une câble, la pelle, la pioche, l'acte de soulever un sac pesant', and others (*Lettres*, p. 400).

³⁷ Marey, 'La Station physiologique de Paris', *La Nature*, 31 December 1883, p. 226–30 (p. 228).



Figure 2 Étienne-Jules Marey and Georges Demenÿ, *Athlète nu tirant un bloc à l'aide d'une corde*, c. 1892. Collège de France (Paris).

his booklet destined for artists, Marey instinctively turns towards images of labour that had been originally produced in the name of science. In fact, the closely related series depicting *Efforts successifs de traction* (Figure 3), which constitutes the centrepiece of the *Études*, points to the archetypal nature of Marey's representations of work, for these images owe an unmistakable debt to academic studies such as Théodore Géricault's *Étude de nu, homme tirant sur une corde* (Figure 4).

It is of no small consequence that the images of Marey's newly conceived aesthetics of work might echo, mimic, or reiterate those that his laboratory was producing within the framework of its scientific experiments. Indeed, these images give us ample reason to view his book on art as response to the dilemma of interpretation that had plagued the scientific project from its inception.³⁸ Here we might recall that Marey's experiments, while technically spectacular, are mostly indecipherable in scientific terms; they are incapable of precisely quantifying the physiological phenomena that they were designed to reveal. If the *Études* demonstrate anything, it is that Marey's science shows itself to be, in large measure, a *mise-en-scène* of scientific epistemology, an aesthetics of discovery.

It is perhaps not surprising that the physiologist's most candid acknowledgement of the difficulties of his method's empirical assumptions might actually be found in his pronouncements on art. This is why his development of a chronophotographic aesthetic is no longer of ancillary interest but, in fact, might be read as the linchpin of any reading of the scientific programme. From the serpentine oscillations of the skeleton series to the stylized images of labour, Marey's science and (unintended) art gesture, mirror-like, towards one another as a kind of mutually affirming projection. To press home this point, consider the manner in which Marey addresses potential artistic applications for chronophotography while commenting on the uncanny feelings his images elicit in viewers. In *Le Mouvement*, Marey contends that although the bizarreness of his images may initially make them appear ugly, this is only because the uninitiated have not yet recognized the 'truth' of their revelation:

Qu'est-ce à dire? Le laid ne serait-il que l'inconnu, et la vérité blesserait-elle nos regards quand nous la voyons pour la première fois? [...] Mais peu à peu il s'est familiarisé avec ces images qui circulaient dans toutes les mains; elles ont appris à trouver sur la Nature des attitudes qu'on ne savait pas voir; on est déjà presque froissé d'une incorrection légère dans la représentation

³⁸ On the difficulties he encountered in understanding work as a function of an organism's capacity for displacement, see Marey, *Le Mouvement*, pp. 148–60.

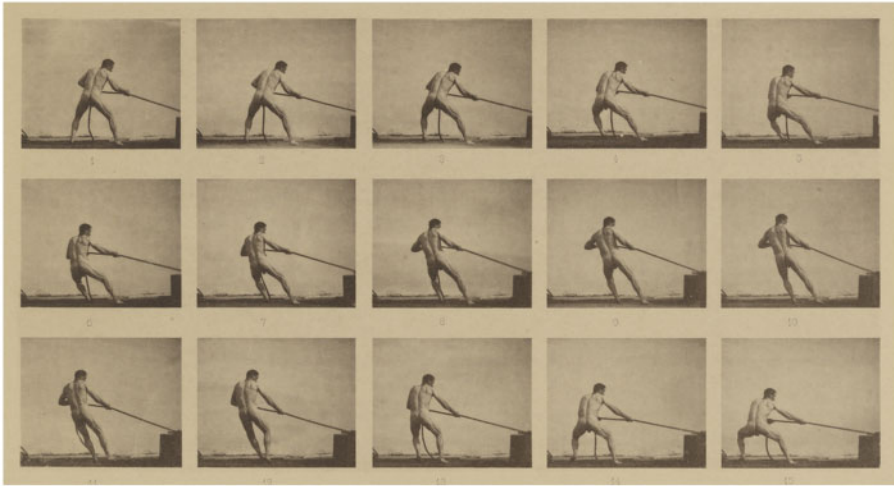


Figure 3 Étienne-Jules Marey, *Efforts successifs de traction*, 1893. J. Paul Getty Museum (Los Angeles).

du Cheval en mouvement. [...] Jusqu'où ira cette éducation de l'œil? Quelle influence aura-t-elle sur l'Art? L'avenir seul le montrera.³⁹

Here Marey is gesturing towards an aesthetics of fleetingness that at first glance appears to have more in common with modernism and its cultural forms than it does with the academic-minded conceptions of art that the physiologist had championed throughout his career.⁴⁰ His is a nod to the ephemeral, to the radical erosion of pictorial unity, to the new modes of conceiving spatial and temporal continuity and division. Yet in this nod Marey conflates his principal claim to scientific knowledge with his fundamental aesthetic assertion, as both of these things require that the uncanny effects produced by his apparatus be domesticated through the retraining of the eye. This is the great irony of his work: it is at the moments when chronophotography most clearly points to the kinematic, to the revelation of motion considered abstractly, that Marey rigorously reaffirms an aesthetics of immobility and of total visibility. Nowhere are these tactics of conflation more evident than in his postulation of 'positions of visibility'.

From positions of visibility to an inscrutable optics

In several images, such as *Un coup d'épée* and *Escrime* (Figure 5), produced at the Station physiologique in the early 1890s, Marey seeks to reconcile what were

³⁹ Marey, *Le Mouvement*, p. 179.

⁴⁰ See, for example, Baudelaire in 'Le Peintre de la vie moderne' (1863) where the author touts an aesthetics of 'le transitoire, le fugitif, le contingent'; *Œuvres complètes*, II, 683–724 (p. 695). In the end, Baudelaire's *flâneur* (the withdrawn, chameleon-like observer who wandered the streets of the metropolis) is not so different from Marey's all-seeing camera in the sense that the *flâneur* incarnates the desire for a kind of ideal transparency, a fantasy about seeing completely a world in motion: 'Si une mode, une coupe de vêtement a été légèrement transformée [...] croyez qu'à une distance énorme son œil d'aigle l'a déjà deviné' ('Le Peintre de la vie moderne', *Œuvres complètes*, II, 693).



Figure 4 Théodore Géricault, *Étude de nu, homme tirant sur une corde*, c. 1816. Musée Bonnat (Bayonne).

resolutely ambiguous visual findings with his belief that all life processes fit into a general theory of energy that governs bodies in motion:

De même qu'une machine en marche ne laisse voir certains de ses organes qu'aux points morts, c'est-à-dire à ces courts instants où le mouvement s'achève dans un sens, et va recommencer en

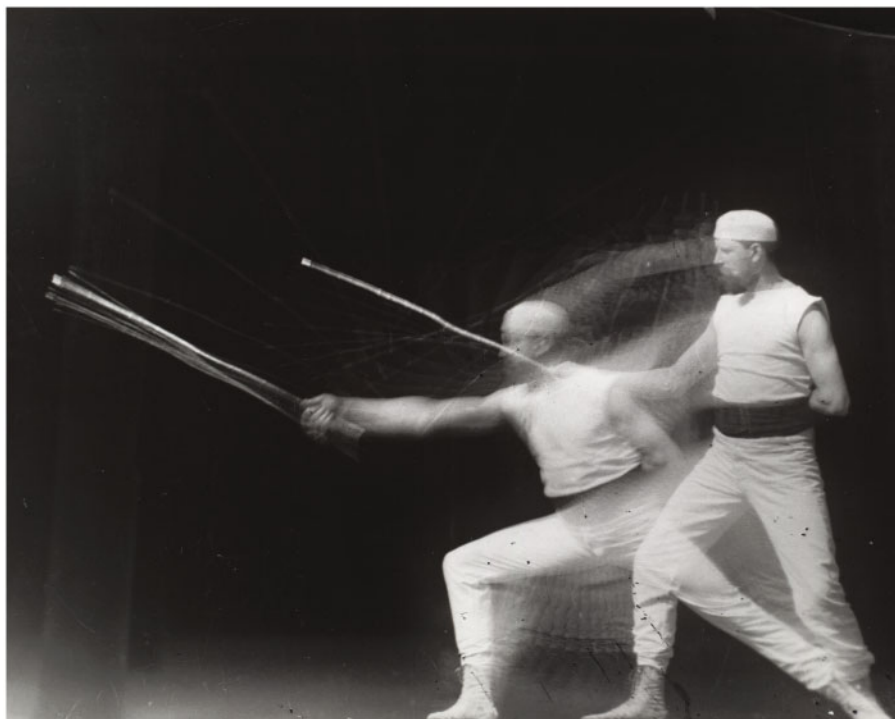


Figure 5 Marey, *Escrime*, c. 1894. Cinémathèque française (Paris).

sens contraire, de même dans certains actes de l'Homme, il y a des attitudes qui durent plus longtemps que d'autres. Or la Chronophotographie sur plaque fixe pourrait servir à les déterminer.⁴¹

It is of no small consequence that such images were representative of those that Marey chose to include both in his scientific corpus and in his book of art photography.⁴² Where the chronophotograph's blurred transitional phases made it impossible to calculate accurately the forces expended in producing movement, Marey's 'positions of visibility' serve to recuperate these images for scientific use by revealing a privileged aesthetic moment that is derived from the universal laws of mechanics. These moments occur at the extremities of range when the body is temporarily at rest (here, for example, at the beginning and end of the fencer's lunge). In Marey's conception, the apparatus becomes the site of a visual nexus of matter and energy of the kind that Anson Rabinbach describes in his historical account of thermodynamics and the changes it brought about in nineteenth-century conceptions of matter: 'Materialism was transformed into a theory of energy in

⁴¹ Marey, *Le Mouvement*, p. 173.

⁴² Namely in the eighteen images of *Un coup de bâton* that make up the first *planche* of the *Études*.

which matter and force were inseparable. The concept of energy provided nature with a transcendental principle of motion.⁴³ If the precise relationship between matter and energy would remain elusive in Marey's system, chronophotography would at least make visible this 'transcendental principle'.

The aesthetic practices that underlie Marey's positions of visibility may very well be useful to the academic artist in search of isolated poses or to the physiologist interested in grasping the range of motion employed in a given gesture. Nonetheless Marey's theory perpetuates a logical fallacy that undermines the scientific agenda of the chronophotographic endeavour. By identifying points where bodies in motion are momentarily at rest, Marey's positions of visibility only replicate and prolong natural vision. In the absence of a method that might derive from chronophotography a means of calculating the locomotive forces at work in bodies moving in three dimensions, Marey must have come to the conclusion that he needed not to improve his apparatus, but to expand his aesthetic theory in order to imagine a fully defined (if previously invisible) dynamic range.

Here the visual stability of the privileged aesthetic moment is confronted by the epistemological imperative of an aesthetic of successive moments.⁴⁴ This is the tension that arises between the need to 'see' and the need to understand, to reveal bodies through the use of static images, and to comprehend them in motion. This tension forms the conflicted theoretical proposition of Marey's positions of visibility. It is from this starting point that Marey builds out a solution to the problem of readability. While urging the 'les plus grands mathématiciens' of his age to develop a means of determining absolute values for the forces at work in bodies in movement, Marey reaffirms his new orientation in these terms: 'Du reste, l'estimation rigoureuse du travail dépensé à une allure quelconque a bien moins d'intérêt que la recherche des variations de ce travail à mesure que l'allure s'accélère.'⁴⁵ In the place of the mathematical calculation of work, Marey is proposing a system based in variation. In other words, for Marey, chronophotographic evidence is henceforth appreciated and weighed on a strictly relative scale, each image both imparting to and deriving from all the other images that make up its data set a comparative value, based on the camera's ability to discern frame-to-frame variation.

This brings us back to the series of male nudes that Marey and Demenÿ began to produce at the Station physiologique in the early 1890s. We might recall here that their models, most of whom came from the elite military school at Joinville-le-Pont, were chosen for their pronounced musculature, which Marey boldly

⁴³ Anson Rabinbach, 'The Body without Fatigue: A Nineteenth-Century Utopia', in *Political Symbolism in Modern Europe: Essays in Honor of George L. Mosse*, ed. by Seymour Drescher, David Sabean, and Allan Sharlin (New Brunswick, NJ: Transaction Books, 1982), pp. 42–62 (p. 45).

⁴⁴ These successive moments are the foundation of the kinds of 'cellularization' that Jonathan Crary describes in his discussion of Guy Debord's theory of spectacle: 'spectacle is [...] the development of a technology of separation [...]. This is why it is not inappropriate to conflate seemingly different optical or technological objects: they are similarly about arrangements of bodies in space, techniques of isolation, cellularization, and above all separation' (Crary, *Techniques of the Observer*, p. 74).

⁴⁵ Marey, *Le Mouvement*, pp. 156–57, n. 1 (p. 157).

surmised would provide visual evidence of the invisible forces that escaped his lens.⁴⁶ A dozen pages on from his proposition on positions of visibility, the physiologist ventures the conclusion that rapid muscular contractions are not simply visible to the apparatus but, with careful analysis, are also predictable:

Les reliefs des muscles en action ont pour ainsi dire une physionomie propre [...] on pourrait dire que le *modèle* d'un membre ne traduit pas seulement l'acte qui s'exécute, mais permet, jusqu'à un certain point, de prévoir les actes qui vont suivre.⁴⁷

This is a remarkable assertion, for Marey is positing something like a teleological physiology. The body is made understandable by the camera while at the same time prefiguring the knowledge it will impart from one frame to the next. In other words, to the well-trained eye, the reading of the single image renders its successor obsolete, or, better, contains within the isolated *cliché* the potentiality of all other images to come. In this way, I would suggest, we witness Marey attempting to find a conceptual space somewhere between what he thought to be the utter 'blindness' of cinematic movement, on one hand, and the inability of the privileged aesthetic moment to comprehend dynamic motion, on the other hand. In many respects, Marey's ideal photograph seems to be a single image whose reading provokes a mental cinematics, simultaneously straddling phenomena that Deleuze has termed 'poses' and 'coupes':

La révolution scientifique moderne a consisté à rapporter le mouvement, non plus à des instants privilégiés, mais à l'instant quelconque. Quitte à recomposer le mouvement, on ne le recomposait plus, à partir d'éléments formels transcendants (poses), mais à partir d'éléments matériels immanents (coupes). [...] Partout, la succession mécanique d'instant quelconques remplaçait l'ordre dialectique des poses.⁴⁸

When forced to abandon his proposal for a universal scientific theory of locomotion, Marey calls upon the notion of a universal aesthetic through which art and science come to form a kind of visual tautology. The 'truth' of Marey's scientific programme depends on it. The implication here is that the chronophotographic apparatus was able to capture, as Deleuze might put it, 'éléments formels transcendants' from the 'succession mécanique d'instant' in order to enlist them in the scientific project.

It is perhaps no coincidence that Marey's stylized acts of labour were precisely those occupations that were experiencing dramatic change under the impulse of industrial technology. Already verging on anachronism at the time of their creation, Marey's artisan labourers were disappearing from the landscape of nineteenth-century Europe. His blacksmiths would soon be confronted with the assembly lines and mass-production techniques of the great factories that were rising in the shadows of cities. His tumbling soldiers bounded unwittingly towards the machine guns, gas attacks, and cannon fire of industrialized warfare. In this

⁴⁶ Marey demands that 'chaque homme employé soit bien caractérisé physiquement' (*Lettres*, non-dated note, possibly from 23 January 1891, p. 310).

⁴⁷ Marey, *Le Mouvement*, p. 169; original emphasis.

⁴⁸ Deleuze, *Cinéma*, 1: *L'Image mouvement*, p. 13.

respect, these images of labour make perfect sense as they conveniently align with Marey's view of aesthetics and its attempt to domesticate the disruptive nature of his technology. Might it be, then, that the physiologist's 'art photos' in the *Études* were an unconscious bid to reclaim the metaphysical essence of the body that Walter Benjamin and others have argued was being lost in this age of mechanical reproduction, and, in doing so, to link their inalienable 'truths', as they are revealed by the apparatus, to a kind of ersatz of scientific discovery? Still self-possessed, still 'divine' in the autonomy and intentionality of their labour, his folksy subjects signal that they are not entirely subsumed into a mechanized, routinary world.⁴⁹ If this position has one advantage for Marey, it is that the classical body's immanent truths are now conferred on the scientific programme where knowledge of the body becomes the sole product of positivistic revelation.

In many respects, Marey's technical-scientific dilemma points to the foundational role that optical technologies were playing in the aesthetic crises of his time. In an odd but very real sense, Marey's interpretive dilemma had pointed his science towards contemporary aesthetic debates, which contrasted two distinct ways of understanding our experience of reality. Was reality something that is best transcribed by line or by colour? Do we perceive the world objectively as through the lens of a camera or do we somehow assemble the elements of our reality in our mind's eye? Is our experience of life most clearly captured in fixed, discernible moments of time or is life experienced as constant movement? What makes Marey's project so interesting is that his invention captures and encapsulates these conflicting world-views. The conflation of his study of work with art photography in the *Études* demonstrates that his science is propped up by tried and true aesthetic canons — the platonic union of beauty and truth, the 'sculptural' revelation of the secret existence of bodies arrested in flight, and others. Yet when coupled with the fundamentally indecipherable nature of his data, chronophotography had proven itself to be incompatible with both the 'real' and the 'universal' as Marey and many of his generation understood them. His apparatus had revealed the uncanny qualities of motion, and thus unwittingly aligned the chronophotograph with the modernists' aesthetics of the bizarre.

It is no wonder, then, that Marey's imperfect science is dictated by a convoluted aesthetics. In striving to find a middle ground between the optical verisimilitude of naturalist photography and the kinetic possibilities of moving pictures, the physiologist develops an extravagant visual linguistics, a materialist epistemology of the dynamic that is rooted in the ordering of bodies frozen in time. The essential paradox of Marey's photographic process arises from his theory of corporal dynamics, a dynamics that can only be (imperfectly) comprehended through the statue-like *clichés* of bodies arranged in positions of visibility. In abandoning his

⁴⁹ Throughout his career Marey will assert the machine-like nature of the body. In *La Machine animale*, he writes, for example, that: 'La comparaison des animaux aux machines n'est pas seulement légitime, elle est aussi d'une utilité extrême à différents points de vue [car le scientifique peut] emprunter à la mécanique pure les démonstrations synthétiques d'un phénomène de la vie animale' (Marey, *La Machine animale*, p. vi). The human body's privileged ontological status goes unacknowledged here.

desire to arrive at the scientific measurement of mechanical force, Marey falls back on an aesthetics which only gestures to the mastery of the still mysterious nature of movement, velocity, and acceleration of bodies in space. In the end, Mareysian aesthetics point back to larger methodological and technical difficulties that the scientist had encountered in his quest to reveal the invisible workings of biomechanics. These aesthetics might, in turn, be a useful means of understanding the scientist's desperate efforts to wring empirical knowledge out of a fascinating but impenetrable optics.