

Fritz Kahn. *Das Leben des Menschen*, 1929.

Film, Aesthetics, Science: Hugo Münsterberg's Laboratory of Moving Images

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But even memory, attention and imagination do not tell the whole story of our inner mind. The core of man lies in his feeling and emotions.

—Hugo Münsterberg¹

The “movies” themselves are moving all the time. To be sure, they move on different roads.

—Hugo Münsterberg²

Imagine a room, a mental space, a cinema. Now place yourself in a psychological laboratory at the turn of the last century. Think of a space full of objects suspended in the eerie silence of thought, where instruments alone make ambient noise, mechanical, intermittent, insistent, and repetitive. This noise makes me think of the sound made by a film projector. Indeed, the entire atmosphere reminds me of that art of projection: here, as in a movie theater, the mood is one of absorption. People are engrossed in observant silence. They form groups, often sitting in ordered rows, immersed in a mental exercise that both isolates and connects them. In this particular space of mental experimentation, one is engaged, captivated, enveloped, and consumed. The objects and images that move as the mind races by are mesmerizing.

The laboratory in question is that of Hugo Münsterberg (1863–1916), the German philosopher and psychologist who pioneered the scholarly study of film. An analysis of his experimental laboratory at Harvard University invites an exploration of the ways in which science, psychology, and aesthetics intersected with visual representation at the cusp of the cinematic age and of how the analytic aspect of film and the tools of film theory were born as instruments in this cultural location. Münsterberg's work articulated an inventive cultural conjunction around the various “instruments” of knowledge, including knowledge of the self. In this “laboratory” of representational apparatuses, scientific research on mental processes and the expression of affects came to be linked to image technology, including the art

and industry of film.

This encounter of science and imaging on psychic grounds was an important part of modernity's innovative quest. Yet, despite having stood at the crossroads of this cultural confluence, Münsterberg, arguably the most popularly recognized psychologist in the United States during his lifetime, is now largely forgotten. His work on film has not been considered central to psychology; conversely, his laboratory work has been largely ignored in film studies. Although the importance of his pioneering 1916 book *The Photoplay: A Psychological Study* as a foundation of film theory is recognized, its theoretical apparatus has rarely been given adequate consideration in relation to the cultural and experimental context that generated it.³ The complexity of the interaction between the laboratory of experimental science and the apparatus of film imaging, in particular, still needs to be dissected. I first came to see this experimental space as a crucial cultural location while writing on the interplay between motion and emotion in modernity at the very university where Münsterberg developed his laboratory and conceived his film theory.⁴ What was this lab like? How had it functioned to open the doors to, and locate a space for, the exploration of affects in culture? Münsterberg not only devised the first full "experiment" in the language of film theory but articulated his theory in a language that emerged from the experimental laboratory. If he was able to write about film as an affective as well as cognitive instrument, it was because the emotion of cinema had been "instrumentally" present in his laboratory. The history of science and the language of film are deeply intertwined in this epistemological architectonics, as the movement of mental life and the motion of cinema are empathetically adjoined on the cultural map of modernity.

Psychotechnology

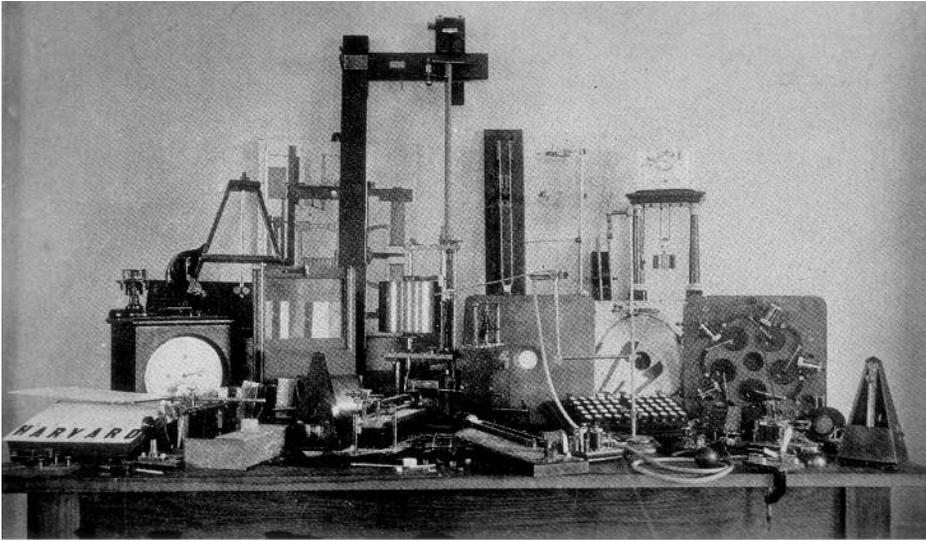
As modern experimental research met new forms of representation, technology became entangled with psychic life. According to Friedrich Kittler, Münsterberg coined the term "psychotechnology" to define the field of interaction he was exploring.⁵ As a philosopher, Münsterberg related psychology to technology in general, and to film in particular, through the observation of their shared processes. Conceiving of psychic life as a mechanism to be unraveled—a technology of sorts—he conversely became interested in the flow of new technology as a psychic instrument. It was along these lines that Münsterberg recognized the psychic function of the film apparatus. In *The Photoplay*, he offered an understanding of this issue that went beyond a simple reading of film form (e.g., the way the cinematic flashback captures the workings of memory or the close-up magnifies the affect) to speak of the power of filmic motion in a larger sense as a set of processes that replicate

the inner activities of the human mind.⁶ For Münsterberg, cinema works as an actual “projection” of the mind. Ultimately he represented film as a psychic projection, picturing our minds moving like a motion picture. While the scientific apparatus pursued the mapping of the mind, it also gave cinema a place within this realm as its own representative psychic mechanism.

Visiting Münsterberg’s collection of instruments for measuring mental activity gives us the actual “measure” of how much the birth of film, and its theorization, is related to the inscription of affects in time and space. Münsterberg observed that the kinesthetic properties of our cinematic machine result in a transport—that is, they carry us away, and around. In his words, in film, “not more than one-sixteenth of a second is needed to carry us from one corner of the globe to the other, from a jubilant setting to a mourning scene. The whole keyboard of the imagination may be used to serve this emotionalizing of nature.”⁷ The venture described here is marked with the atmospheric aesthetics of *Stimmung*, bears the trace of geographic exploration and the imprint of scientific imaging, and thus creates, through several moving lenses, a modern access to the surface of the world.

Above all, the inner venture that Münsterberg describes in *The Photoplay* is an intimate voyage—a tour of the emotions. In laying out a psychic atlas, his theory of what one might call “emotion pictures” made room for the navigation of feeling and charged cinema with the “moving” power of emotion. Most important, his theory involved a specific kind of “transport”: the movement of empathy, which actively engages the dynamics and atmospherics of space. As Münsterberg spoke of “emotional setting,” he recognized the geography of affects—the fact that affects not only constitute a space but also influence our perception of sites.⁸ In speaking of affects as atmosphere he claimed that in film “the feeling of the soul emanates into its surrounding” and, conversely, that an environment can express a mood.⁹

For Münsterberg, the power of cinema lies in this aesthetic relational ability—an empathetic “transport,” a voyage from inside to outside. His theory evokes the nineteenth-century notion of *Einfühlung*, which the German psychologist Theodor Lipps (1851–1914) described as a mimicry or transfer activated between the subject and its surroundings: with the expressive, dynamic forms of architecture, with colors and sounds, scenery and situations, atmospheres and moods.¹⁰ In *The Photoplay* Münsterberg recognizes such “projections,” showing that “depth and movement alike come to us in the moving picture world, not as hard facts but as a mixture. . . . They are present and yet they are not in the things. We invest the impressions with them.”¹¹ In viewing a film, a passage is created as “the objective world is molded by the interests of the mind” in permeable ways.¹² Ultimately, in Münsterberg’s view, “the photoplay tells the human story by overcoming the



forms of the outer world, namely space, time, and causality, and by adjusting the events to the forms of the inner world, namely, attention, memory, imagination, and emotion.”¹³ This affirmation of the transitive, empathetic power of cinema is a synthesis of Münsterberg’s laboratory work. The chapter headings of his 1916 book on film, which describe “the psychology of the photoplay” in sections entitled “Depth and Movement,” “Attention,” “Memory and Imagination,” and “Emotions,” correspond precisely to the main categories of experiments conducted in his Harvard Psychological Laboratory. The architecture of the film book stands on solid ground, built as it is upon Münsterberg’s body of experimental research: it reproduces the geography of the laboratory with research that makes room for psychic transfers.

To account for the mnemonic, imaginative, and emotional impact of the moving image, Münsterberg pushed the psychophysiological direction that had emerged in the philosophy of psychic life in his laboratory. His modern physiological view of the psyche was based on a deep interest in sensations. In his words:

Impressions which come to our eye at first awaken only sensations. But it is well known that in the view of modern physiological psychology our consciousness of the emotion itself is shaped and marked by the sensations which arise from our bodily organs. As soon as such abnormal visual impressions stream into our consciousness, our whole background of fusing bodily sensations becomes altered and new emotions seem to take hold of us.¹⁴

Münsterberg understood the cinema to be a vehicle of such physiological activity and placed its emotions in the moving realm of sensations. For him, film makes an impression, which comes into our visual field in the form of sensation, and this bodily sensorium becomes the basis of a transitive, emotional knowledge. In the way it explains the relation of the film sense to emotion, Münsterberg’s modern physiological psychology anticipates a neuroaesthetic approach. In this view, “the brain is a screen” and art is not only sensation but also conveys a sentient transmission of affects.¹⁵

Writing about mental life in 1891 on the basis of his early experiments on sensations, Münsterberg proposed:

The source of the elements of consciousness which are most important for our mental life—those which control the make-up of our ideas, judgment, feelings, and will-acts—do not lie in the particular sense organs, but rather in the internal but peripheral body parts—the muscles, joints, glands, blood vessels, tendons, intestines.¹⁶

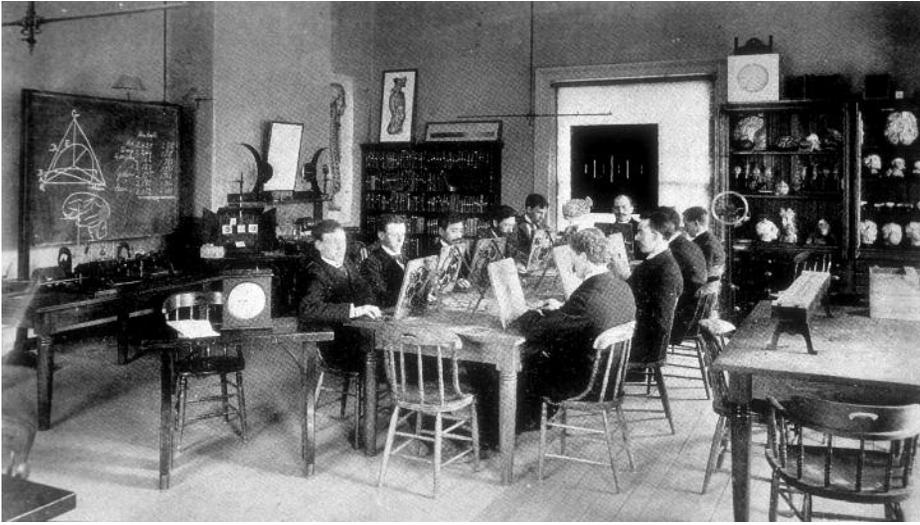
In this early psychological formulation, one can feel the “motor” that would drive the filmic passion of Münsterberg’s later theory of film. In *The Photoplay*, he would write that film depends on “those processes which are most essential for the true life emotions, namely those in the glands, blood vessels, and involuntary muscles.”¹⁷ Münsterberg’s idea that an emotional kineshetics materializes in film touches on the muscular effort that accompanies voluntary motion and the faculty by which this sensation is perceived; it also bears on the involuntary body of emotions. One can sense here the material base of cinematic pathos. As an approach to the physical impact of emotion pictures on a spectatorial body, this understanding represents an important entry into the neurophysiology of spectatorial life.

In Münsterberg’s hands, spectatorship thus began to be conceived as an actual “cell” of mental and affective life. A scientific apparatus was applied to “measure” film’s psychophysiological interaction with the inner life of sensing, imaging, reminiscing, and feeling. As the psychological research turned into a film theory, it touched on the material fiber of a passion to reimagine, remember, and reinvent the tactile, moody surface of experience.

How “instrumental” this area of research may have been for future neuroaesthetics can be further understood by taking a closer look at the laboratory of emotion pictures. Because Münsterberg arrived at film after testing neurological flux with scientific instruments, he was able to see that the cinema is, itself, an “instrument.”¹⁸

Pathway to the Psychological Laboratory: A Cultural Geography

The Harvard Psychological Laboratory was in many ways the product of the late-nineteenth-century academic conjunction of philosophy and psychology on aesthetic grounds. Duchenne de Boulogne (1806–1875)—whose method was transformed by Jean-Martin Charcot, his most famous student, into a well-known prefilmic theatrics—had paved the way for the line of experimentation that connected photography, and eventually motion pictures, to the study of affects. Duchenne’s *Mécanisme de la physionomie humaine* (1862) sought to map the mechanisms that underlie the configuration and expression of emotions.¹⁹ As the subtitle of the book makes clear, the aim of this research was to make “the expression of passions applicable to the plastic arts.” The book itself, however, resulted from a purely experi-



mental practice: it was the outcome of electrophysiological analysis. Duchenne stimulated the faces of his patients with electrical probes in order to trigger muscular response and to demonstrate the role muscles play in conveying different emotional states. Using a camera to describe his findings and build his theory, he recorded the resulting facial expressions “acted” out by his subjects and acted upon them.

Duchenne’s photographic archive was used in turn by Charles Darwin in 1872 to illustrate his groundbreaking work *The Expression of Emotions in Man and Animals*, which exhibits a torturous athletics of human emotions.²⁰ In an effort to “locate” the actual place of an emotion—in muscular tissue and the apparatus of its movement—scientific research engineered a “sensational” mechanics of passion that, by way of photography, accessed the terrain of the visual arts.

Münsterberg would take this research further by pursuing the psychomechanics of sensations and the haptic physiology of affects, moving beyond Duchenne and his literal galvanization of affects and their use by Darwin. His work would make advances on the terrain of neuroaesthetics by eventually connecting the sentient mechanics of the emotions to the language of motion pictures, the ultimate expression of the age of mechanical reproduction. His ability to do so was the result of a productive encounter with the eminent philosopher and psychologist William James.

James was the first scholar of import to discover Münsterberg and became an immediate supporter of his work. By the time he invited the German philosopher-psychologist to direct his newly created Harvard Psychological Laboratory in 1892, his own work on emotion had been well established with the publication in 1890 of his seminal book on psychology, which gave space to affects and memory.²¹ In many ways, the laboratory that Münsterberg came to direct was the product of James’s work, which had taken interest in emotions and the imagination and was devoted to the work of memory, association, the perception of space and movement, and the relation of sensations to affects. The experimental center of research he was preparing was poised to include the study of feelings.

James had begun to teach psychology at Harvard in 1872.²² The new science of psychology “took place” in a series of disciplinary locations within the institution: first in Boylston Hall—the building that housed the

Museum of Comparative Anatomy—where James taught comparative anatomy and physiology as well as natural history; then in Lawrence Hall, where he established his first laboratory of experimental psychology in 1875; in Dane Hall, the former Law School, where the Harvard Psychological Laboratory was formally founded in 1891; and ultimately in Emerson Hall, the newly built academic seat of philosophy, to which the lab moved in 1905.²³ The borders between philosophy, psychology, and physiology were fluid, and, accordingly, philosophical discourse joined physiology in James's teaching of the psyche, which also involved the use of a lab in the Museum of Comparative Zoology that had been founded by naturalist Louis Agassiz.

The shifting cultural geography embedded in the physical locations of the lab is also reflected in the epistemological framework James adopted in his work. His philosophical address of psychology had strong attachments to a material approach. Giving prominent space to the emotions, he insisted, "The general causes of the emotions are indubitably physiological."²⁴ As he explained in *The Principles of Psychology*, through his work he came to realize "how much our mental life is knit up with our corporeal frame."²⁵ James argued that mind and body are not separate or hierarchically connected and that affects are inextricably linked to sensational processes and physical manifestations. He ventured to say that "the bodily changes follow directly the perception of the exciting fact" and that "our feeling of the same changes IS the emotion."²⁶ James posited, ultimately, that an affect could not even be cognitively apperceived if separated from situational expression and "reverberation."²⁷

As far as James was concerned, sensory anesthesia would mean the end of affective life altogether, because "a purely disembodied human emotion is a nonentity."²⁸ If affects were perceived to have an epidermic life, then our knowledge of them was also epidermic. Without the ability to sense sentiment, one would be epistemologically anesthetized. For James, the intellectual life was bound to inner life. He condemned "an existence of merely cognitive or intellectual form" apart from affective engagement and vehemently opposed what he termed "a feelingless cognition."²⁹ For him, affects are implanted in the fabric of our inquisitive being: emotion is the inner movement that drives our desire to know. Such a way of thinking of "mental mood," he pointed out, is furthermore modern: the relation of sense to sensibility is an effect of modernity, and the sensational cognition of feeling is the ultimate advance brought about by modernity's own characteristic motion.³⁰ Knowledge and affects are linked because they can "move" together—and move us.

This intellectual inclination led James to seek out the young Münsterberg. The two had met in Paris in 1889, at the First International Congress of

Psychology, when Münsterberg was just twenty-seven years old.³¹ In the early works Münsterberg had published while studying medicine, one can see some of the reasons James might have been attracted to the younger scholar. Münsterberg had learned from his mentor Wilhelm Wundt to relate psychology and philosophy, asking large philosophical questions about the nature of time and space, connecting ideas and emotional states, and searching for the place of feeling and volition in our mental makeup. He was ready to prove that ideas are related to sensations, spoke about a “feeling” quality related to physiological states, and was refashioning the concept of inner sensations. He carved out his notion of a “muscular sense,” arguing that sensations result in a motor force and that kinesthetic sensations are especially responsible for our sense of space.

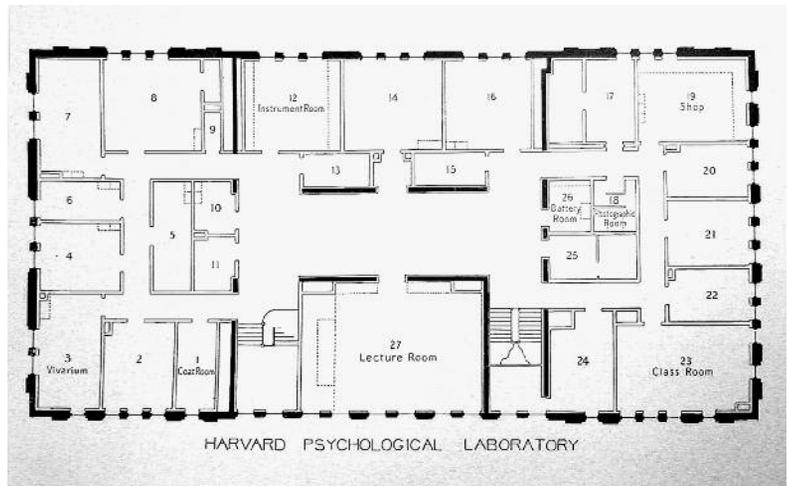
In their early formulation, Münsterberg’s views were close to James’s own conception of mental life.³² If his early material viewpoint migrated into an experimental vision, later becoming the basis of his interest in film, it is certainly due to James’s influence. A mutual conception of a material base for the act of knowing drew James and Münsterberg along the same path of research, looking for a “law connecting body and mind.”³³

In 1892, after scouting for talent to spearhead the disciplinary rise of psychology in the academy, James, admitting his own disinclination for laboratory work, invited Münsterberg to join the Harvard faculty and assume the directorship of the Psychological Laboratory. There Münsterberg would extend the range of psychological theories to a wide array of cultural phenomena, including aesthetics, philosophy, art, pedagogy, industry, politics, and law.

Münsterberg’s Laboratory of Emotion Pictures

Hugo Münsterberg himself invites us to visit the laboratory he took over from William James, considered at the time to be the most important in the United States, in an 1893 reflection on the concepts that animated his philosophy of the new psychology and its forms of experimentation. His description of the goal and activity of the lab is spatial, and it enables us actually to imagine the cultural landscape housed in the laboratory, even to experience its atmosphere and soundscape:

The upper room of Dane Hall, in which for so many years the Law School carried on its quiet work, has recently become filled with noise. Electro-magnets snap, tuning-forks resound, the chronoscope whirs,—hammering and sawing are heard, and the discussions there are no longer concerning legal cases and decisions, but rather concerning sensations and ideas, feeling and emotions, motives and will. Over the door stands in large letters: “Psychological Laboratory.”³⁴



Arguing against conjectures that “experimental Psychology treats of spiritualistic experiments” or that “nothing less than vivisection is in question,” he presents a large, composite picture of the instruments of knowledge at work here.³⁵ Münsterberg links his experimentation to a philosophical quest as well as to advances in physiology and physics, especially in picturing sense organs, motion, nerves, and the functioning of the brain, and he borrows from astronomy an understanding of time and temporal measure. All these methods were used for “figuring” cognitive functions that include mnemonics, desires, and reflection and for exploring the duration of mental acts and the relation of external stimuli to inner sensations in combined ways. Equipped with this epistemological background, the lab was to study “the relation between the outer processes and the inner states”—a perspective that would become the crux of his film theory, sensitive to this empathetic dynamic and focused on the relation between the “outer” and “inner development of moving pictures.”³⁶ In stating that “to show the significance of the experimental method for the high and most complicated phenomena of mental life, has come to be the goal of our labors,” Münsterberg addresses specific objects.³⁷ He makes clear that this research on mental life integrates the world of affects:

In the series of scientific investigations now begun in our youthful laboratory the questions concerning elementary time-measurements and sense impressions take a place far behind the study of the combination and fusing of ideas, of process of thought and acts of speech, of space and time perception, of memory and attention, of feeling and will.³⁸

In order to make this research on mental life more tangible, and to grasp the place of emotion in its context, Münsterberg himself can be a guide. His words accompany us on a further journey through the lab as they display its experimental itinerary. In this text, as he takes the reader for a walk, Münsterberg offers a kinesthetic view of mental process as inscribed in the lab:

A stroll through the workrooms, even outside of working hours . . . permits one to see clearly this high development from a glance at the apparatus stored in the glass cases. Four great groups of contrivances can thereby be easily distinguished. . . . First the apparatus intended

to illustrate the relations between mind and body through representation of the brain, nerves, sense-organs, etc. Costly models of the brain, eye, and ear, all with detachable parts, valuable models of nerve paths, fine preparations in wax, dissected parts in alcohol, etc.—all are here. Here belong also the anatomical diagrams and the histological nerve-preparation with excellent microscopes.³⁹

Münsterberg starts his stroll from the site of the body in order to evidence the anatomical and physiological base of the cognitive and emotional apparatus upon which he is experimenting. The instruments he mentions in his “architectural promenade” convey this sense in the very form of their design and in their materiality. They are aesthetically composed, carefully sculpted, and coated with elaborate brushstrokes, rich in chromatic nuances. As objects of design, they stimulate a curiosity to survey the surface of the body, and they impel us to explore the landscape that lies within. These instruments of knowledge appear to call for touch, seeking the hand of the experimenter to be laid upon them and to grope beneath corporeal surface.

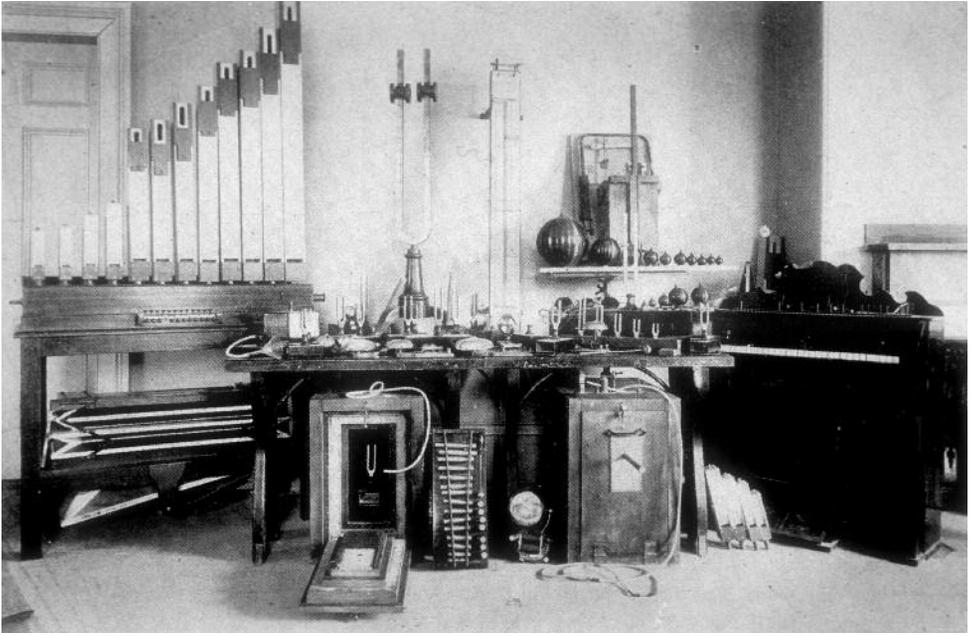
Having passed by the *humani corporis fabrica*, from the “fabric” of this corporeal landscape Münsterberg leads us to the psychology of the senses. This section of the lab, he says,

is the most imposing. Eye and ear have equal recognition. A copious collection composed of tuning-forks, an organ, a harmonical, pipes, resonators, etc. etc., serve for psychological acoustics. Color-mixers of various sorts, costly prisms, apparatus for after images and color-blindness, a dark room, perimeters, etc., serve for psychological optics.⁴⁰

Optical research is by no means the only site of investigation here. In Münsterberg’s lab, the eye is not chosen to represent hierarchically the subject and the self but is paired with other forms of sensory expression. The lab is keen on extensive experimentation involving sound and is especially “tuned” to psychological acoustics. Here, one can hear the sound of mental life and the rhythm of psychic change. Eye and ear enjoy equal status in this laboratory, but the other senses are not marginalized. Münsterberg says that they “are not forgotten. Complicated touch and temperature apparatus, and the instrument for the study of the sensation of movement” have an important place in this picturing of mental life.⁴¹

As we continue our stroll through the laboratory, Münsterberg informs us that

of greatest value is the incomparably rich collection of instruments belonging to the third section. They serve for the time-measurement of psychical acts. . . . Here the methods used gain constantly in value.



They allow us to estimate most minutely distinctions which are inaccessible to self-observation, and the more their resources are developed, the deeper the glance we gain into the structure of the mental organism.⁴²

In observing the “organism” of mental life, Münsterberg notes that “clocks have somewhat the same function as the microscope of the anatomist.”⁴³ This parallel highlights the centrality of time, which was “anatomized” in the research. The observation of temporal matters was mainly achieved by the use of a chronoscope of Münsterberg’s invention, one that is still extant, along with a variety of tuning forks registering the variation of psychophysiological reactions, including involuntary ones. Through a dissection of time, the rhythm and duration of mental life was carefully observed in Münsterberg’s laboratory. On these temporal grounds film and science met: the sectioning and sequencing of time and the search for its movement turned the history of science into the language of cinema as the experimental researches of Eadweard Muybridge and Étienne-Jules Marey, among others, analytically parsed the leap of time that led from lab to film.⁴⁴ The emergence of film was taking place in the very space of scientific research on time travel that saw the emergence of film theory.

As we continue our cinematic-architectural promenade through Münsterberg’s lab, we enter the fourth section, which included

all that apparatus which serves exclusively for the investigation of higher mental processes, such as the perceptions of space and time, memory and attention . . . feelings and emotions . . . apparatus for the study of aesthetic feelings or the expression of the emotions. . . . Exactly in this department . . . the tiny mechanical workshop of our laboratory has proved most useful.”⁴⁵

This fourth section of the Harvard Psychological Laboratory, the most important and cherished of the enterprise, housed the research that most directly transferred into a theory of film. Münsterberg saw film as an expres-

sion of mental life and psychic energy and explored it in *The Photoplay* according to the categories of “depth and movement,” “attention,” “memory and imagination,” and “emotions.” These filmic processes correspond to the categories of “higher mental processes” explored in the lab, which include, as the quoted description clarifies, “the perceptions of space and time, memory and attention . . . feelings and emotions.” **Film theory thus became an extension of laboratory research on mental picturing as Münsterberg began to mold the psychic geography of his film book upon the architecture of his laboratory.**

In this cultural transfer, one can observe aspects of the making of the self. For Münsterberg, the higher functions of mental life are not restricted to the cognitive but reach into the imaginative work of recollection and affect, and film expresses, with precision, this way in which the mind works beyond cognition. As it shows the depth and movement of psychic phenomena, film makes manifest all its elusive inner mechanisms. The film apparatus exhibits them on a screen that is the mind’s own screen. Mental picturing is fully materialized in moving images as the language of cinema becomes the register of inner life—a “projection” of our affective existence. Here, moving images are a laboratory of emotion, and they move, indeed.

The Psychological Laboratory Displayed at the World’s Fair

If we consider that Münsterberg’s laboratory and his film theory were a product of the culture of modernity, it is fitting to discover that their encounter involves the setting of another space of modernity: world exhibitions. The apparatus of film and the instruments of science shared exhibition space at world’s fairs, which were themselves documented in many panorama films of the modern era, including Edison’s 1901 *Pan-American Exposition by Night*. Along with innovative visual technology such as film, new sciences such as psychology took an active part in the display of modern culture at the expositions. Münsterberg himself was involved in this process, contributing to the establishment of world exhibitions as locations for scientific congresses. He participated in the 1893 World’s Columbian Exposition in Chicago, where he displayed the work of his laboratory and even prepared an exhibition catalogue.⁴⁶ One of his life achievements was the organization of the International Congress of Arts and Sciences in conjunction with the Saint Louis World’s Fair (The Louisiana Purchase Exposition) of 1904.

In many ways, the catalogue of the instruments displayed at the Chicago World’s Fair confirms the haptic picture of the Harvard Psychological Laboratory that Münsterberg provided in his descriptive journey through the lab’s premises.⁴⁷ Adding a detailed account of all the instruments used



in the facility, this catalogue completes the map of the lab's means of detecting emotion by way of motion, offering a chart of the division of labor and a precise taxonomy of the research.

The research on psychic life conducted in the years 1892–1893, when Münsterberg took over from James, is summarized in an appendix to the *Harvard Psychological Laboratory* catalogue as being particularly focused on “memory, especially the relation of disparate senses in recollection.”⁴⁸ In this lab, as in film, mental tools are required to sense “the complication of perceptions,” including different senses coming together in elaborate response.⁴⁹ The lab in particular conducted a “psychometric investigation of the fusion of sensations of touch.”⁵⁰ Dermal sensitivity and muscular action were considered important aspects of the process in which affects are expressed, just as in Münsterberg’s kinesthetic account of filmic emotion. The unconscious was read as it emerged in involuntary motor reaction, with the lab studying “the influence of previous motor ideas in producing unconscious movements.”⁵¹ This research reached an emotional athletics when tracing “the influence of muscular fatigue on the psychical processes.”⁵²

The instruments are grouped according to research categories. First are “objects for anatomical and physiological demonstrations of the physical basis of mental life,” which pay particular attention to the brain and the sense organs.⁵³ Next, in the spirit of the physiological observation of mental life, comes the study of sensations, beginning with hearing. In the section devoted to sight, a precinematic device—a magic lantern—appears with apparatuses for discerning color difference and mixing color. Next to sight, a section called “dermal and muscular sensations” is devoted to touch and movement. Münsterberg defines this domain as “tactual space,” where touch is spatial and space is tangible.⁵⁴ With more than “two hundred arrangements for studying the number and extension of skin sensations,” the skin becomes the measure of our understanding of the environment.⁵⁵ In this haptic way, the laboratory tested the border of the permeable relation between outer and inner space and the perimeter of empathy—sites that became theoretical thresholds for *The Photoplay*.

“The apparatus for studying the higher psychical processes,” so central in the film book, begins with “time measurement of mental acts.”⁵⁶ The tem-

porality of mental life and the reaction times of mental processes are investigated with a “touch-reaction instrument” that creates “twenty different stimuli.”⁵⁷ Next are a number of instruments for probing visual capacities and optical illusion, including the impression of movement. These instruments for testing the perception of time-space include such precinematic devices as the stereoscope, the stroboscope, and the zoetrope, a rotating device that makes still images move. Haptic instruments for “studying the muscle-sensations, tactual space, and the presentation of movement” are exhibited next to the “apparatus for studying the perception of the position of the body.” “Time-sense” accompanies “space-sense.” At the end of this mental journey, the apparatus to study the higher psychical processes approaches the real inner work of film with the dynamic of “association, attention, discrimination, memory, feelings, emotions, [and] will.”⁵⁸

The material displayed at the World’s Columbian Exhibition included four hundred photographs, as well as picture books. Among the extant visual documents, the experiments for detecting emotion appear to be especially cinematic. For example, the lab’s research tools included a number of painterly sequences—montages of faces—used to study the expression of affects. The idea, derived from physiognomy, is that one’s inner life transpires on the outside and can be read as it is impressed on the visage. The laboratory tested this materiality of emotion as imprinted on, and grafted and mapped onto, one’s features. Silent cinema, heir to physiognomic discourse, would continue this line of emotional mapping, insisting on facial close-ups and enhancing the affective play of those close-ups. So would early film theory, especially in the formulation of Béla Balázs, who pioneered an understanding of affect in film in terms of microphysiognomy and offered an “animated” reading of visual life that extended from the human face to the face of things.⁵⁹

Münsterberg’s experiments borrowed from physiognomy but went beyond it. They concerned the moving montage of the emotions, which was recognized in his film theory by turning laboratory experimentation into a theorization of affects. In these experiments the attention given to the movement of the affects is cinematic. Here, a singular face or portion of the face is not significant *per se*, because affective meaning is created by the combination, juxtaposition, and succession of the expressions. One is reminded of the Kuleshov effect, in which the same shot of a facial expression is associated by way of editing with different situations. In response to the different contexts, the audience fabricates different emotional reactions. One might “project” onto the same face sadness or joy, love or hate, hunger or satisfaction depending on what followed in the sequence. The filmmaker’s test, like the scientist’s own, was about affective montage as a form of empathy. This

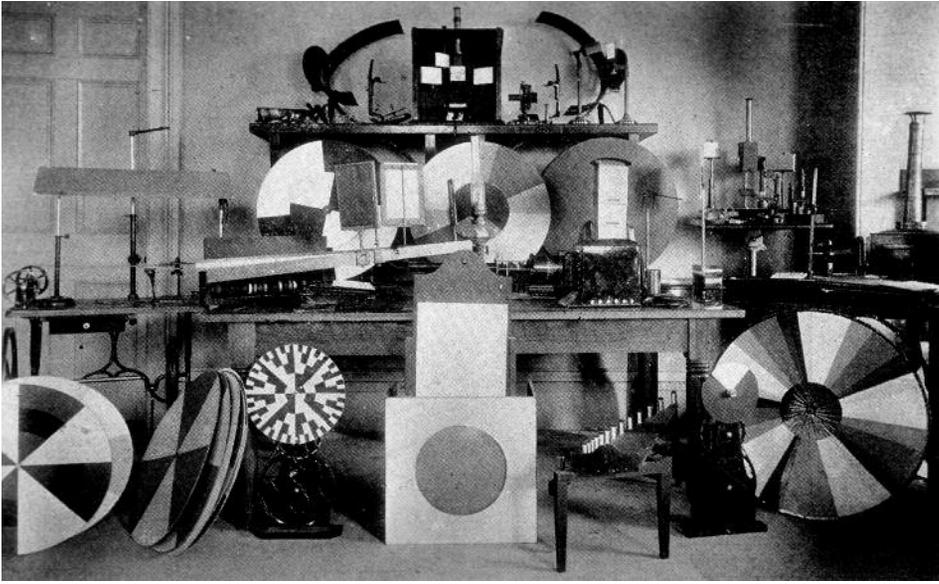
type of experimentation understood that the dynamic of motion creates an emotion, which is itself always in movement, and proved that knowledge is activated in intersubjective interaction: it depends on the *emotional* transfer that creates empathy.

Displayed at the Columbian Exposition were apparatuses that probed this potentially cinematic phenomenon, including an “instrument for studying movements during the emotions.”⁶⁰ The hypothesis tested in the lab was that emotion provokes an effect in the body, profoundly “affecting” it, and this emotional effect, in turn, can be physically detected by tracing its subtle movements. For this purpose Münsterberg used instruments designed after Étienne-Jules Marey, whose waves of motion became film.⁶¹ In order to show the dynamics of psychic life, Münsterberg used Marey’s myograph, which traced muscular contraction; employed his sphygmograph, which registered blood pressure; and activated his pneumograph, which provided a record of chest respiration. As the graphic reading of affect developed, emotion—a “trace” of motion—turned into cinematic writing. If in cinematography a physiology of affects became a language of movement, it follows that, for Münsterberg, this affective mobility became a theory of film.

In this laboratory, cinema was a memory trace left by the future. The instruments at the World’s Columbian Exposition designed a cinematic worldview. Take, for example, the memory apparatus marked “Münsterberg’s instrument for studying association and memory,” which has survived the test of time. Memory is here fashioned as a black box. Inside the box, a rotating device shows a sequence of images that elicit audience response. The architecture of this instrument prefigures the dark room of the film theater. This memory apparatus is none other than the apparatus known as film: it displays that particular memory theater that is the cinema. This shadowy room of moving pictures, a camera obscura of memory, traveled from lab to film. No wonder, then, that this geography of mnemonic, associative, affective, empathetic space, devised in a lab, turned into the actual space of film theory.

The Design of Mental Life

If the instruments of knowledge displayed in the Harvard Psychological Laboratory turned into the theoretical tools that crafted the cinematic apparatus as an affective instrument, this was also due to the form of their manufacture. To further understand these instruments, one needs to pay more attention to them as objects of design. In the words of Jacques Rancière, “if I speak of design . . . what interests me is the manner in which by tracing lines, disposing words or organizing surfaces, one designs a shared common space . . . a configuration of what is visible and thinkable, a form of habitation of the sensible world.”⁶²



The instruments were aesthetically rendered when designed, and Münsterberg was aware of the texture of his objects, which circulated meaning beyond a history of technology. They palpably rendered new worlds thinkable, representable, designing a shareable, common space of knowledge and even crafting a space of imaginary circulation between science and the arts. Like modern “cabinets of curiosities,” Münsterberg’s scientific objects were arranged in photographs as if for an art installation. Photographs of the lab itself were staged, their composition often displaying a collagist aesthetic, or in the case of an image of instruments for experiments on sight, the montagist avant-garde machine approach of a Léger. In describing the lab, Münsterberg draws attention to the fashioning of the instruments: “Copious supplies of wood and glass, of brass and cotton wadding, of all the varieties of paper and iron tools, of wires and tubes, and of physical and chemical paraphernalia, enable us continually to adapt the instruments to our questions.”⁶³ Speaking of the design of the tools, he emphasizes their tangible qualities, their flexibility and malleability. Their material versatility, their actual “fashioning,” enables their methodological adaptability, making them “suited” to a variety of epistemic questions. The instruments display a haptic,

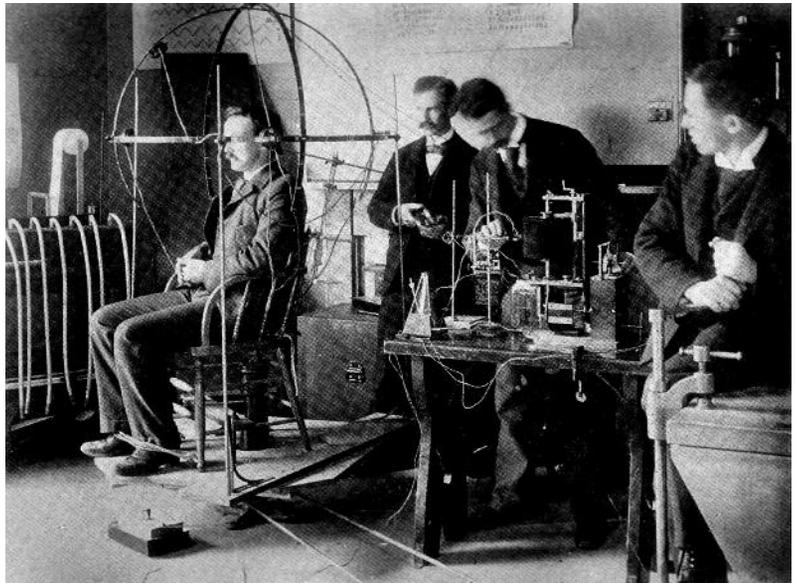
transformative ability: if the design of the objects is a question of manufacture, the ideas they design are themselves subject to a suitable, handicraft-style making.

Some instruments even have an ordinary feel, a quotidian appearance. For example, experiments in how subjects detect color were conducted by using colorful batches of wool as discerning material. This scientific setting ultimately weaves a familiar scene: to build perceptual instruments, experimental psychology resorts to a humble set of tools, refashioning the balls of thread women knitted in nineteenth-century parlors as well as their way of experiencing time. The “fabric” of color, its textural manifestation, was the object of inquiry: the lab made scientific discoveries about mental

Opposite, top: Instruments for experiments on sight, Harvard Psychological Laboratory. Courtesy of Harvard University's Collection of Historical Scientific Instruments.

Opposite, bottom: Antirrheoscope, or the waterfall illusion, Harvard Psychological Laboratory. Courtesy of Harvard University's Collection of Historical Scientific Instruments.

Right: Experiments on dizziness and its effect on the localization of sound, Harvard Psychological Laboratory. Courtesy of Harvard University's Collection of Historical Scientific Instruments.



activities by learning from the fabric of everyday life, its instruments, and the texture of domestic space.

The case of the antirrheoscope, one of the most famous objects of the lab, is not dissimilar. Creating what is commonly known as the “waterfall” illusion, this instrument is a tall, upright, rectangular, striped object that was used to explain the illusion of movement and study its perceptual effects. The subject stares at the central inset of the striped rectangle, where the lines are set in rotating motion by a crank. When the motion is stopped, the subject continues to see the object moving and may even experience movement going in a different direction. Displaying the afterimage effect that was long used to explain the illusion of movement in film, the instrument tells its own version of cinema: how it is that a series of still frames appears projected as a “flow” of images. If in the waterfall that is cinema the images are impressed on celluloid, here they are made of fabric. The instrument is famous for having been handmade, reputedly cut and sewn together from the bathing suit of a professor’s wife.⁶⁴ Even if the story is apocryphal, scientific instruments nonetheless have a fictional life, and this imaginative tale suggests that the myth of film’s origin lies in women’s fashion. Thinking of this instrument, among others, as an object of design and a subject of material culture, one can see that it actually “fashioned” movement while fabricating the activity of mental life. The psychological laboratory thus materially interwove the flow of motion with emotional fabric, in a manner that was suited to the times and closely “knit” to the fashioning of everyday life, its coloring, and apparel.

The laboratory “sculpted” the material of emotion and, delving into its fabric, actually “designed” the world of affects. With regard to the emotion of modern motion, many cinematic feelings were conveyed in the actual shape of Münsterberg’s instruments. Of special significance is a swaying chair belonging to the experimental section of the lab devoted to association, attention, memory, feelings, and emotion—that is, the section devoted to the same epistemological categories that Münsterberg recognized to be the work of film in *The Photoplay*. In an image of the instrument, the chair is positioned inside a spherical contraption and attached to a mechanism

that makes it rotate. A man is sitting, chained to the chair, and is about to spin. The speed of the motion provokes a sensation of dizziness, which, as Münsterberg would suggest, can “affect” one’s sense of place, and even one’s grasp of the location of sound. This experiment in the sound of “moving” dizziness makes apparent what became the physical basis of cinematic affect; it speaks of the imaginary chains of spectatorial absorption, the vertigo of mental speed, and the emotional roller-coaster ride of moving images. The sensation of displacement as one emerges from the chair approaches the kind of electrifying dislocation and hypnotic experience that is shared in film. In the same space of emotive display in which one finds the swaying chair, a hypnoscope is also present. The laboratory acquired it in 1890, at the inception of the filmic age.⁶⁵ This instrument features two sets of clockwork-driven mirrors moving in different directions and designed to spin out, activating the mirrors of reflection as a state of mind and creating an absorptive, hypnotic condition. The instrument’s design is tellingly cinematic: no wonder the hypnotic, mesmerizing, “moving” power of cinema came to be theoretically born here, in this laboratory, out of the spinning apparatuses that registered the flow of mental life.

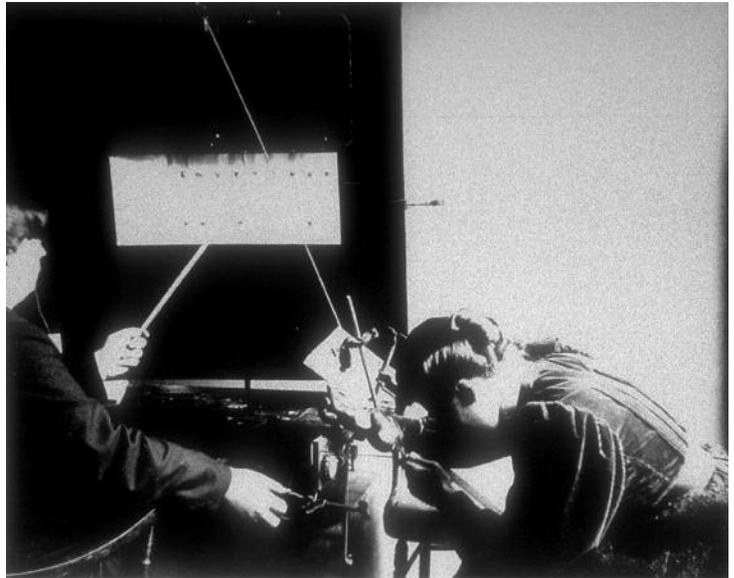
The Lab Dwellers

The extant photographs of the Harvard Psychological Laboratory give an idea of the cultural design of the instruments and the configuration of its space and offer as well a picture of the inhabitants of this modern factory of ideas. In one picture, Münsterberg is positioned at the head of a table. Down the length of the table experimenters sit across from one another, intent on their chain-reaction experiment: each responds to a signal resulting from the previous person’s response. In another photograph, the experimenters are scattered around tables where psychological experimentation takes place in the customary rotational method. A wire model of the brain towers over them from the back.

The photographs of the Psychological Laboratory, when not devoid of human presence, show mostly “men at work” posing for the camera in frontal views as they perform tasks. But exceptions, even notable ones, exist to counter this masculine picturing of the new science, and of modernity in general. One way to deflect this image of the laboratory is to think about the fashioning of the instruments, recognizing how “woman’s work” is inscribed, even against the grain, in their texture.

The fact that only men are portrayed in the catalogue prepared for the World’s Fair, however, poses a question: were women excised merely from the representation, or were they denied access to the laboratory altogether? Archival research unearthed a single photograph of a woman working in

A woman finds room to experiment at the Harvard Psychological Laboratory. Courtesy of Harvard University's Collection of Historical Scientific Instruments.



the lab. There she was: a female figure leaning over her experiment, intent on the repetitive, obsessive observation of mental life. Could she be using a magnifying lens or a special writing tool—a tuning fork or, better yet, a stylus called a “wave writer” that was ever present in the lab? With this she might detect and record the rhythm of thought. In handling this instrument of knowledge, she might be able to “write” an affect. She could even “style” a mood or graph an emotional wave, inscribing with her instrument the rhythm of psychic energy, its graphic design. Whatever the objective, the experimenter appears absorbed, “tuned in” to the slightest unconscious movement or rhythmic wave. The trace of an invisible topography emerges from her activity: an inner landscape may become graphically mapped in her hands, by way of tactual, “instrumental” extensions.

But who was she? Was she the only woman in Münsterberg’s lab? At the time, women could be admitted only to Radcliffe, the college for women that was known as the Harvard Annex. This might explain the absence of women in the official pictures of the World’s Fair catalog. Yet, here is this woman from the archive. Because the posture she adopts as she leans in on her task obscures her face, she can stand in for a number of women, speaking both for their engagement in, and exclusion from, the experimental laboratory.

Modern Instruments of Writing: Hugo Münsterberg and Gertrude Stein

Although Münsterberg’s views on gender, in tune with his time, were not particularly progressive, he nonetheless supported women’s education, taught at Radcliffe more than routinely, and even trained Mary Whiton Calkins, the eminent psychologist, who was given special permission to work at Harvard’s Psychological Laboratory.⁶⁶ Calkins was not an exception, for other women as well had lab experience with Münsterberg.⁶⁷ A female student reminisced that this work gave them personal access to a new world: “we dissected our sensory selves and examined tactile reactions, and we recorded, grouped, and classified our mental processes.”⁶⁸ This laboratory of modernity also propelled the writing of a new aesthetics through the work of one very special female student: Gertrude Stein. Beginning in 1893, Stein studied experimental psychology with William James and Hugo Münsterberg and, for three years, engrossed herself in experiments that made use of psychological technology.⁶⁹

Stein was Münsterberg’s ideal student, and she later kept in touch with

her mentor, as she did with James. She benefited from this inquiry into mental life in profound ways. As Stein stated in *The Autobiography of Alice B. Toklas*, she “worked out a series of experiments in automatic writing under the direction of Münsterberg. . . . The method of writing to be afterwards developed in *Three Lives* and *Making of Americans* already shows itself” there.⁷⁰ The reports of these investigations were the first texts of Stein’s to be published, and they confirm the author’s own sense that laboratory experimentation shaped her future work.⁷¹ As Stein describes it, she was led to practice an analytical method “of a decidedly rhythmic character,” where “the majority of the subjects were either readily taught some rhythmic movement or had some spontaneous movement of their own.”⁷² This included the “unconscious exercise of memory and invention,” an activity that has a “marked tendency to repetition.”⁷³ In the lab, Stein was introduced to precise description and framing of both external and internal reality as they flow in character types. She absorbed this experimental—and cinematic—technique of observation and reproduced it, exactly, in the rhythmic repetition of her minimal, undulating writing.

Attentive to the pulse of being and the timing of thought, Stein was particularly engaged by the ergograph, an instrument invented in 1884 by the Italian physiologist Angelo Mosso to study energy and fatigue and to understand the motor power of intelligence. In writing about her experience with this object in her 1894 text “In a Psychological Laboratory,” Stein recorded the type of work produced by “the automatic pen” that was the ergograph’s pointer, noting that “she feels that the silent pen is writing on and on forever.”⁷⁴ The physical configuration of this instrument, among others, “resonates” with the actual design of her writing, its inner energy. Listening to the pulse of her sentence structure, one can become attuned to the mechanical rhythm of laboratory research: “As Geography return to geography, return geography. Geography. Comes next. . . . Geographically, geographical. Geographically to place, geographically in case in case of it. Looking up under fairly see fairly looking up under as to movement. The movement described. . . . An interval.”⁷⁵ In listening carefully to this type of writing, one hears a specific silent sound: the repetitive, mechanical, insistent, intermittent noise made by the laboratory instruments of the new psychology. Here is the echo of those resounding objects designed to graph the slightest variation in repetition—things, fashioned to trace with wave patterns the fabric of our flowing mental life. The vibrating, material existence of these objects of mental design reverberates in Stein’s words, bearing a trace.

For Stein, the techniques of the lab became a method, an instrument for writing. The rhythmic, repetitive sound of the laboratory space, the minimal observation of a phenomenon, the very atmosphere of the lab—its mood—

became empathetically transferred into the architecture of her prose. The observational tools of psychotechnology became the implements of her modernist style. The mechanisms of mental life probed in Münsterberg's laboratory thus became "instrumental" in creating Gertrude Stein's innovative, modernist writing apparatus.

A Gallery of Instruments

The instruments activated in Münsterberg's laboratory contributed to the design of a new form of knowledge because they rendered thinkable modern ways to inhabit sensible worlds and mobilize mental space. The aesthetic materiality of these objects—which traced motion, "sounded" out inner rhythms, and configured surfaces—styled and circulated new artistic shapes to suit a psychotechnology. As this graphic design of mental life developed, it migrated, becoming not only thinkable but also representable in cinematography, which turned experiments into experience. Haptic instruments of inner observation morphed into the investigative fabric of cinema as these objects of material culture transformed into the very texture of moving images.

Having observed the precinematic design of Münsterberg's laboratory, one can turn back to his 1916 book on film and grasp the full import of *The Photoplay*, now positioned in the context of his laboratory and set in the company of its instruments of knowledge and apparatuses of writing. In particular, one would like to see this work positioned in the "gallery" of his measuring instruments because they impart something about the impact of cinematic technology; they illustrate, that is, how cinema takes part in the technology of modern emotion. In the end, one might imagine this entire apparatus displayed in the context of an exhibition of Münsterberg's laboratory, mobilized again in conjunction with film. Reinvented in the form of this imaginary art installation, the joint emotional machinery would convey not only the disciplinary side of measuring but the measure of fascination mobilized in the motion of emotion, a force that can confound even scientific discipline. When Münsterberg's film theory is imagined this way, surrounded by all his instrumental objects, animated in revived installation, the ideas themselves appear to spin, because this psychotechnology was what sustained a vision of film theory itself genealogically designed—"fashioned"—as a laboratory of moving images.

Notes

1. Hugo Münsterberg, "Why We Go to the Movies," *The Cosmopolitan* 60, no. 1 (15 December 1915): 31.
2. Münsterberg, "Why We Go to the Movies," 22.
3. For some early works in English that recognize Münsterberg's pioneering film theory, see Donald Laurence Frederickson, *The Aesthetic of Isolation in Film Theory: Hugo Münsterberg* (New York: Arno Press, 1973); Dudley Andrew, *The Major Film Theories* (New York: Oxford University Press, 1976), 14–26; and Noël Carroll, "Film/Mind Analogies: The Case of Hugo Münsterberg," *Journal of Aesthetics and Art Criticism*, no. 46 (Summer 1988): 489–499.
4. This essay is part of a larger project that investigates Münsterberg in the context of the relation of film, aesthetics, and science. For an earlier reading, see Giuliana Bruno, *Atlas of Emotion: Journeys in Art, Architecture, and Film* (New York: Verso, 2002), ch. 8.
5. Friedrich A. Kittler, *Gramophone, Film, Typewriter*, trans. Geoffrey Winthrop-Young and Michael Wutz (Stanford: Stanford University Press, 1999), 159–163.
6. Hugo Münsterberg, *Hugo Münsterberg on Film: The Photoplay: A Psychological Study and Other Writings*, ed. Allan Landgale (New York: Routledge, 2002), 103. This recent edition of his writings on film (previously long out of print) is more complete than previous editions and is accompanied by an informative introduction by the editor.
7. Münsterberg, *The Photoplay*, 103.
8. Münsterberg, *The Photoplay*, 102.
9. Münsterberg, *The Photoplay*, 102.
10. On the subject of *Einfühlung* as a spatial understanding of empathy, see Theodor Lipps, "Empathy and Aesthetic Pleasure," in *Aesthetic Theories: Studies in the Philosophy of Art*, ed. Karl Aschenbrenner and Arnold Isenberg (Englewood Cliffs, NJ: Prentice-Hall, 1965), 403–412.
11. Münsterberg, *The Photoplay*, 78.
12. Münsterberg, *The Photoplay*, 96.
13. Münsterberg, *The Photoplay*, 129.
14. Münsterberg, *The Photoplay*, 107–108.
15. On some level, Münsterberg anticipates the more contemporary neuroaesthetic approach articulated by Gilles Deleuze in "The Brain Is the Screen: An Interview with Gilles Deleuze," in *Deleuze and the Philosophy of Cinema*, ed. Gregory Flaxman (Minneapolis: University of Minnesota Press, 2000), 365–373.
16. Hugo Münsterberg, *Ueber Aufgaben und Methoden der Psychologie* (1891), in *Gesellschaft für psychologische Forschung, Schriften*, no. 1 (Leipzig: A. Abel, 1893), 223; quoted in Matthew Hale Jr., *Human Science and Social Order: Hugo Münsterberg and the Origins of Applied Psychology* (Philadelphia: Temple University Press, 1980), 39. Hale's work is a comprehensive monograph on Münsterberg's role in psychology.
17. Münsterberg, *The Photoplay*, 100.
18. For a contemporary theorization of the notion of "instrument" in the history of science, see Mario Biagioli, *Galileo's Instruments of Credit: Telescopes, Images, Secrecy* (Chicago: University of Chicago Press, 2006).
19. Guillaume-Benjamin Duchenne de Boulogne, *Mécanisme de la physionomie humaine; ou, Analyse électro-physiologique de l'expression des passions applicable à la pratique des arts plastiques* (Paris: Jules Renouard, 1862); published in English under the title *The*

Mechanism of Human Facial Expression, ed. and trans. R. Andrew Cuthbertson (Cambridge, UK: Cambridge University Press, 1990).

20. Charles Darwin, *The Expression of the Emotions in Man and Animals* (London: John Murray, 1872).

21. For a sense of James's work on sensory, mental, and affective life, see, among other writings, William James, *The Principles of Psychology* (New York: Dover, 1890), esp. vol. 2.

22. On the development of psychology and experimentation in James's work, see, among other writings, Robert S. Harper, "The Laboratory of William James," *Harvard Alumni Bulletin*, 5 November 1949; and Herbert Nichols, "The Psychological Laboratory at Harvard," *McLure's Magazine*, no. 1 (October 1893): 399–409.

23. As Münsterberg explained in his inaugural speech for Emerson Hall, he wished to position the lab in the philosophy building so that experimental psychologists would "feel at home" to pursue research on mental life in the space where "metaphysics and epistemology keep house." Hugo Münsterberg, "The Place of Experimental Psychology," in *Harvard Psychological Studies*, vol. 2, ed. Hugo Münsterberg (Boston: Houghton, Mifflin; and Cambridge, MA: Riverside Press, 1906), 31. See also Hugo Münsterberg, "Experimental Psychology in Harvard," in *Harvard Psychological Studies*, vol. 2, ed. Münsterberg, 3–7.

24. James, *The Principles of Psychology*, vol. 2, 449.

25. James, *The Principles of Psychology*, vol. 2, 467.

26. James, *The Principles of Psychology*, vol. 2, 449. Emphasis is in original.

27. James, *The Principles of Psychology*, vol. 2, 450.

28. James, *The Principles of Psychology*, vol. 2, 452.

29. James, *The Principles of Psychology*, vol. 2, 452.

30. James, *The Principles of Psychology*, vol. 2, 450.

31. For biographical information on Münsterberg, see Margaret Münsterberg, *Hugo Münsterberg: His Life and Work* (New York: D. Appleton and Company, 1922).

32. In a letter of August 1890, James expressed his intellectual sympathy for the young Münsterberg: "You seem to be doing more to open out new vistas in psychology than any one to-day. . . . Moreover you handle things with such a broad, light touch in writing about them that it is a constant pleasure to read what you say." William James to Hugo Münsterberg, August 1890, in William James Papers, Houghton Library, Harvard University.

33. James to Münsterberg, August 1890. See also Henry James, ed., *The Letters of William James*, vol. 1 (Boston: Atlantic Monthly Press, 1920). In later years the two men's paths diverged as James took an interest in psychic manifestations while Münsterberg's motor theory of consciousness developed more pragmatic links to social and industrial efficiency (even contributing to the invention of the lie detector) and was much publicized by its author, who encouraged the popularization of his ideas.

34. Hugo Münsterberg, "The New Psychology and Harvard's Equipment for Teaching It," *Harvard Graduate Magazine* 1, no. 2 (1893): 201.

35. Münsterberg, "The New Psychology," 201–202.

36. Münsterberg, "The New Psychology," 203. The first two chapters of *The Photoplay* are titled "The Outer Development of the Moving Pictures" and "The Inner Development of the Moving Pictures."

37. Münsterberg, "The New Psychology," 204.

38. Münsterberg, "The New Psychology," 205.

39. Münsterberg, "The New Psychology," 205.

40. Münsterberg, "The New Psychology," 205.
41. Münsterberg, "The New Psychology," 205.
42. Münsterberg, "The New Psychology," 205.
43. Münsterberg, "The New Psychology," 205.
44. On this subject, see Mary Ann Doane, *The Emergence of Cinematic Time: Modernity, Contingency, The Archive* (Cambridge: Harvard University Press, 2002); and Lisa Cartwright, *Screening The Body: Tracing Medicine's Visual Culture* (Minneapolis: University of Minnesota Press, 1995). For a treatment of the body and motion studies in relation to Münsterberg, see Scott Curtis, "'Like a Hailstorm on the Nerves of Modern Man': Cinema, Legibility, and the Body in Germany, 1895–1914" (Ph.D. diss., University of Iowa, 1996), ch. 1.
45. Münsterberg, "The New Psychology," 206.
46. Hugo Münsterberg, *Harvard Psychological Laboratory* (Cambridge: Harvard University, 1893).
47. Aside from the description of the lab in Münsterberg's "The New Psychology," see also Nichols, "The Psychological Laboratory at Harvard." Both descriptions are also confirmed in the account of the laboratory provided in Münsterberg, ed., "Studies from the Harvard Psychological Laboratory," *The Psychological Review* 1, no. 5 (September 1894): 441–495.
48. Münsterberg, *Harvard Psychological Laboratory*, 19.
49. Münsterberg, *Harvard Psychological Laboratory*, 15.
50. Münsterberg, *Harvard Psychological Laboratory*, 19.
51. Münsterberg, *Harvard Psychological Laboratory*, 19.
52. Münsterberg, *Harvard Psychological Laboratory*, 20.
53. Münsterberg, *Harvard Psychological Laboratory*, 5.
54. Münsterberg, *Harvard Psychological Laboratory*, 11.
55. Münsterberg, *Harvard Psychological Laboratory*, 11.
56. Münsterberg, *Harvard Psychological Laboratory*, 12.
57. Münsterberg, *Harvard Psychological Laboratory*, 13.
58. Münsterberg, *Harvard Psychological Laboratory*, 14–15.
59. See Béla Balázs, *Theory of Film: Character and Growth of a New Art*, trans. Edith Bone (New York: Dover, 1970).
60. Münsterberg, *Harvard Psychological Laboratory*, 15.
61. See Marta Braun, *Picturing Time: The Work of Etienne-Jules Marey* (Chicago: University of Chicago Press, 1992); and François Dagognet, *Etienne-Jules Marey: A Passion for the Trace*, trans. Robert Galeta with Jeanine Herman (New York: Zone Books, 1992).
62. Jacques Rancière, *Le destin des images* (Paris: La Fabrique Éditions, 2003), 105.
63. Münsterberg, "The New Psychology," 206.
64. The story came up on several occasions and was confirmed as a piece of the lab's oral history by Sarah Schechner, the curator of Harvard's Collection of Historical Scientific Instruments, where most of the extant instruments used by James and Münsterberg are stored. I thank her for her generous assistance during my research.
65. See the "Psychology Account Books, 1890–1920," p. 1, in Harvard University Archives.
66. Calkins distinguished herself in the lab. Münsterberg personally pleaded to let her obtain a Harvard Ph.D., for which she had fulfilled all requirements. His efforts failed: the Harvard Corporation finally denied her this degree because of her gender.
67. On Münsterberg and gender, see Rena Sanderson, "Gender and Modernity in

Transnational Perspective: Hugo Münsterberg and the American Woman,” *Prospects*, no. 23 (1998): 285–313. He taught many women, including Bertha Boody, who became a college dean, and outside of the classroom continued mentoring his female students in informal gatherings at his house. When Münsterberg died on December 16, 1916, he was in the midst of delivering a classroom lecture to the women of Radcliffe College.

68. Grace Hollingsworth Tucker, “The Gods Serve Hebe,” *Radcliffe Quarterly*, October 1933, 203.

69. Stein joined Radcliffe in 1893. She took a full-year laboratory course for three of the four years she studied at the college, and for the last two years she performed experiments in graduate-level classes, receiving an A for each course. She also took a course with Münsterberg on the philosophy of psychology. On the subject of Stein, see Coventry Edwards-Pitt, “Sonnets to the Psyche: Gertrude Stein, the Harvard Psychology Laboratory, and Literary Modernism” (Senior Honor’s Thesis, Department of the History of Science, Harvard University, 1998). I am indebted to this work for the treatment of Stein in the lab and to my colleague Robert Brain, formerly in the Department of the History of Science, whom I thank for this reference and for helpful discussion of Münsterberg’s laboratory.

70. Carl Van Vechten, ed., *Selected Writings of Gertrude Stein* (New York: Vintage Books, 1990), 73.

71. Gertrude Stein and Leon Solomons, “Normal Motor Automatism,” *Psychological Review*, September 1896, 492–512; and Gertrude Stein, “Cultivated Motor Automatism: A Study of Character in Its Relation to Attention,” *Psychological Review*, January 1898: 295–306.

72. Stein, “Cultivated Motor Automatism,” 296.

73. Stein and Solomons, “Normal Motor Automatism,” 494, 506. The subjects studied here are the authors. On the subject of gender in this report, see Friedrich A. Kittler, *Discourse Networks, 1800/1900*, trans. Michael Metteer with Chris Cullens (Stanford: Stanford University Press, 1992), 225–229.

74. This text, written as a theme assignment for English 22, is in the Gertrude Stein Papers, Yale Collection of American Literature Manuscripts, Beinecke Library, Yale University. The text is reproduced in an appendix to Edwards-Pitt’s “Sonnets to the Psyche.”

75. Gertrude Stein, *Geography* (1923), in *A Stein Reader*, ed. Ulla E. Dydo (Evanston, IL: Northwestern University Press, 1993), 467.