



# SEEING BY ELECTRICITY

*The Emergence of Television, 1878–1939*

DORON GALILI

**SEEING BY ELECTRICITY**

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1878–1939

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Cover art: John Logie Baird's (1888–1946) first television demonstration, 1926. Photograph taken from the screen of his first Televisor. Universal Images Group/Getty.

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To my family

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## INTRODUCTION

The inaugural meeting of the International Institute of Educational Cinematography's Coordinating Television Committee, which took place in Nice, France, in April 1935, provided a rare opportunity to hear cinema pioneer Louis Lumière discuss the new medium of television. An honorary guest of the newly formed Committee, Lumière delivered an opening address to an audience of broadcasters, technicians, and film industry representatives who had gathered to talk about the future of television and its relationship with cinema. Lumière spoke of television's potential in an enthusiastic manner typical of the 1930s. He spoke of television as one of the technologies "which have so profoundly changed our social life in all its forms" and anticipated that it would assist in broadening humanity's knowledge. In addition to these celebratory statements, Lumière also reflected on television's place within a long lineage of older media. He noted that television is "still a novelty, but it has an ancient affiliation. Like all novelties, it arouses both skepticism and enthusiasm. As with all the culminations of old affiliations, we try to establish its origin and also its connection with the inventions and applications which preceded it."<sup>1</sup>

It is not unlikely that Lumière made this claim merely self-servingly in order to posit his own invention of the cinematograph in the lineage of the most recent celebrated technological marvel. But even if this was the case, his statement is still significant, for it is an early instance of inquiring about the origins of one medium by way of focusing on its relationships

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with other media, a method that has become fundamental in recent works in film and historiography. While his claim about the “culminations of old affiliations” maintains a sense of a historical trajectory of progress that is overall rejected today, the conception of television’s “ancient affiliations” could be read as anticipating recent historiographic approaches to intermediality and in particular to studies in the field of media archaeology. What Lumière suggests at this moment of the very beginning of public television broadcasts is that the history of television is intertwined with the history of related media, hinting that its mid-1930s fruition is indebted in one way or another to the cinema.

By the time Lumière delivered his address, commentators and technicians writing on television had identified the origins of the new medium in a series of inventions and experiments involving the electric transmission of moving images which date back to the late 1870s and provided the foundations for the eventual realization of television apparatus. The appearance of these early ideas about the electrical transmission of image, known at the time as technologies for “seeing by electricity,” coincided with crucial moments in what is often regarded as precinema history. During the same years as the first articles on the prospects of moving images transmission were published, figures such as Eadweard Muybridge and Émile Reynaud demonstrated advances in serial photography and the projection of animated pictures. Thus, readers of the June 1880 volume of *Scientific American* could read about Muybridge’s demonstration of the zoopraxiscope, an animated photography projection device, on one page, and two pages later about a method for “seeing by electricity” using a selenium camera and a transmission device. No working television apparatus existed until several decades later, but as William Uricchio has noted, by the time cinema emerged in the late nineteenth century, “the basic conceptual problems of the technology had been resolved, and an imagined and technologically possible way of seeing at a distance was fully anticipated and articulated.”<sup>2</sup>

However, while Lumière’s 1935 speech on television calls for an exploration of the medium’s origins and early intermedial affiliations, his own capacity as a cinema pioneer also symbolizes the principal obstacle of carrying out such a historiographic task. The prominent status that cinema had quickly gained and maintained throughout the twentieth century too easily gives the impression that film is the inevitable vanishing point of the histories of the moving image and of screen practices. Indeed, some of the canonical histories of moving image media have rendered the rich visual culture of the nineteenth century as a mere precursor of cinema. Falling

out of the strictly precinema narratives, the history of early electric moving image transmission media has been marginalized in such works, in favor of a focus on themes such as projection, photography, and optical toys, which provided the more immediate context for the coming of film.<sup>3</sup> Although more recent works in film historiography have rejected such precinema teleologies in favor of a broader interdisciplinary view, which places the coming of cinema alongside a myriad of other modern phenomena, only very few of them engaged with the early history of television.<sup>4</sup> Scholarship in the younger field of television studies also largely overlooked the medium's historical origins in the nineteenth and early twentieth centuries, though for different reasons. Conceiving of television primarily as a mass medium, television scholars focus on questions of texts and interpretations, programming flow, media effects, and reception. Whereas several key works on the beginning of television broadcasts provided important context for the launching of the mass media practice, most major works on the history of television take as their starting point the post-World War II era.<sup>5</sup> The current rise in interest in media archaeology and sound studies has led to an expansion in scholarship about early television history.<sup>6</sup> Still, the richest body of information about the earliest phases in the emergence of television currently exists in technological histories of the medium, but since such works are often written by electrical engineers and for electrical engineers, they typically lack critical examination of the historical and cultural origins of the technologies.<sup>7</sup>

The challenges in early television historiography, however, stem not only from disciplinary oversight or marginalization but also from the very historical terms that govern discourses in media-historical scholarship. Namely, in the rich and influential corpus of scholarship on early cinema and modern visual culture, late nineteenth- and early twentieth-century modernity has become closely identified with cinema's materiality and aesthetics. By this, I do not mean only that it is filmic records of the previous turn of the century that inform our ideas about the period; much more profoundly, the vast pathbreaking body of scholarship about the relations between fin-de-siècle visual media and the social, technological, and cultural changes brought about by modernization has established a compelling understanding of the coming of cinema as "the fullest expression and combination of modernity's attributes."<sup>8</sup> Film historians working in this tradition have explored cinema's origins in relation to various aspects of modernization, such as transformations in sensory experience, processes of urbanization and technologization, and the rise of sensational and spectacular entertain-

ment forms.<sup>9</sup> Often drawing on Charles Baudelaire's definition of modernity as "the ephemeral, the fugitive, the contingent" and on Walter Benjamin's corresponding discussion of the transformation of sensory perception in modernity, several film historians have pointed out correspondences between the dominant aesthetic mode of early cinema and the fragmented, fleeting visual experience of urban-industrial modernity; between the film camera's ability to inscribe movement in duration and modernity's cultural concerns with recording, archiving, and gaining access to the instant; and between the mass production, circulation, and appeal of the cinematic image and the formation of modern capitalist mass culture and modern forms of subjectivity.<sup>10</sup> Given the central role that cinema has come to play in our understanding of modernity, the very terms available for the discussion of the historical context for television's emergence are already determined by their close association with the cinema.

To be sure, no film historian that I am aware of has argued for the exclusivity of cinema's role in the culture of modernity. Yet if we consider that, as Tom Gunning has persuasively shown, early cinema "metaphorised modernity" and serves as an "emblem of modernity," how are we to establish the origins of television, a distinct moving image medium that appeared and developed during the same cultural-historical moments?<sup>11</sup> A history of the origins of television that wishes to remain mindful of the medium's specificity must not only excavate the technological history of moving image transmission and the media practices and discourses that surrounded its formation. It must also account for how it is that out of the social, cultural, and intermedial context of modernity, two distinct forms of moving image media emerged: one for the photographic inscription and reanimation of pictures, and one for the electric transmission of images at a distance. Such a history, in turn, ought to establish television's place in a number of alternative lineages, including ones that fall outside the realms of visual media—namely, those of the history of electrification, of signal communication systems like the telegraph and the telephone, and of networked technological configurations. In other words, a history of the origins of television must seek to portray the correspondences between the moving image and the historical process of modernization in a broader, more ambivalent manner than is typically acknowledged. This book attempts to do so.

*Seeing by Electricity* traces the earliest phases in the history of television in order to come to terms with what Lumière has called its ancient affiliations. My focus is on the period in television history that preceded the mass media application of television. This period spans from the initial concep-

tion of electrical technologies for moving image transmission in the 1870s to the launching of regular television broadcast services, which were first introduced in Nazi Germany in 1935 and were followed by the British Broadcasting Company (BBC) in 1936 and by the National Broadcasting Company (NBC) in the United States in 1939. As this book shall argue, the intermedial relationship between film and television did not start with their economic and institutional rivalry of the late 1940s; rather, it goes back to their very origins. The book considers how television influenced the history of cinema in many intersections during its first five decades, starting with playing a role in the initial reception of early cinema in the turn of the twentieth century, through how it signaled new opportunities and posed new threats on the Hollywood industry of the classical system, to how the first generations of film theorists speculated about the coming of a new nonphotographic apparatus of moving image, and up to how television offered a radical alternative to cinema in the view of various modernist avant-garde projects. Thus, whereas this is primarily a work of media historiography that sheds light on underexplored periods in television history, the research I present in the following chapters also holds implications for how we are to theorize the present state of moving image media. If the proliferation of digital audiovisual technologies in the twenty-first century has led many scholars to reassess the nature of cinema in light of new moving image media, this book argues that in fact cinema was “haunted” throughout its history by a looming other form of moving image media, which continuously threatened to replace it and render it obsolete.

### Historiographic Frameworks and Considerations

The very notion of the origins of television could be narrated in accordance with various different frameworks. Media historians have approached television as part of the history of domestic media, of small-screen apparatus, of electronic media, of broadcasting, of moving image media technology, and most recently as part of the history of video.<sup>12</sup> Even the use of the word “television” appears problematic in the context of the discussion of the medium’s origins. The word was coined only in the year 1900, and in the decades prior to that, moving image transmission apparatus was referred to utilizing numerous different names, such as “telectroscope,” “diaphote,” “telephote,” “telehor,” “phantoscope,” “electric telescope,” “distant seer,” and, of course, “seeing by electricity.” Furthermore, the word “television” denotes a sense of self-identity, which is foreign to the late nineteenth-century conceptions

that have set the stage for the medium's emergence. In other words, "television" as we presently use it inevitably invokes a bundle of popular and theoretical conceptions, established forms of spectatorship, and affiliated cultural practices that were in no way part of the culture and the discourses that surrounded its emergence.

I therefore consider the subject of this book to be, rather, the history of *moving image transmission*. I prefer this term for two main reasons. First, the category of moving image transmission is flexible enough to encompass the characteristics of both the earliest speculations and experiments in question here, which were not yet television per se, and those of the realized manifestation television in the various forms it took throughout its history. Whether we think of television as an analog or digital technology; as broadcast, narrowcast, or point-to-point communication device; as based on cable or wireless transmission; as delivering "live" events or prerecorded material; or as a domestic or public viewing medium, we principally address a media practice that involves the transmission of moving images to a distant viewer. Second, the emphasis on the notion of transmission in the discussion of the origins of television also foregrounds important aspects in its relation to cinematic moving images. The basic operation of the cinematic apparatus involves capturing, storing, and reanimating scenes by means of displaying a rapid succession of discrete inscribed images. Conversely, the basic operation of moving image transmission technologies involves the scanning or dissecting of a captured image to discrete picture-elements, which are in turn converted to signals (either analog or digital) and conveyed at a distance (either by wire or wirelessly) to receiving devices that represent them in the form of a visual image. In this sense, the framework of history of moving image transmission proves useful not only for the study of the technological, institutional, and cultural formation of television as a particular medial formation of moving image transmission apparatus but also for the exploration of its intermedial relationship with the cinema.

The distinction between recording and transmission draws on fundamental media-theoretical ideas that could be traced back to Harold Innis's categorization of spatial and temporal techniques of communication. For Innis, "media that emphasize time are those that are durable in character, such as parchment, clay, and stone. . . . Media that emphasize space are apt to be less durable and light in character, such as papyrus and paper."<sup>13</sup> Applying a similar logic to modern media technologies, William Uricchio and Siegfried Zielinski—two of the most prominent contributors to the study of early television history—have emphasized the discrepancy between cin-

ema's recording function and televisual instantaneous transmission. Uricchio has explored the "competing temporalities" of film and television in a series of articles that highlight the nineteenth-century cultural fascination with the idea of simultaneity or "liveness," as evidenced most potently in early responses to the introduction of the telephone and numerous imaginary depictions of image transmission media.<sup>14</sup> Uricchio hypothesizes that late nineteenth-century audiences encountered the medium of cinema with a sense of disappointment because it fell short of fulfilling the promise of simultaneity that flourished in early televisual imaginaries. Cinema, Uricchio suggests, appeared as a detour in the history of television, a partial realization of the medium that emerged only later in the twentieth century. Zielinski, similarly, argues that "the two intrinsic targets of the projects [of cinema and television] were poles apart," since "in contradistinction to the [cinematic] preservation of images for the purpose of processing and presenting them, the lineage of television is concerned essentially with overcoming spatial distance without any loss of time."<sup>15</sup> In his book *Audiovisions*, Zielinski narrates a wide-ranging media history that concludes in the digital-era convergence of the distinct historical trajectories of cinema and television. The stated goal of *Audiovisions* is to come to terms with the contemporary media situation by way of defining cinema and television's "historically delimited significance as specific cultural configurations."<sup>16</sup>

While I share Uricchio and Zielinski's historiographic concern with the dissimilar technological affordances of the cinematic and the transmitted moving image, my interest in this book is to explore historical instances of intermedial influences, technical amalgamations, and shared imaginaries that problematize the clear-cut distinction between the fundamental medial functions of recording and transmission. Media theorist John Durham Peters has offered an important critique of the tendency to distinguish between communication media based on their spatiotemporal features. Whereas transmission media overcome space and recordings overcome time, Peters has made a case for the ultimate unity and interconvertibility of these distinct traits. Transmission, however fast, takes time; recording, likewise, costs space, as it involves the inscription of temporal events onto spatial coordinates.<sup>17</sup> Thus, based on examples drawn from limited cases of large space- and timescales in geology and astronomy as well as from the history of media technologies, Peters has shown that "to send a message (transmission), it must be preserved from death or corruption in transit (recording)," while "to record, one must alienate the original by writing onto some surface."<sup>18</sup>

This important conceptual intervention does not cancel out the categories of recording and transmission altogether, but does have implications regarding how we are to frame televisual transmission in relation to other forms of moving images, for it invites further research on media process that occur across the separate categories. Yet it is not only media-philosophical notions that motivate my inquiries into the overlaps between storage and transmission, for the historical records themselves are full of instances of hybrids, amalgamations, and border crossing between cinematic and televisual properties and principles. As Anne-Katrin Weber puts it, such intermedial configurations call for historical narratives “encompassing composite and heterogeneous media forms that emerge at the intersections of henceforth inseparable paradigms and industries.”<sup>19</sup> Concepts about storage and transmission media appeared early on in the popular imagination in their purest form, but very quickly they became intertwined, and at times they were even confused with one another. In technological designs, operative plans, pioneering theoretical projects, fictional narrative, avant-garde practices, and journalistic reports, mixes of “live” transmission and “canned” films appear throughout the late nineteenth- and early twentieth-century discourses on film and television. Therefore, rather than considering the early histories of cinema and television as distinct parallel lineages determined by their technical characteristics, this book argues that from its very beginning, the idea of the moving image was conceived in a variety of formations. Indeed, it was only against this backdrop that, in the 1920s and 1930s, distinctive medium-specific definitions of cinema and television were first articulated.

Another methodological principle that informs the history I present in this book is the notion of intermediality as a historical category. Film historian André Gaudreault has suggested that intermediality does not only designate instances in which a media form reaches out beyond its established boundaries, but is also a constitutive element in media history. In his writings on films from around the turn of the twentieth century, Gaudreault has shown how cinema did not come into being as a full-fledged autonomous medium. Rather, early films merely emulated existing practices of other media forms, and only in the following decade did cinema develop medium-specific traits and institutions.<sup>20</sup> Based on these observations, Gaudreault (in collaboration with Phillippe Marion) develops a model for media historiography that distinguishes between distinct moments of two “births” of a given medium.<sup>21</sup> The first birth is marked by the appearance of a new technology, a new tool in the service of old practices or an extension of existing

media. The second birth, conversely, involves the establishment of medium-specific professional procedures and the attainment of cultural legitimacy, which provide the medium with an autonomous acknowledged identity. The model of two births thus suggests a process of distinction vis-à-vis the surrounding mediascape, in which a new medium transforms from being integrated among other media to possessing singular specific traits and institutions. Granted, no medium ever severs all of its intermedial connections. A medium's autonomy is always relative, but the nature of its intermedial relations changes radically around the formation of its distinguished features.

Gaudreault and Marion's discussion of medium specificity as a product of a historical process of cultural, aesthetic, and institutional formation is productive for the historiography of television. In light of their intermedial framing of the emergence of new media forms, my account of the period that preceded the launching of broadcasting services is intended to be read neither as a "prehistory of television" nor as a Bazinian pursuit of the medium's origins in order to "reveal something of its nature."<sup>22</sup> Rather than supposing a fixed or inherent essence of the medium, this book is concerned with the multiplicity of possibilities that typified the early stages of television's history. It surveys the various ways in which the early speculative conceptions of moving image transmission had borrowed and adapted attributes from other media, and the major transformations the very notion of image transmission underwent before its public launch in the form of a broadcast medium with a fairly distinctive media identity.

At the same time, the case of television poses unique challenges that necessitates making some adaptations to the cinema-inspired model of the double birth. What is unique about the case of television, and what makes it an exemplary case for intermedial historiography, is its unusually slow and drawn-out period of emergence. The initial ideas about televisual communications had existed for fifty years before the introduction of the prototypes of television apparatus. The history of moving image transmission media, therefore, starts with the numerous discursive inventions of televisual media in the nineteenth century, long before the supposed "first birth" of television technology.<sup>23</sup> Second, almost six decades had passed between the initial articulated speculations regarding the electrical transmission of moving images and the formation of television broadcasting stations (in the case of cinema, conversely, only six years had passed between the moment Thomas Edison first expressed interest in designing a motion picture apparatus and the commercial deployment of the kinetoscope).<sup>24</sup> The sixty-year period of

the emergence of television marks not only radical changes in the surrounding media environment but also a new phase in the history of modernization. In this respect, the concepts of both the medium of television and the cultural context within which it emerged are, at best, moving targets. The first ideas about seeing by electricity were expressed shortly after the invention of the telephone and were considered to be a new type of telegraphic technology; as such, they were shaped by the distinct cultural imaginary of the fin-de-siècle urban industrial modernity, typified by the rapid introduction of technological communication and transportation novelties and an alteration in the notions of time and space. But the first working television prototypes appeared in the midst of the distinctive form of twentieth-century modernity, defined by Miriam Hansen as “the modernity of mass production, mass consumption, and mass annihilation, of rationalization, standardization, and media publics.”<sup>25</sup> In that age of mass media such as broadcast radio and the Hollywood studio system, television became part of what has become known as “the culture industry,” governed by big and powerful commercial conglomerates that emulated Fordist principles of standardization and rationalization. Tracing the history of this slow emergence, in sum, allows us to observe a vast array of technological and cultural changes that not only shaped television but transformed the entire modern mediascape.

#### Periodization and Chapter Breakdown

The six chapters of this book focus on different aspects of the relationship between cinema and moving image transmission and are organized in two distinct sections. Part I, “Archaeologies of Moving Image Transmission,” deals with the speculative era in television history, which spans nearly half a century between the earliest publications on the prospects of image transmission in the late 1870s and the presentations of the first working television prototypes in the mid-1920s. Focusing on the conditions for the first imaginary formations and technological schemes for image transmission apparatus, the chapters in this section demonstrate how—much like Wolfgang Ernst has observed regarding the electronic tube—television “has no linear discursive history but instead, especially in the beginning, followed more of a zigzag course of experimental groping in the dark.”<sup>26</sup> Dealing with periods that preceded the existence of actual television services, this scope of this section is decidedly international. As it demonstrates, both the technological ideas about devices for seeing by electricity and the utopian and dysto-

pian cultural attitudes toward these prospects freely floated across national, discursive, and disciplinary boundaries.

Chapter 1 locates the initial conceptions of moving image transmission within the intermedial context of the late nineteenth-century electrical telecommunication systems. Drawing on technical discourses as well as on utopian and science fiction literature of the era, it argues that the concurrent emergence of cinema and moving image transmission media is best seen as two distinct but interrelated (or even dialectical) manners of mediating modernity's oft-theorized transformations in sensory perception and the configuration of time and space. Chapter 2 maps the technological history of early schemes for moving image transmission devices onto the history of the changing notions of vision in the nineteenth century. The chapter demonstrates how the first designs for electrical visual media were modeled after the manner in which modern physiologists depicted the structure and function of the human eye. This consideration of image transmission technology as essentially imitating the human sensory apparatus offers an understanding of television as a prosthetic medium that extends the powers of human vision and therefore intersects with histories of other modern media and with various modernist conceptions of a new, technologically enhanced human. In chapter 3 I turn to the period of early cinema and hypothesize that just as cinema played a role in the formation of early concepts of moving image transmission, so too did moving image transmission media influence the cultural context of the initial reception of cinema. This intermedial exploration brings to light the fact that during the early history of moving image media, the distinctions between recording and transmission were not mutually exclusive but rather contingent, continuous, and destined to converge.

Part II, "Debating the Specificity of Television, On- and Off-Screen," considers television's experimental era, starting with the realization of mechanical television apparatus by pioneers such as Charles Francis Jenkins and John Logie Baird and ending with the launching of regular public television services in the mid-1930s, shortly before the project of television largely halted for the duration of World War II. The experimental era saw not only technological development in moving image transmission devices and infrastructure, but also intensive economic, cultural, and regulatory processes that would lead to the eventual formation of the autonomous mass media institutions of television. As the chapters in this section illustrate, the medium-specific properties of television did not come into being alongside the arrival of the technological apparatus; rather, they were established by way of

ongoing cultural practices and debates that attempted to distinguish the new medium from the old dominant medium of cinema. The experimental era also marks the period during which the project of television became bound to national settings and specific political and economic conditions. Therefore, my consideration of the formation of television's media identity in this period focuses on different national settings—the United States, the Soviet Union, and Germany (and partly Italy). These distinct cases demonstrate how, as Lisa Gitelman has argued, the identity of media forms is never neutral and fixed but is always defined in historically and culturally specific terms.<sup>27</sup>

Chapter 4 concerns how the American film and radio industries responded to advances in moving image transmission technologies and how the broadcasting model came to shape the future of television in the late 1920s and early 1930s. During that period, television was considered cinema's rival, as well as its "stepbrother" or "cousin"; as an inevitable future formation of cinema; or simply as a technology for the wireless distribution of motion picture films.<sup>28</sup> The chapter delineates how ideas of televisual medium specificity came into being as part of the industrial debates about the control and use of the medium, namely, as part of Hollywood's pragmatic defenses of its industrial interest and the radio networks' efforts to expand into visual broadcasting. To complement the discussion of how television came to be understood as ontologically distinct from cinema, the chapter also discusses two early instances of intermedial overlaps: the notion of "films on television" is explored in a study of the first experimental broadcasts of motion pictures on television, and the notion of "television in films" is demonstrated by early cinematic depictions of televisual devices. The final two chapters change the setting to different national and cultural contexts as they examine the impact of television on the cinematic avant-garde and early film theory. In these chapters, my focus is on two of the figures most identified with the concern for film's aesthetic and ontological specificity. The topic of chapter 5 is the reception of the idea of television in the Soviet Union. It revisits filmmaker and theorist Dziga Vertov's early writings on television in order to consider the early history of radical avant-garde deployments of the medium. As this chapter shows, despite his perceived affinity with high-modernist cinematic aesthetics, Vertov was quick to regard television as a superior media form that was destined not only to replace film but also to fulfill the revolutionary objectives of Soviet cinema. The formation of medium-specific notions of television is taken up again in chapter 6, which turns to the national settings of interwar Germany and Italy and

concerns the work of film critic and perceptual psychologist Rudolf Arnheim. This chapter shows how the efforts to come to terms with nonfilmic moving image media necessitated classical film theory to engage with questions of intermediality and media change that decades later became central in media theory. In closing, the book's conclusion offers observations about how the history of the emergence of television may inform further considerations of the present mediascape in film and television studies.

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## NOTES

### Introduction

1. “The Nice Congress,” *Intercine* 7, no. 4 (April 1935): 193. About the international assembly, see also “Radio and Cinema in Europe to Cooperate on Television,” *Broadcasting*, May 15, 1935, 54.

2. William Uricchio, “Storage, Simultaneity and the Media Technologies of Modernity,” in *Allegories of Communication: Intermedial Concerns from Cinema to the Digital*, ed. John Fullerton and Jan Ols-son (Eastleigh, UK: John Libbey, 2004), 132.

3. See, for example, C. W. Ceram, *Archaeology of the Cinema* (London: Thames and Hudson, 1965); Deac Rossell, *Living Pictures: The Origins of the Movies* (Albany: State University of New York Press, 1998); Laurent Mannoni, *The Great Art of Light and Shadow: Archeology of the Cinema*, trans. Richard Crangle (Exeter: University of Exeter Press, 2000).

4. For research on early cinema’s relation to the telephone, the telegraph, and the railway, see Tom Gunning, “Heard over the Phone: *The Lonely Villa* and the De Lorde Tradition of Terrified Communication,” *Screen* 32, no. 2 (Summer 1991); Paul Young, “Media on Display: A Telegraphic History of Early American Cinema,” in *New Media 1740–1915*, ed. Lisa Gitelman and Geoffrey B. Pingree (Cambridge, MA: MIT Press, 2003), 229–264; Lynne Kirby, *Parallel Tracks: The Railroad and Silent Cinema* (Durham, NC: Duke University Press, 1997).

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and the Making of a Medium (New Brunswick, NJ: Rutgers University Press, 2014). For a perspective outside the field of television studies, Joseph H. Udelson's *The Great Television Race: A History of the American Television Industry, 1925–1941* (Tuscaloosa: University of Alabama Press, 1982) provides a thorough institutional history of the American television industry.

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8. Leo Charney and Vanessa R. Schwartz, introduction to *Cinema and the Invention of Modern Life*, ed. Charney and Schwartz (Berkeley: University of California Press, 1995), 1.

9. For an overview of central issues and contributions for the debates in this area, see Ben Singer, *Melodrama and Modernity: Early Sensational Cinema and Its Contexts* (New York: Columbia University Press, 2001).

10. Tom Gunning, "The Whole Town's Gawking: Early Cinema and the Visual Experience of Modernity," *Yale Journal of Criticism* 7, no. 2 (1994): 193–194; Mary Ann Doane, *The Emergence of Cinematic Time: Modernity, Contingency, the Archive* (Cambridge, MA: Harvard University Press, 2002), 62; Miriam Bratu Hansen, *Cinema and Experience: Siegfried Kracauer, Walter Benjamin, and Theodor W. Adorno* (Berkeley: University of California Press, 2012); Ann Friedberg, *Window Shopping: Cinema and the Postmodern* (Berkeley: University of California Press, 1993).

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nology in the Late 19th Century,” in *Der Film in der Geschichte*, ed. Knut Hickethier, Eggo Müller, and Rainer Rother (Berlin: Edition Sigma, 1997), 19–25.

15. Siegfried Zielinski, *Audiovisions: Cinema and Television as Entr’actes in History*, trans. Gloria Custance (Amsterdam: Amsterdam University Press, 1999), 59.

16. Zielinski, *Audiovisions*, 14.

17. John Durham Peters, *The Marvelous Clouds: Toward a Philosophy of Elemental Media* (Chicago: University of Chicago Press, 2015), 306–307.

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26. Wolfgang Ernst, *Digital Memory and the Archive*, ed. Jussi Parikka (Minneapolis: University of Minnesota Press, 2013), 165.

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3. Adriano De Paiva, “A telephonia, a telegraphia e a telescopia,” *O Instituto* 25