Cinematic innervation: the intuitive form of perception in the distracted perceptual field

Sungyong Ahn*

The Graduate School of Advanced Imaging Science, Multimedia & Film, Chung-Ang University, Seoul, South Korea

Abstract

In “The Work of Art in the Age of Its Technological Reproducibility,” Walter Benjamin alluded that the human perceptual field in his time would become more distracted by the intervention of technologies, and so masses’ tactility activated by distraction would be more important in the mechanized perception. Regarding this historical situation, Benjamin anticipated that the new mode of mass perception would be organized through people’s collective “innervation” to technologies. This article aims to contextualize this physiological term’s cultural, technical, and political implications within various discourses about perception from the late 19th century physiologies to early 20th century film theories. Benjamin considers the tactility of people’s potential to reconstruct the optical scheme of perception from the “flatness of screen” in which distances between viewers and perceived objects collapse. In a similar vein, the late 19th century’s physiology reconceptualized perception in its relation not so much to the transcendental division of subject/object as to the sensual condition of a retina as “a single immanent plane.” From this perspective, perception is phenomena entailed by a body’s contact to a sensual environment, so how sense inputs circulate in a neural network is a determinant for explaining perceptual processes. With regard to this paradigm change, the invention of cinema in the late 19th century was significant because it radically changed the composition of the perceptual field in two directions. Cinema introduced the virtualized perceptual fields on which sense circulations were completely controlled by the operation of camera. At the same time, the mediation of projectors in theaters reorganized viewers’ neural paths for perceptual innervation. As Hugo Münsterberg and Sergei Eisenstein’s theories reflect, cinematic media’s intervention in the perceptual field made it possible for masses’ collective consciousness to be redrawn as a social nervous system on a neurophysiological level, so this media functioned as a social apparatus for the mechanization/modernization of humanity.

Keywords: innervation; neurophysiology; Walter Benjamin; media history; perceptual field

*Correspondence to: Sungyong Ahn, Chung-Ang University, Seoul, South Korea. Email: holidragona@gmail.com

©2013 S. Ahn. This is an Open Access article distributed under the terms of the Creative Commons Attribution 3.0 Unported (CC BY 3.0) Licence (http://creativecommons.org/licenses/by/3.0/), permitting all non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Citation: Journal of Aesthetics & Culture, Vol. 5, 2013 http://dx.doi.org/10.3402/jac.v5i0.21681
At the end of the third version of “The Work of Art in the Age of Its Technological Reproducibility” (1939), Walter Benjamin evaluates the experience of cinema in the early 20th century in terms of its “tactile reception” rather than “optical.” Considering the location of “tactility” in Benjamin’s works—it’s relation to “habit” and “optical unconsciousness,” its implied opposition to optical “concentration” and “attention”—we can roughly visualize the perceptual condition of movie theaters at his time. Contrary to optical reception, which presupposes the attentive operation of consciousness, habit is a capacity to unconsciously appropriate something. A cinematic screen might be a new field of perception unfamiliar to viewers’ optical consciousness, and so should be refamiliarized by their tactile habit at an unconscious level. However, with Benjamin’s brief reference, it is still unclear why tactility takes precedence over other senses for this function.

In a note in section VI of the second version of the same essay (1936), Benjamin refers to “innervation” as the masses’ means for adapting to machines, appropriating them as parts of the perception process, and thus organizing collective consciousness through connection to technologies. Miriam Bratu Hansen contextualizes innervation “in Benjamin’s dictionary.” She says “innervation broadly refers to a neurophysiological process that mediates between internal and external, psychic and motoric, human and machinic registers.” If cinema is included in these technologies, and transmission of neural signals is also occurring as the mediation process between a motoric screen and psychic viewers, innervation could then be the unconscious condition of cinematic perception in that it is the most imperceptible but, at the same time, the most fundamental process of our mind. It is tempting in this context to connect innervation to tactile habit, both of which operate on the level of optical unconsciousness. However, innervation in Benjamin’s texts is not just a concealed fact of the human nervous system but the effect caused by the technological mediation of human perception. It might still be unclear as to why he chose a physiological term for describing the mechanized condition of human unconsciousness. In resolving these ambiguities surrounding Benjamin’s notions of tactility and innervation, we should locate them not only within his bibliography but also in the historical context which influenced his thoughts, and that is what this article will do.

When Benjamin says “Just as the entire mode of existence of human collectives changes over long historical periods, so too does their mode of perception,” he emphasizes the necessity for historicizing perception alongside changes in the social environment. Benjamin conceptualizes the decay of aura and perceptual distraction in the age of mechanical reproduction in relation to the optical division between observers and objects. A person’s distance to the perceived world changes decisively with the machines’ intervention in the human field of perception. “Aura” is only possible when viewers keep a proper distance from an object. “Distraction” depicts the state where this stable distance collapses. As Benjamin’s rhetoric of bullet-like intensities in theaters implies, distraction signifies the viewers’ failure of distanciation and their contact with objects, which results from the mechanical intensification of sensations. In this condition, tactility (as a sense of contact) is not just one of five senses, but a historical remainder, a sense surviving from the destruction of traditional optics. And, the tactile habit is viewers’ potential to restore his/her optical means of perception from the flatness of screen.

In a similar vein, physiological optics in the late 19th century theorized human perception not within the frame of subject/object, but in terms of direct sensations on a biological screen, a retina. As Jonathan Crary says in Techniques of the Observer, “the model of the camera obscura” and its transcendental premise of optical distance are what the physiology in this time disputed, so whole modes of perception should be reorganized from “a single immanent plane” of sensations. Physiologists imagine innervation in this time as a neural activity that organizes discrete forms of perception on this plane. From this, we might find the similarity between the distracted perceptual field caused by the mechanical reproduction and a plane of sensations suggested by the scientific discourses on perception. As Hansen alludes in mentioning the possible influences of Freud’s early works, which share the same framework with the 19th century physiology, Benjamin’s innervation should be contextualized within both the history of media and scientific discourses on perception.
As such, innervation might link to Benjamin’s scientific and epistemological premise for perception in the modern mediascape, if tactility rather than optics is proper to a distracted field of perception. Moreover, innervation, if it underlies human tactile contact with media, would be the nervous system’s means to connect to the film’s plane of sensations. In this sense, Susan Buck-Morss’s definition of innervation is insightful. She states, “innervation” is Benjamin’s term for a mimetic reception of the external world, one that is empowering, in contrast to a defensive mimetic adaptation that protects at the price of paralyzing the organism, robbing it of its capacity of imagination, and therefore of active response.7

For Benjamin, tactile reception is an “antidote” against “the anesthesia of perceptions” caused by distraction; and innervation with film means a human body’s ability to rearrange disordered sense data from machines into meaningful perceptions. It is the same in that “imagination” does so freely from the rules of “understanding” in Kantian philosophy. Innervation is the neural productivity, which is activated by the liquidation of the optical tradition in the age of mechanical reproduction. If this historical change in perceptual fields can be articulated as perceptual “deterritorialization,” to borrow Deleuze and Guattari’s term, we can also consider innervation, the process of reorganizing sensations, as the “reterritorialization” of perception.

This article aims to reveal the historical meanings of “innervation” located between the deterritorialization of traditional optics and reterritorialization of new modes of perception. Some important implications of using the term innervation in the historiography of sense include the following: perception is a procedure in which sense data flow into our body through the specific circuits of nerve fibers; and, as the concepts of de/reterritorialization allude, these circuits have been historically transformed and so cannot be fixed in universal categories of traditional psychology; moreover, the characteristics of perceptual fields in a historical period are involved with how these circuits are modified in their connection to media environments. In order to trace cinema’s influences on the fluctuation of human perceptual fields during Benjamin’s era, this article will examine various discussions on human perception in physiology, phenomenology, and film theory, and, furthermore, cybernetics in the post-war era. If these discourses reflect the historical transformation of perception over time, we can then infer the function of innervation in the disordered perceptual field that emerged in the late 19th century.

THE DETERRITORIALIZED FIELD OF PERCEPTION

In “The Film and the New Psychology” (1945), Maurice Merleau-Ponty says “cinematographic drama is finer-grained than real-life dramas.”8 What he means by finer-grain is that a cinematic screen is composed of some microelements, which are imperceptible in reality. Given the so-called stroboscopic effect, the process of organizing impressions of movement from a discontinuous series of film reels, these finer-grained elements can be understood as molecular sensations, which are not integrated into a subject’s concrete perception yet. With regard to this condition of a screen, Merleau-Ponty mentions the coincidence of the invention of cinema and the appearance of gestalt theories. As a new trend in the research of perception in late 19th century, gestalt theories delved into the problem of “local elements” theoretically distinguishable from what we actually perceive,9 and analyzed how perception as a comprehensive process is organized from the interrelation of these elements. Contrary to traditional psychology, which separated primary properties intrinsic to objects from secondary qualities perceived through hallucination by subjects, such as stroboscopic effects, these theories shift the problem of perception into a field of sense elements and their mutual interaction.

As Merleau-Ponty claims, gestalt theories represent the paradigm of “new psychology” that focuses on the “temporal or spatial arrangement of elements”10 emancipated from static notions of subject/object. In the same manner, he considers cinema a new media which presents the horizon of sense elements that are no longer bifurcated into rigid categories of “subject” and “object.” For Merleau-Ponty, the perceptual field is a kind of phenomenological horizon in which both “noesis” (intentional acts of consciousness) and “noema” (intended objects) are relentlessly comingled, and
cinema is the evidence indicating the existence of sense elements avoiding categorization based on transcendental demarcation of subject.

From Merleau-Ponty’s argument, we can infer that both the development of media and theories on perception in the late 19th and early 20th centuries reflect the repudiation of a transcendental distinction between physical reality and the psychic world. This raises the question, if relations between subject and object can be discussed not discretely but on the same field, what is the common principle applicable both to physical space and mind? In “On Gestalt-Qualities” (1937), Christian von Ehrenfels, one of the founders of gestalt theory, mentions “the laws of association” as a proper answer. For explaining processes where sensible auditory or visual content is found from “a ground” of sensations filled with noise, Ehrenfels presupposes a two-folded procedure of gestalt association. First, when we perceive something, the image of it (as a gestalt-quality) is “certainly physically” associated as a specific arrangement of sensations in a ground. At the same time, we also associate this image “in all probability psychically” in our mind as an idea. Ehrenfels still uses the distinction between physical and psychological, but, considering his reference to Ernst Mach’s physiology, what he means by the laws of association in mind is not so much intangible psychic activities but physiological circulation and rearrangement of sensations in a body. In this sense, what the new paradigm of gestalt theories reflects is this two-foldedness of the perceptual field from which both subject and object are associated through physiological/physical processes. Moreover, considering Merleau-Ponty’s description of perception as “the presence of world’s flesh to my flesh,” the finer-grained cinematic perception in his text implies the field of sense elements which are connected directly to our body. Thus, insomuch as innervation indicates the body’s physiological capacity to receive and circulate sense impulses in a nervous system, film exposes the process of innervation beneath perception.

In the introduction to The Analysis of Sensations and the Relation of the Physical to the Psychical (1897), Ernst Mach argues that the temporal–spatial interconnection of sensations is the common condition shared both by the physical and psychological worlds. According to Mach, physical reality is, from the thermodynamic point of view, composed of interconnected sensations, such as color, sound, temperature, and pressure, which are mediated by a physical medium on the micro level. Likewise, from the physiological perspective, the psychological traits of the human mind such as feelings and volition can also be analyzed as products of circulations of sensations in our body. In this analysis, which locates two territories transcendentally separated in Cartesian optics on the same fabric of sensation, Mach shows that traditional “substance-concepts” in philosophy, such as “body” and “ego” or “matter” and “soul,” do not remain in permanent forms but open to the constant rearrangement of sensations. Only degrees of “relative permanency” are meaningful for discussing physical and psychological substances. It means that, with different degrees, whole arrangements of sensation both in our body and physical reality tend to be temporarily dispersed as the second law of thermodynamics, the law of entropy, implies.

Although, for Mach, the impermanency of association results in the dispersion of substance-concepts, the relativity of permanency still seems essential for Ehrenfels’ idea of gestalt association. The reason is that if the gestalt is distinguished when a certain arrangement of sensations is more permanently interconnected than others in a noisy ground, the degrees of permanency between sensations would be determinant in the laws of association. Furthermore, if it were conceivable that the varied properties of a physical/physiological medium (through which sensations are arranged) determine these degrees of permanency, then the two-foldedness of gestalt association would be involved with different conditions of sense mediation in bodies and physical reality. It was commonsense in Mach’s era that all kinds of physical material or so-called “ether” could function as this medium in nature. The problem then is, what did physiologists consider the bodily medium that regulated the permanencies of sense association in the nervous system?

Freud, in his early physiological work, “Project for a Scientific Psychology” (1895), answered that neurons, the nerve cells, were the medium. In order to adduce the material evidence of his psychoanalytic topography of the human mind which is characterized by its principle of self-preservation, Freud describes a neural network as
a system constructed by manifold paths of neurons that typically retain high conductivity after initial sense input is passed.\textsuperscript{17} He assumes that our consciousness is structured by differentiated conductivities in neuron connections, which induce sense input to circulate through already inscribed paths for preventing random associations of sense. This hypothesis illustrates how sensations flowing in a body can be physiologically rearranged in relatively permanent forms. What makes Freud's conception interesting is that, although he considers this network a kind of thermodynamic system, he thinks of the anti-entropic tendency for permanent neural association as a crucial property of an organism. According to Ludwig Boltzmann's explanation of the second law of thermodynamic in 1874, entropy measures the number of ways we can rearrange a system without changing its basic appearance.\textsuperscript{18} He suggests that if a system follows this law, the number of ways its elements can be arranged should gradually increase. However, insofar as the function of conductivity in nerve paths is to preserve the homeostasis of sense circulation, Freud's nervous system seems to contain a defense mechanism against the external tendency toward disorder. In 1878, previous to Freud, Hermann Helmholtz already alluded to these structured conductivities of neural connections, which have since been supported by cybernetics in the 1940s\textsuperscript{19} and further corroborated by the discovery of synapses. Freud's project implies that the new topography of the human mind started to be drawn as an anti-entropic system on fields of sensations exposed to the second law of thermodynamics.

From this brief outline of theories from the late 19th and early 20th centuries, it is possible to map the scientific discourses on perception. While thermodynamics has shifted the traditional substance-concepts outwardly to fields of sensations, neurophysiology has folded these sensations inwardly (into bodies). The gestalt theory has dramatized these opposite forces in the conception of figure and ground. As Merleau-Ponty observes, the invention of film in 1895 revealed this emerging two-folded field of sensations not by a theoretical demonstration, but by a technological redoubling of this two-foldedness. It is because the mechanical reproduction of cinema has caused the radical liquidation of gestalt-qualities on both sides of the field, through the camera's operation on the physical side and, at the same time, through the projector's operation on the physiological side. In this regard, Benjamin's insight into mechanized perception shows us what this technical medium intervening between the physical/psychical worlds has actually done to people's ways of perceiving. He states in the third version of the artwork essay:

And, the reproduction, as offered by illustrated magazines and newsreels, differs unmistakably from the image. Uniqueness and permanence are as closely entwined in the latter as are transitoriness and repeatability in the former. The stripping of the veil from the object, the destruction of the aura, is the signature of a perception whose "sense for sameness in the world" has so increased that, by means of reproduction, it extracts sameness even from what is unique. Thus is manifested in the field of perception what in the theoretical sphere is noticeable in the increasing significance of statistics.\textsuperscript{20}

The image characterized by its uniqueness and permanence, veiled by the aura, represents the traditional category of perception. On the other hand, the reproduction which extracts the sense of sameness from this shell is the machine's way to statistically recompose perceptual fields. If "certain physically associated gestalt-qualities" in Ehrenfels's argument are what cause the permanency of image in one's mind, then what is "sense for sameness in the world"\textsuperscript{21} exposed by mechanical reproduction which dissipates the spatial–temporal permanency of the nature? Although the similarity between reproductions seems to be the easiest answer, it is worth noting that the sameness is not invented by machines but just revealed when the aura of objects decay through mechanical reproduction. Thus, the sense of sameness in this context should be understood in terms of statistical elements of perception which are veiled by substance concepts or the permanency of gestalts in "real-life dramas," what "cinematographic drama" exposes as a universal condition of all kinds of discrete perceptions. Furthermore, remembering that statistics was the chosen method for studying a system's thermodynamic features, which traditional concepts left in the realm of unpredictability, Benjamin's description of it offers a new way to analyze perceptions in distracted fields.
INNERVATIONS: RETERRITORIALIZATION OF PERCEPTION FROM TACTILITY

When Benjamin discusses the rehabilitation of optical reception, he compares the perceptual condition in movie theaters to the situation where, in a strange building, people’s tactile sensitivity overwhelms their sight. Benjamin describes tactility as people’s capacity to perceive something through their repetitive uses of it. This habitual aspect of tactility is, for him, what makes this sense different from other modes of perception, particularly sight which is characterized by its involvement in the mind’s concentration. The field of perception in architectural experience is thus defined as follows: in a building, there is less something to draw one’s concentration, so people should start from their habitual interaction with it to recognize surroundings. If this something attentive in one’s sight is involved in some kind of gestalt-quality distinguishable from a noisy background, then the strange building might be where people cannot find any physically certain gestalt-qualities matched to their mental association at first-sight. Thus, they should re-associate their mental images through habitual contact with it. In this sense, Benjamin’s claim that tactility determines the optical reception in a building alludes to the priority of tactility in organizing psychical images for the attentive operation of other perceptual organs. Cinematic distraction can be translated into a condition in which all of the psychic gestalt-qualities traditionally associated with attentive perceptions are dispersed. Tactility is thus also the fundamental mode of perception in a movie theater.

Therefore, although Benjamin doesn’t specify, it is possible to relate tactility to innervation with regard to each concept’s function in Benjamin’s essay, as well as to physiological discourses in his time. First, since tactility can be operated or activated even in the distracted field of perception, innervation occurs within a body connected to entropic outside. Second, as the habitual operation of tactility does not need any previously organized objects for concentration, innervation is prior to any other perceptual associations in a neural network. Third, just as the mode of optical reception can be reorganized through tactility, innervation is the micro process for producing higher forms of perception. And, this comparison alludes to the possibility that the concept of habit (or habituation) can be understood in solely terms of human’s neural interaction with sensual environment without mentioning immaterial aspects of consciousness. When Hermann Helmholtz presents in “The Fact of Perception” (1878) the tactile movements of fingertips to illustrate the neural organization of visual scheme, he trades on this relation between tactility and innervation.

While Mach states that the world is deterritorialized into interconnected sensations, Helmholtz’s aim in “The Fact of Perception” is to prove the possibility of reconstructing higher perceptual forms from this interconnection in a nervous system. In this work which influenced Freud’s conception of neurons, Helmholtz mentions human consciousness as the product of the thermodynamic operation of nerve fibers connected with the physical world through innervations. By describing perception as the exchange of energy between the body and the world, he dissolves the a priori forms of “intuition” and “understanding” established by Kant, into micro-elements in a neural network. Since the “real” is understood by Helmholtz as arrays of intensity or energy, he claims innervation, the transmission of electric/chemical signals in bundles of nerve fibers, as the only possible “intuitive form” of perception. In this regard, the purpose of his physiological and thermodynamic explanation of the human mind is to repudiate the Kantian topography of human perception, composed by universal forms of geometry, and to replace the a priori hypothesis with the (empirical) operations of nerve fibers. He carries out the following thought experiment to demonstrate how some “presentation” of objects can be organized in the nervous system without any a priori forms:

Let us try to set ourselves back to the state or condition of a man without any experience at all. In order to begin without any intuition of space, we must assume that such an individual no longer recognises the effects of his own innervations, except to the extent that he has now learned how, by means of his memory of a first innervation or by the execution of a second one contrary to the first, to return to the state out of which he originally moved. Since this mutual self-annulment of different innervations is completely independent of what is actually
perceived, the individual can discover how to initiate innervations without any prior knowledge of the external world. Let us assume that the man at first finds himself to be just one object in a region of stationary objects. As long as he initiates no motor impulses, his sensations will remain unchanged. However, if he makes some movement (if he moves his eyes or his hands, for example, or moves forward), his sensations will change. And if he returns (in memory or by another movement) to his initial state, all his sensations will again be the same as they were earlier. 

Consider this imaginary body as a “body without organs” in the sense that it does not have any empirical or transcendental forms of perception which are necessary for the normal function of perceptual organs. Just as soon as its head turns to the field of sensations, initial sense input will flow into its nervous system. In this moment, the path passed by these first impulses would form the initial circuit of innervations, and this circuit would signify the body’s state charged by current sensations. Later on, if the head turns to other spots, the body’s nerve fibers would be innervated through a different path and the prior circuit would be discharged. However, the body, which has a capacity to return to the initial state of sensations, can learn how to restore the prior circuit of innervations by turning its head against the direction of the second movement. The more repetitively this head movement occurs, the more permanently the initial paths would be preserved. Helmholtz considers this sensory–motor reaction, habitually restoring a certain state of innervations, as the primary principle for the topological organization of the nervous system.

Given the hypothesis that a nerve circuit that is already discharged by a reverse body movement can be re-innervated not solely by its physical move to the initial position but even through the movement in memory, this initial circuit should remain highly conductive for a while in order to be remembered. It means that innervation is not only a transitory exchange of signals but also a process engraving relatively permanent paths of signal transmission on a nervous system. (These differentiated conductivities result, in Freud’s explanation, from the transition of physical energies into energies within neural connections. Thus, innervation obeys the first law of thermodynamics, the law of energy preservation, while the high permanency of paths reflects its anti-entropic tendency.) Moreover, inasmuch as this circuit signifies a state of sense arrangements in a past moment, it would also potentially function as memory elements. Helmholtz names this rechargeable trace of innervation as “presentabilia” and the extensible set of them in continuous sensory–motor reactions as the “circles of presentabilia.” The perception of “objects” means, for him, just the recognition (or re-innervation) of a specific circle of presentabilia from current sensations.

Helmholtz’s thought experiment shows how some elementary forms of perception can be organized from the wiring mechanism of innervations in a “body without perceptual organs.” If this were the case, it would be theoretical evidence of a human’s capacity for habitual reception; what Benjamin refers to in architectural experience. Consider our retina as a two-folded screen connected both to manifold nerve fibers and a field of sensations. When we walk through a corridor of this strange building, the inside of this screen would seem to be randomly innervated due to the distracted outside of high entropy. However, if we repetitively travel back-and-forth, we could coordinate the sense input through the circle of presentabilia engraved by habitual innervations. It implies that our optical means of perceiving the building can be restructured only from the intuitive process of innervation without any transcendental forms of perception.

Is it then also possible to apply this physiological condition of a biological screen to a cinematic screen, as Benjamin claimed in his comparison of cinema/architecture? In the aspects where both screens share, it is possible. First, as the movement of an eyeball changes sense arrangements on the retina, the camera’s movement replaces each image 24 times a second, changing the impressions on a sensitive plate. Second, when the nerve fibers connected to visual cells engrave a circle of presentabilia, which are representable through body movement or memory, the camera engraves past impressions on circuits of film, which are represented through projection. (In this sense, Andre Bazin’s mummy complex—a film’s anti-entropic tendency—alludes to the coincidence between the invention of film and the physiological discovery of the self-preservation mechanism of a nervous system.) Primarily, just
as “a number of colored plane surfaces” is the only possible “form of intuition” on the retina, the “temporal or spatial arrangement of elements” is the primary condition of the camera and screen, as Merleau-Ponty observed.

From this intuitive condition shared by the retina and cinematic screen, the meaning of visuality is reconceptualized not by its a priori geometric forms, but from the level of interconnected nerve fibers. An important implication for Helmholtz’s illustration of the turning head is that, insofar as the innervation is the only possible intuitive form (even to our retina), such a three-dimensional spatiality is not a priori. It is, instead, only, a posteriori, organized when manifold circles of presentabilia are rearranged as a “simultaneous” and “continuous” set of abstract form. In this sense, it makes more sense to understand the presentabilia, which lacks any dimensions of line, surface and volume, in terms of “tactility” (at least in the meantime). The reason is that, whereas other modes of perception, such as seeing a shape or hearing a sound are experienced as outcomes of rearranging dispersed sense-data through a spatial-temporal coordination, tactility can be sensed from zero-dimension intensities on a spot. Tactility may be the sense most suited to the field of higher entropy, in the sense that it is free from the rigid geometric coordination of elements. (It is important not to construe tactility as a mode of organs. It should be treated as being on a fundamentally micro level of the body, organizable into higher forms of perception. Thus, what Deleuze and Guattari called “haptic” might be more relevant in this context: the transmutable perceptual potential of a body without organs, organized into all of the distinctive modes of the tactile, optic, and acoustic.)

With this intuitive form of intensity, the human skin’s tactile reception would be sufficient to reorganize Kant’s geometric form of space. To establish the possibility of a geometry based exclusively on tactility, Helmholtz gives an example in which fingertips touch of an object’s surface. In his view, the movement of fingertips is expected to initially arrange sense input from the surface as a continuous linear circle. However, since fingertips can move consecutively towards “a manifold of the second order,” their movements would consequentially form a manifold of mutually intersected linear circles. Helmholtz claimed that the idea of two-dimensional plane can be organized from the integration of this manifold of one-dimensional traces, and three-dimensional spaces could also be organized in a similar way when fingertips move to other surfaces. Through these bodily movements, he suggests that the tactile reception of fingers represents a neural network’s potential to organize more abstract perceptual forms from the intuitive field of sensations. Furthermore, a camera lens is likewise connected to this same field and its tactile movements are an intuitive form of cinematic perception.

THE EXTENSION OF INNERVATIONS TO TECHNOLOGY

In his monumental work, Cybernetics (1948), Norbert Wiener summarizes the history of engineering from the 17th to 20th centuries in three stages. According to Wiener, “If the 17th and early 18th centuries are the age of the clock, and the later 18th and 19th centuries are the age of steam-engines, the present time is the age of communication and control.” He says that while machines in the first stage are controlled by the principles of Newtonian dynamics, which are characterized by the complete calculability of the dynamical relation between its elements, machines in other two stages operate in a field of thermodynamics in which only the probability of relation between elements is calculable. Moreover, when he mentions the “accurate reproduction of a signal” as the purpose of the third stage of engineering, Wiener introduces some important tasks in the design of cybernetic machines. On the one hand, he asks how to distinguish certain arrangements of elements from noise in a field and, on the other, how to modify them as meaningful information. Although the telegraph and telephone and military radar were almost the only viable inventions representing this third stage in his time, Wiener thought that cybernetic machines would be developed through the mechanical simulation of a neural network. One of the major aims in the book is to show the possibility of mechanically realizing the visual cortex’s function in organizing gestalt-qualities; thus what he refers to as “signals” includes not only radio waves but also sense elements for visual information. The incipient information engineering was influenced from the physiological discourses on perception before Wiener. Although there is little evidence
that 19th century physiologists held an interest in engineering, they may have been the first to make machines that aimed at the “reproduction of a neural signal” before the proponents of cybernetics.

Helmholtz designed a well-known mechanical instrument, a myography, to demonstrate his hypothesis about the invisible thermodynamic interactions of nerve fibers. However, due to the excessive weight of the original design, it was only after revisions by French physiologist Etienne-Jules Marey, renowned for his contribution to the invention of film, that myography could produce satiable results. Marey substituted the pendulums used in the original model to stimulate nerve cells with an electric excitation. He also connected a tendon of muscle to a wire that transmitted contractile forces of muscle to a stylus on a cylindrical film layer (Figure 1). Marey designed a more direct sensory-motor circuit between machines and a body and so could obtain more precise data of animals’ innervations. What Marey’s myography proves is that when the same impulses are repetitively provided to a receptor of the body, they are not randomly dispersed in a neural network, but always innervated through sustainable reflex circuits. It shows that the neural mechanism defers the entropy increment by regulating the inner-circulation of sensations in relatively permanent paths. Moreover, by extending the circuits of reflex to a machine, myography succeeded in producing information about the “circles of presentabilia” which might be inscribed from a tactile receptor on a body. In this respect, a cylindrical film of myography is a machine devised for the “accurate reproduction of neural signals” through the mechanical extension of innervations.

Marey’s early studies on physiology used the machine only as a subsidiary of the “graphic method” to visualize processes of innervation concealed in a body. On the other hand, the “photographic method” in his later works on animal locomotion implies a shift in his experimental interest toward machines. Whereas the functions of mechanic parts in myography are limited to stimulating and reproducing physiological innervations, chronophotography, significant for its role in the invention of film, was designed as a completely mechanical process of signal reproduction excluding any organic parts. Treating this work as one early example of information engineering, it seems possible to locate the prehistory of cinematography in this late 19th century development on the strength of this scientific analysis of perceptual signals. Benjamin also emphasizes, in his explanation of “optical

Figure 1. Marey’s myography. Reproduced from Marta Braun, Picturing Time, 25.
consciousness,” this scientific use of photography as an important function of the medium alongside its artistic ones.36

Chronophotography is a picture of the consecutive impressions of a moving body recorded by a “photographic gun.” Since Marey used it for graphical clarity of movements rather than for an abundance of details, he marked white spots and lines on a model’s body, and let this model walk in front of the photographic gun in a dark studio. As a result, Marey could get simultaneous linear depictions of the model’s movement reminiscent of experiments on visual gestalt (Figure 2). Using a photographic method for the scientific analysis of visual perception was effective for two reasons. First, it recorded a series of sensations in regularized arrangements while sense-data on the human retina contains too much redundancy to be completely controlled. Second, inscriptions on film are more permanently preserved than in human minds, which are still under the rule of the law of entropy. This fact implies that the photographic method is more efficient for reproducing visual information than human observations because of its greater anti-entropic tendency. Marey’s evaluation of chronophotography as “the language of phenomena themselves”37 shows that he thought of this intuitive form of photography as the most distinctive feature of mechanical perception.

However, despite Marey’s pursuit for clarity, chronophotography also includes a relative “manifoldness” of circuits which reminds one of the situation of Helmholtz’s nervous system too. This is because, while myography’s graphic method depicts just a continuous linear chain of stimulus from a tactile receptor, the photographic method inscribes manifold circuits of sensations simultaneously from many receptors in a discontinuous form on a film strip. If these traces of light are interpreted as paths of innervations on a technological retina, a sensitive plate, we could then translate the vertical set of dots and lines above a certain point on a timeline (a spot and five lines in Figure 3) as a circle of stimuli which flow simultaneously into separated areas on the film’s surface at a given moment. On the other hand, the sequence of spots or lines horizontally arranged along the timeline can be understood as a discontinuous circuit of intensities which “hit” a certain area of the surface during the experiment (Figure 4). The graph as a whole thus represents simultaneous but discontinuous circles of presentabilia formed from these seven separated sequences. Furthermore, given that the ostensible two-dimensionality of the head and leg parts in the photograph results from the superimposition of linear circuits, which causes the impression of continuousness, it is tempting to conclude that chronophotography also organizes the perception of the plane in the same way as Helmholtz’s fingertips. As the “mutually intersected linear circles” are necessary for leaping to a two-dimensional plane in Helmholtz’s article, mutually superimposed photographic sensations are the condition for higher abstractness in the modes of perception that myography’s simple method lacks. In order for a graph of myography to be changed into a diagram of perception in

Figure 2. “Joinville soldier walking” (1883). Reproduced from Marta Braun, Picturing Time, 84.
chronophotography, the manifoldness of sense inputs from multiple receptors is essential because a certain degree of disorder in sensations which are too complex to be arranged in a linear circuit, and so induce an anti-entropic system to form a mutually intersected network of circuits, is necessary for a higher dimensional gestalt association. Thus, what a picture of chronophotography depicts can be compared with the situation of neural network connected with many sense receptors on a retina, where abstract forms of perception, such as a two-dimensional space, are emerged from the disorder of intuitive intensities. In this sense, chronophotography demonstrates that both a machine and human body are situated on the same entropic field, so the perceptions of both demand the processes for recording signals (sense elements) and converting them into meaningful information through entropic bodies. As Wiener says in *Cybernetics*, how to statistically simulate the neural processes of signal control with technological means has been an important issue in information engineering. Therefore, as the technological analysis and mechanic reorganization of human perception, Marey’s chronophotography and myography anticipate the subjection of the mechanic/organic process of gestalt association into information engineering. In the following section, we will examine how cinema in the early 20th century has functioned as the machine controlling visual signals in the human perceptual field.

**THE MECHANIZATION OF PERCEPTION**

In 1916, Hugo Münsterberg, one of the first film theorists, said in *The Photoplay* that “Our life is a great compromise between that which our voluntary attention aims at and that which the aims of...
the surrounding world force on our involuntary attention." Insofar as he considers attention as a mental act of selection through which "the chaos of the surrounding impressions is organized into a real cosmos of experience," the cognitive operation of innervation converting meaningless sense input into a perception of something in Helmholtz's argument is named as attention here. As the psychological translation of "intentionality" in phenomenology, this concept adds an existential implication to our discussion made earlier on the two-foldedness of the perceptual field—as a being-in-the-world, an organic body exists only through situating itself within a coordinated world of experience that is organized from the bodily rearrangement of sense input in a spatially simultaneous and temporally continuous form. By both capturing the entropic world in a geometric scheme drawn on a neural network and by deferring the outside tendency for chaos, a body situates both a perceivable objective world and a perceiving subject on each side of its skin.

Although this existential condition of a body is priorly defined by its anti-entropic reaction to the chaotic world, Münsterberg did not consider attention solely as an intentional activity since perception is, for him, the result of a "compromise" between a nervous system and "surrounding world force" rather than the expression of the transcendental freedom of the mind. His distinction between voluntary and involuntary attentions connotes the existence of "cues" (or "signals") in a field of sensations which coerces a subject to "involuntarily" focus on specific sensations despite his/her capacity to avoid these restrictions through voluntary body movements or memory. If the "certainly physically" interconnected sense elements causing the association of psychic gestalt "in all probability psychologically" are kinds of signals, the gestalt-quality is not just the product of a neural mechanism but also the evidence of our body's intentional aspect. Extending its inner-circuits of perception intentionally to the world of objects is, as Merleau-Ponty mentions in *Phenomenology of Perception*, our body's way of being.

Since both myography and chronophotography were designed in experimental conditions which restrict the flow of sensations in a circulatory system (by using an electric excitator in myography, in a darkened studio and a black costume with white marks in chronophotography), Marey’s experiments seem to illustrate how differently the systems of organic/mechanic innervations form these negotiative circuits with restrictive surroundings. However, despite this seeming difference, what should be emphasized here is that the negotiations in both experiments are performed not by an organism's intentional act but through a dead body's involuntary attention (of automatic reflex) or the mechanized inscription of machines.

In the situation where a brain is removed from a specimen or any human intervention is deliberately prevented, the processes of innervation are controlled only by mechanical cues which determine the permanency between series of sense input. Marey's works, in this sense, foreshadow the appearance of a new horizon of phenomenology, where the human body's connection to perceptual fields is regulated neither by natural cues transferred through a physical medium nor by the voluntary attention of the mind, but just by the mechanical circulation of sense. The topography of the neural network is drawn there neither by Freud's self-preservative organism nor Merleau-Ponty's intentional body, but by the machines' reproduction/rearrangement of sense signals.

In the second version of his artwork essay, Benjamin mentions this mechanized condition of human perception as the result of the invention of the "second technology," characterized by its autonomous operation without the intervention of human agency. By contrasting it to the first technology designed for humanity's everlasting goal of controlling nature, Benjamin implies that the second nature which this technology's mechanical reproduction reveals is no longer involved with human interest or intentional attention, but emerges, maintaining a distance from the human. Since machines' mediation has intervened within the two-folded field of perception where physical and psychic worlds were mutually interconnected, people should take a detour of mechanic circuits in order to access nature. For Benjamin, the restoration of human perception in this over-mediated media environment is thus only possible by adapting the human mode of "apperceptions" to a machine, training it to harmoniously react to the "experimental and endlessly varied" recomposition of mechanized sensations (Benjamin thinks that film is a very useful medium for this kind of training), and through integrating technologies.
into human perception. As the note in section VI denotes, innervations are considered to be the mechanism for this adaptation.

Marey’s experiments might, in this historical situation, reflect the time’s effort to adjust between the organic/mechanic circuits of perception. Chronophotography’s filtering of natural lights through geometric line marks and dots exemplifies the sensual rearrangement of physical realities in mechanic circuits. As the film’s reproduction exposes the fluid nature of “optical unconsciousness,” the array of sensations on chronophotography show more intuitive and elemental forms of visual perception which is emancipated from the permanency of the first nature. Conversely, the automatic sensory-motor reaction of myography informs how people’s reactions to mechanically mediated senses can be unconsciously adjusted by a machine’s cue for involuntary attention. Considering each side of connection of these instruments, Marey’s mechanical reproduction has two distinguishable ends; first, with connection to physical realities, chronophotography disperses sensations in perceptual fields; on the other end of myography’s connection to a nervous system, it circulates this liquidated sense into sustainable paths of involuntary reflex in a body. Regarding this, Marey’s works illustrate what Benjamin considered to be two consequences of the liquidation of perception: the distraction and the body’s habitual readjustment. However, insofar as what Benjamin expected in people’s adaptation to machines not as automatic reflex, but the “apperceptions” as a mode of consciousness, we should not inadvertently conclude that the situation of specimens on the myography was the only possible condition of human/machine innervations in the age of mechanical reproduction.

In Suspension of Perception, Jonathan Crary proves that various discourses on attention in the late 19th and early 20th centuries were related to the social interest in how to use technological media of second nature to stabilize the masses’ attention. From psychology and physiology to phenomenology and esthetics, an important task of these discourses was to explain the mechanism of the mind in order to produce a meaningful perception from the noise caused by modern machines, and the operation of film happened to be the focus of their explanations. What makes their citation of film more interesting is that film had been chosen both as a medium simulating the ordinary activities of the human mind and as the epitome of the mechanic mode of consciousness distinguishable from the human one. While proponents of machine esthetics such as the futurist, surrealist and impressionist movie makers extolled the high speed of sensual circulation and disruptive spatial forms in film as a reflection of an advanced and alternative mode of consciousness in a mechanized society, more moderate sides thought of the same medium as just a mechanical simulation of human perception.

Following these threads, Hugo Münsterberg emphasized film’s usefulness for modernizing the masses’ consciousness. But, contrary to the avant-gardes, film’s superiority as artistic media, for Münsterberg, was based on its capacity to separate people from the complexity of the physical world rather than its potential to reflect the mechanized social environment. He thinks that, in a darkened movie theater, where the viewer’s body movements are restricted and sense impressions are more sharpened than in reality, people are under a condition similar to hypnosis, in which their voluntary attention is completely suppressed, so that their mind is successfully controlled by mechanical cues which regulate the viewer’s involuntary attention. It means that, in a theater, all voluntary functions of the body, which Helmholtz’s fingertips exemplify, are substituted by the projector’s operation and the camera’s movement. Despite this mechanized situation, Münsterberg’s explanation of filmic consciousness is very anthropomorphic in that what these cues intend in the restriction of viewers’ voluntariness is to simulate and restore the ideal model of the human mind more perfectly than its operation in everyday life. Compared to the first nature where restrictions from physical laws and contingency prevent the absolute freedom of mind, a movie theater where sense input can be artificially controlled is considered to be an ideal place for holding experiments to reconstruct the mind. Moreover, reference to specific film styles of his time such as the mise-en-scène contrasting foreground from background for the illusion of depth, close-ups for emulating changes in attention, and parallel editing causing effects of hallucination and recollective senses show that there was, in the early history of cinema, a tendency to restore a psychological model of the human mind by using these controllable cues of
sensations as the 1970’s apparatus theorist claimed. (However, when apparatus theorists opined a priority of film’s anthropomorphic features with its ideological foundation, Münsterberg treated the same anthropomorphic characteristics as the result of the machine’s simulation of the human mind.)

Although Münsterberg emphasizes the active role of machines in the construction of the filmic mode of consciousness, it is necessary to mention that, in his explanation, what actually adds higher forms of perceptions to these crude impressions on a screen is the viewers’ involuntary attention which follows the instructions of cues. The simulation of the mind in The Photoplay can be analyzed into two parts of the production processes: on the mechanical part, a camera and projector function to provide raw materials of consciousness to viewers with a series of working codes which order people to react in certain paths psychologically predetermined; on the other biological part of viewers who are involuntarily engaged in this production, a nervous system labors mechanically to produce a perception of depth and movements, memories and emotions. Considering Münsterberg’s career as a social psychologist studying how to rationalize workers’ attention in factories, this hierarchic relation between machines and viewers is an esthetic application of the industrial model of production to the masses’ perceptual experience. From this implication, an ironic conclusion is drawn; what moviegoers are consuming as cultural content in a movie theater is, in fact, what their perceptual labor is producing.

When Jonathan Beller coins the neologism “the cinematic mode of production,” he claims that late capitalism is characterized as the expansion of the logic of capitalism to the territory of human cognition to exploit the masses’ neural creativity, and the invention of film in the late 19th century was the anticipation of the emerging late mode of capitalism. He writes,

Cinema welds human sensual activity, what Marx called “sensual labor,” in the context of commodity production, to celluloid. Instead of striking a blow to sheet metal wrapped around a mold or tightening a bolt, we sutured one image to the next. We manufactured the new commodities by intensifying an aspect of the old ones, their image component. Inducing viewers to connect one image to another through specific circuits of innervations, suturing dispersed sensations in simulated paths of the nervous system against increasing entropy, makes the masses’ involuntary attention produce a signifying chain. This is the role of “cues” in Münsterberg’s theory. In this sense, The Photoplay is a psychological analysis of “the cinematic mode of production” in which viewers’ organic and physiological system is necessary as the source of labor power despite their passive position.

When Sergei Eisenstein compared his montage theory to the “manufacturing logic” in factories, he knew that the movie theater is a place not only for mass consumption but for the mass production of perception too. By suggesting the concept of “attraction,” Eisenstein clarifies that the performance of production takes place on the masses’ nervous system on which circuits of sensual reflex are inscribed. In “A Dialectic Approach to Film Form” (1929), he mentions montages at the level of sensations which precede the semantic synthesis of shots. Departing from Pudovkin’s architectural analogy, he emphasizes, from a Pavlovian perspective, the superimposition (or collision) of sense impulses rather than naïve juxtaposition of shots. Given the intervals between each frame which remain unfilled with the darkness of 1/24th of a second, an actual superimposition is physically impossible on a screen. Thus, the superimposition is not so much concerned with the physical arrangements of images, as it is with the physiological event in the viewers’ nervous system which recodes the intermittence of photographic inscriptions as a continuous perceptual meaning. In this respect, montage of attraction for Eisenstein was the innervations between the machine and human body.

Eisenstein analyzes this recoding process of the nerve reflex in three consecutive stages. First, there is a discontinuous transition between two sets of graphical elements, and from their superimposition, a form of plane is organized. Second, from the superimposition between two planes interpreted from graphics, the impression of volume is made as a result. Then, the concept of a place is produced from the superimposition of two volumes. In this description which reminds the movements of Helmholtz’ fingertips, he mentions the “incongruence” between the current impression and the previous one as the inducer of
montage, which encourages viewers to organize a higher dimension of perception in order to offset the difference. The intervals in the mechanic circuits, the incongruence or differences in film reels, are the nods of network to which the viewers’ nervous system is connected. Through this connection, a body’s anti-entropic reaction, its tendency to offset differences through leaping to the higher meanings, is stimulated. What attracts the viewers’ attention is thus the vacuum of meaning between the manifold sensations. This sensual emptiness waiting to be supplied with perceptions is where the effect of montage occurs.

Contrary to Münsterberg’s anthropomorphism, the purpose of Eisenstein’s theory was to prove that, on a micro scale of sense circulation, machines and organisms share a universal process of value production, namely the montage. And while the incipient classical style of early cinema Münsterberg focused on was what shows a machine’s simulation of the human mind, film’s social function in Eisenstein thought is to adjust the masses’ perception to the mechanic mode, so as to make people simulate a machines’ way of perception. As Benjamin anticipated the emergence of future consciousness from the masses’ potential to innervate with the second technology, Eisenstein claimed the “cinematographic eye” as the new organ of “collective consciousness, appearing as a reflection of a new (socialist) stage of human society.” In this context, what he means by the collectivity is not just the situation where people consume the same movies together at the same place, but implies the fact that cinematic perception is the product of collaboration between humans and machines, between film reels and nerve fibers. Furthermore, as Benjamin alludes when he mentions the viewers’ mutual regulation of their response in movie theaters, the collectivity of innervations also applies to the relation between viewers who secretly exchange emotional cues with each other despite the restriction of their body movements.

HISTORICIZING LIQUIDATION OF PERCEPTION

As Ernst Mach’s introduction to The Analysis of Sensations and the Relation of the Physical to the Psychical states, the 19th century view of physiology was based on the thermodynamic world view that had deterritorialized the division between the subjective psychic and objective physical world. In this view, both worlds are analyzed into interconnected sense elements mediated by a physical or neural medium. Because all of physical/physiological connections tend to be dispersed with varied degrees of permanency, the substances composing both worlds are not diachronically universal but tend toward disorder and fluidity. Following this, Benjamin’s discussion on the second technology implies that the circulation of sensations in the perceptual field has reached a new level of fluidity since the late 19th century when technological media started to intervene between people’s physical and psychical realities. As a consequence, the traditional way people perceived nature has been liquidated in the second nature whose degree of permanency is fundamentally regulated by the second technology. This has been raised as a social imperative to reinvent people’s modes of attention suitable for the connection to machines. Considering that Münsterberg and Eisenstein shared the same opinion as Benjamin that film has a function to invent this new habit of perception through innervations, their studies can be understood as the two starting points of longstanding experiments on the mechanization of human perception.

The Photoplay marks a tendency to humanize machines following an idealized psychological model of mind. Münsterberg conceptualized screens as simulated circuits of the human nervous system, allowing viewers to recognize themselves through the mirror image of machines. On the other hand, Eisenstein’s factory of attraction aims to substitute a mechanic mode of consciousness for the anthropomorphic ideal of the mind. Insofar as the former’s idea of restoration of the human observer was a necessity for the development of the classical narrative while the latter had ceaselessly doubted this custom of perception, the dissimilar approaches of Münsterberg and Eisenstein match the trend of narrative film and the experimental avant-garde—what Tom Gunning has categorized in “the cinema of attraction” as the two tendencies of film history. However, although Münsterberg and Eisenstein are opposed in their conclusion, both also share the same standpoint that people’s reactions to mechanical signals and their pathways for innervations can be completely controllable and calculable.
the viewers’ nerve network involuntarily susceptible to social reformation. While the avant-gardes in film history exploited this neural potential to produce new modes of mass consciousness, the other capitalist party has restored the traditional ideal of individual observer from this distracted field and converted it into new forms of commodity which movie as cultural industry exemplifies. What these tendencies signify is that, during the 20th century, people’s collective innervation with cinematic media has been contrary to Benjamin’s expectations in two aspects: through overall commercialization/narrativization, it has not been collective but re-individualized; moreover, even in some minor experiments for collective innervation, it has been uncertain if the masses have been voluntary subject.

In Window Shopping, Ann Friedberg reads from Benjamin’s works on film, 19th century arcades, and other historical records about the mechanized and capitalized urban landscape, the symptoms indicating the change of commodity forms in the market from “the commodity-as-object into the commodity-as-experience” signifying the emerging “post industrial society.” She translates “mobilization” and “virtualization” of perception caused by the mediation of cinematic technology as a consumer society’s strategy for capitalizing people’s ordinary perceptual experiences into market behaviors which fetishize the mechanical perception itself. From Friedberg’s perspective, the liquidation in Benjamin’s work does not solely mean the destruction of old forms of perception, but as the term is also used in the business field, it implies conversing prior value production processes of high permanency, such as apperception based on the traditional topography of mind, into more fluid elements that are exploitable and capitalizable in the factory of attraction or the factory of cultural industry. This is why I use Deleuze and Guattari’s terms of de/reterritorialization for describing the distracted field of perception in the late 19th and early 20th century. According to their theory, the whole kind of decoded flow resulting from the deterritorialization of traditional value systems can be potentially recoded as the circulation of capital. For them, deterritorializations are not just accidents but the consequences of the capital machine’s operation as the “megamachine” of a society. Innervation as the recoding process which converts mechanical cues and decoded montage intervals into a mode of subjectivity or a form of commodity-as-experience shows well how film has functioned as a part of the capital machine to expand its logic even to the masses’ nervous system.

THE INNERVATIONS AS MEDITATION

Contrasting with Eisenstein’s factory of attraction, Dziga Vertov called his documentary films “the factory of facts.” Although reorganizing perceptions from the “intervals” on film reels through finding the most efficient “equations” and “visual formula” between these gaps was also his concern as it was Eisenstein’s, Vertov’s Kino-Eye is different from the cinematographic eye in one respect. Where Eisenstein intended to produce the communist consciousness in a collaboration between human and technology, Vertov aimed to use his camera as a means to expose the production process itself to show how the whole “objects and breads” are produced by workers, and why workers are just owners of them. Even though Vertov does not denote whether cinema itself is also included in these objects produced by workers, his Man with a Movie Camera presents, through its structure, how cinematic perception is produced from the montage of intervals by various workers’ participation. By exposing the existence of the movie camera and its operator shooting Man with a Movie Camera, depicting the editing process converting what was shot just before into intervals of films, and showing a theater where Man with a Movie Camera is screening, Vertov makes his film self-conscious of the relations of its own production. As the result, this film exposes the material condition of cinematic perception, and it shows, as Jonathan Beller points out, “the conjunction of humanity and the machine in a circulatory system” on which the perceptual field of the age of mechanical reproduction is based. Vertov’s factory of facts is comparable to Helmholtz’s “the fact of perception” in the aspect that both reveal a circulatory system’s unconscious processes beneath perception. Just as Helmholtz describes perceptions as neural productions of innervation, Man with a Movie Camera depicts the cinematic perception as cybernetic production. In this regard, Vertov’s Kino-Eye suggests, as Annette Michelson remarks in her introduction to Kino-Eye, the concept of “film-as-production” against
the “commodity-as-experience.” The viewers’ appropriation of cinematic perception as their part of cognitive production is what Vertov’s innervation aims to do.

In light of this, it might possible to relate Benjamin’s vision of innervation to Kino-Eye because, as I mentioned in introductory remarks, he also thinks of it as the masses’ way of appropriating technologies for perception. Furthermore, as Kino-Eye contrasts with both the viewers’ involuntariness and the machine’s calculability, innervation for Benjamin also means the process of speculation on the activities of one’s mind, rather than just mechanical circulation. In a section about the “Prayer-Wheel” in “One-Way Street,” Benjamin says,

Prayer-Wheel. – Only images in the mind vitalize the will. The mere word, by contrast, at most inflames it, to leave it smouldering, blasted. There is no intact will without exact pictorial imagination. No imagination without innervation. Now breathing is the latter’s most delicate regulator. The sound of formulae is a canon of such breathing. Hence the practice of meditating Yoga, which breathes in accord with the holy syllables. Hence its omnipotence.

As the instrument for Buddhist meditation, the prayer-wheel functions as an aid for people to speculate on the will’s activities in their mind and the appearance of boundary between the ego and others as the consequences of the will’s movements. Through this physiological explanation of meditation, Benjamin says that the will entails the imagination as the human capacity to present images in a mind, and it is always the result of innervation. In this sense, innervation is what parallels the will’s activity like it is activated in Helmholtz’s writing by the volition for body movement and memory. Furthermore, given the purpose of Buddhist meditation—focused not so much on the organization of ego as speculation on the condition of the mind, as well as the emancipation from the fixation on a closed-circuit of mind—Benjamin’s innervation in “One-Way Street” has some implications different from photoplay and the factory of attraction. First, it is less concerned with the nervous system’s mechanical reaction to impulses or cues since it is the will’s material form. Second, the paths of innervation should not be fixed to the permanent modes of subject or the fetishized forms of objects in meditation. Third, innervation is a meditator’s means for observing his/her own process of the neural production of pictorial images so it is self-reflexive. Along these lines, we can conclude that Benjamin uses the term innervation for describing the (un)consciousness’s physiological processes from the perspective of production, not from products or fixed forms of subject and (commodified) object. Consciousness is always a collective production since, on the field of sensations where any demarcation of ego/others and subjects/objects cannot remain permanently, only a multitude of molecules is conceivable. It is the same in that the viewers in Man with a Movie Camera can only perceive what camera men shoot, editing women montage, street people perform and cinema machines produce, what the viewers themselves collaborate on with this multitude of others. Thus, even in the filmic circulation exposed by Vertov’s film, the boundary of perceptual consciousness cannot be permanently fixed but fluid and collective.

Is Man with a Movie Camera conceivable as an example of a meditational application of innervation in film? The answer is yes insofar as Vertov aimed to make his viewers observe how their perception arises from a circulatory system comprising the human and the mechanical or technological. As he considered his factory of facts as the place where viewers find that whole industrial objects and values are in fact what they produced, Man with a Movie Camera encourages people to observe that the proletariats are cognitive workers who produce a “visual formula” and a proper “equation” between intervals of mechanized perceptual field. Then, is it conceivable that Benjamin’s innervation—the masses’ means of adjusting to the second technology—is influenced by Vertov’s works? Although I can only speculate on likely influences, there are good reasons to suppose a link. When Benjamin compares cinematic perception to the masses’ tactile appropriation in a strange building, he suggests that what produces a new mode of optical reception from distracted sensations is nothing but the viewers’ own habit. Moreover, from his emphasis on the experimental and endlessly varied features of the second technology for people’s innervation despite its purpose for the adaptation, Benjamin suggests that habit contrasts with the perceptual tradition through its flexible transformability and its openness to the ceaseless repetition of perceptual
decoding and recoding. Most of all, Benjamin thinks of innervation to the second technology not just as the masses’ means for adjustment, but their potential to appropriate the machines’ operation for perceptual (re)production. Undoubtedly, those are what Vertov’s film reveals.

If this constantly distracted condition is realized, which modes of consciousness can we imagine? Neither the simulation of the old psychological ideal, nor the calculated reflex of a cybernetic subject suffices—only the consciousness of collective production is possible.

Notes
1. Walter Benjamin, “The Work of Art in the Age of Its Technological Reproducibility (Third Version),” in Selected Writings. v. 4, 1938–1940, trans. Edmund Jephcott and others, ed. Howard Eiland and Michael W. Jennings (Cambridge, MA: Belknap Press of Harvard University Press, 2003), 268–9.
2. Walter Benjamin, “The Work of Art in the Age of Its Technological Reproducibility (Second Version),” in Selected Writings. v. 3, 1935–1938, trans. Edmund Jephcott, ed. Howard Eiland and Michael W. Jennings (Cambridge, MA: Belknap Press of Harvard University Press, 2002), 124.
3. Miriam Bratu Hansen, Cinema and Experience: Siegfried Kracauer, Walter Benjamin, and Theodor W. Adorno (Berkeley: University of California Press, 2012), 133.
4. Walter Benjamin, “The Work of Art in the Age of Its Technological Reproducibility (3rd),” 255.
5. Jonathan Crary, Techniques of the Observer: On Vision and Modernity in the Nineteenth Century (Cambridge, MA: MIT Press, 1990), 92.
6. Miriam Bratu Hansen, Cinema and Experience, 134.
7. Susan Buck-Morss, “Aesthetics and Anaesthetics: Walter Benjamin’s Artwork Essay Reconsidered,” October 62 (1992): 17.
8. Maurice Merleau-Ponty, “The Film and the New Psychology,” in The Robot in the Garden (Cambridge, MA: MIT Press, 2000), 343.
9. Kyunghee Kim, Gestalt Psychology (Seoul: Hakjisa, 2000), 10.
10. Maurice Merleau-Ponty, “The Film and the New Psychology,” 343.
11. Christian Von Ehrenfels, “On Gestalt-Qualities,” Psychological Review 44, trans. Mildred Focht (1937): 522.
12. Ibid.
13. Maurice Merleau-Ponty, The Visible and the Invisible: Followed by Working Notes, trans. Alphonso Lingis, ed. Claude (Evanston: Northwestern University Press, 1968), 127.
14. Ernst Mach, “Introductory Remarks: Anti Meta-physical,” in The Analysis of Sensations and the Relation of the Physical to the Psychica, trans. C.M. Williams (Sydney: Waterlow, 1897), 1st paragraph of section 2, http://www.marxists.org/reference/subject/philosophy/works/ge/mach.htm
15. Ibid., 6th paragraph of section 2.
16. See Hermann Helmholtz, “The Facts of Perception,” in Selected Writings of Hermann Helmholtz (Wesleyan University Press, 1878), 86, 87th paragraph, http://www.marxists.org/reference/subject/philosophy/works/ge/helmholtz.htm
17. Sigmund Freud, “Project for a Scientific Psychology,” in The Standard Edition of the Complete Psychological Works of Sigmund Freud, v. 1, trans. & ed. James Strachey (London: Hogarth Press, 1966), 298–302.
18. See Sean Carroll, From Eternity to Here: The Quest for the Ultimate Theory of Time (New York: Dutton, 2010), 37, note 29 in 387.
19. See Norbert Wiener, Cybernetics: Or Control and Communication in the Animal and the Machine (New York: John Wiley, 1948), 146.
20. Walter Benjamin, “The Work of Art in the Age of Its Technological Reproducibility (3rd),” 255–6.
21. Benjamin is quoting “sense for sameness in the world” from the Danish writer Johannes V. Jensen’s Exotische Novellen. See Ibid., 272, note 10.
22. Ibid., 268.
23. Considering that Benjamin states the difference between “tactile” and “optic” in the case of experience in a building, it is conceivable that this pair of concepts comes from Alois Riegl’s writing on Egyptian and Roman arts. In Late Roman Art Industry, Riegl uses the term “haptic” to distinguish the tactile mode of perception in the Egyptian pyramids from the optical mode of perception in Roman architecture which is characterized by its development of interior space. However, in a sense that the optical perception in a building is dependent on one’s tactile experience in Benjamin’s argument, his use of “tactility” has a different connotation from Riegl’s text. While the “haptic” is separable from “optic” for Riegl, the tactility is the unconscious condition of human’s optical consciousness. See Ibid., 271, note 7; Alois Riegl, Late Roman Art Industry, trans. R. Winkes (Rome: G. Bretschneider, 1985); Giuliana Bruno, Atlas of Emotion: Journeys in Art, Architecture, and Film (New York: Verso, 2002), 247–50.
24. Hermann Helmholtz, “The Facts of Perception,” 37th paragraph.
25. Ibid., 24–25th paragraph.
26. Body without organs’ means, in Deleuze and Guattari’s work, a theoretical body remained after all of organic compositions in social, cultural, and perceptual fields are deterritorialized. In this sense, Helmholtz’s imagined person, who lacks any organic forms of perception can be considered as a physiological imagination of “body without organs.” See Gilles Deleuze and Félix Guattari, Anti-Oedipus: Capitalism and Schizophrenia, trans. Robert Hurley,
Cinematic innervation

Mark Seem, and Helen R. Lane (Minneapolis: University of Minnesota Press, 1983), 9–16.
27. Hermann Helmholtz, “The Facts of Perception,” 26th paragraph.
28. Ibid., 37th paragraph.
29. Ibid., 28th paragraph.
30. Deleuze and Guattari also cited this term from Riegl’s Late Roman Art Industry. In a sense that the “haptic” in their writings means the sensual potentiality which can be actualized into specific perceptions, it is comparable to Benjamin’s tactility. See Gilles Deleuze and Félix Guattari, A Thousand Plateaus: Capitalism and Schizophrenia, trans. Brian Massumi (Minneapolis: University of Minnesota Press, 1987), 492–3.
31. Hermann Helmholtz, “The Facts of Perception,” 31st paragraph.
32. Norbert Wiener, Cybernetics, 50.
33. Ibid.
34. Moreover, film can be categorized in this third set of machines, in the sense that a movie camera functions to distinguish perceptual signals from the thermodynamic field of sensations, reproduces them on film reels, and mechanically rearranges them through editing.
35. Marta Braun, Picturing Time: The Work of Etienne-Jules Marey (1830–1904) (Chicago: University of Chicago Press, 1994), 24.
36. Walter Benjamin, “The Work of Art in the Age of Its Technological Reproducibility (3rd),” 265.
37. Lorraine Daston and Peter Galison, “The Image of Objectivity,” Representations 10 (1992): 81.
38. Hugo Münsterberg, The Photoplay: A Psychological Study (New York: Routledge, 2002), 80.
39. Ibid., 79–80.
40. See Maurice Merleau-Ponty, Phenomenology of Perception, trans. Donald A. Landes (New York: Routledge, 2012), 160.
41. Walter Benjamin, “The Work of Art in the Age of Its Technological Reproducibility (2nd),” 107.
42. Ibid., 107–8.
43. See Jonathan Crary, Suspensions of Perception: Attention, Spectacle, and Modern Culture (Cambridge, MA: MIT Press, 1999), ch. 1.
44. Ibid.
45. Hugo Münsterberg, The Photoplay, 82.
46. Ibid., ch. 3–6.
47. See Jean-Louis Comolli, “Technique and Ideology: Camera, Perspective, Depth of Field,” in Narrative, Apparatus, Ideology: A Film Theory Reader, ed. Philip Rosen (New York: Columbia University Press, 1986), 421–33.
48. See Allan Langdale, “S(t)imulation of Mind: The Film Theory of Hugo Münsterberg,” in The Photoplay, 18.
49. Jonathan Beller, The Cinematic Mode of Production: Attention Economy and the Society of the Spectacle (Hanover, NH: Dartmouth College Press, 2006), 9.
50. When we interpreted a picture of chronophotography, I said, from a very anthropomorphic perspective, that it is “tempting” to conclude that a machine produces geometric forms of visibility in the same manner as Helmholtz’s nervous system. However, even in that interpretation, the truth is that chronophotography is just a mechanical inscription of sensations without any abstractness. This is not only because Marey was satisfied with a graphical method dissimilar to human geometry, but also the majority of intervals between two discontinuous arrays in chronophotography still remained unconnected except some of the head and leg parts. But, if each set of sense elements on its timeline is translated into Münsterberg’s cues for human viewers’ gestalt association, it could restore the organic/mechanic connection of myography even in chronophotography. Moreover, if these cues induce viewers to suture the intervals through their continuous process of innervations, and so fill them with impressions of movements, chronophotography’s mechanic method could then be recoded in the human mode of perception as a machine’s simulation of the mind does in photoplay. It was what Marey hesitated to do, but Eadweard Muybridge, inspired by him, accomplished this through “zoopraxiscope.” And just after some years of their works, the Lumière brothers revised this machine/human connection by changing the chronophotography time intervals to every 1/24th of a second of darkness in cinematography.
51. S.M. Eisenstein, Selected Works. v. 1, Writings, 1922–34, trans. & ed. Richard Taylor (London: BFI Publishing, 1988), 59.
52. S.M. Eisenstein, “A Dialectic Approach to Film Form,” in Film Form, trans. & ed. Jay Leyda (San Diego: Harvest Book, 1977), 49.
53. Ibid., 54.
54. Ibid., 54–5.
55. S.M. Eisenstein, “Dickens, Griffith, and The Film Today,” in Film Form, 233, 245.
56. Walter Benjamin, “The Work of Art in the Age of Its Technological Reproducibility (3rd),” 264.
57. Tom Gunning, “The Cinema of Attraction[s]: Early Film, Its Spectator and the Avant-Garde,” in The Cinema of Attractions Reloaded, ed. Wanda Strauven (Amsterdam: Amsterdam University Press, 2006), 382.
58. See Eisenstein, Selected Works. v. 1, 62.
59. Anne Friedberg, Window Shopping: Cinema and the Postmodern (Berkeley: University of California Press, 1993), 56.
60. For Deleuze and Guattari, overall deterritorializations occurred in industrial, cultural and psychological fields of modern society are results of capitalism’s operation on the social body without organs (socius). And reterritorializations in modern society are results of capital’s recoding of decoded flows of these fields into circulation of capital. See Gilles Deleuze and Félix Guattari, Anti-Oedipus, 141, 223–5.
61. Dziga Vertov, “The Factory of Facts,” in *Kino-Eye: The Writings of Dziga Vertov*, trans. Kevin O’Brien, ed. Annette Michelson (Berkeley: University of California Press, 1984), 58.
62. Dziga Vertov, “The Man with a Movie Camera,” in *Kino-Eye*, 90.
63. Dziga Vertov, “On the Film Known as Kinoglaz,” in *Kino-Eye*, 34.
64. Beller, *The Cinematic Mode of Production*, 49.
65. Annette Michelson, “Introduction,” in *Kino-Eye*, xxxvii–xxxviii.
66. Walter Benjamin, *Selected Writings. v. 2 pt. 2, 1931–1934*, trans. Rodney Livingstone and others, ed. Michael W. Jennings, Howard Eiland, and Gary Smith (Cambridge, MA: Belknap Press of Harvard University Press, 2005), 466.
67. Benjamin mentions Vertov’s Three Songs of Lenin as a case which encourages viewers to recognize themselves as parts of artistic production. See Walter Benjamin, “The Work of Art in the Age of Its Technological Reproducibility (3rd),” 262.