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Media Evolution: Emergence, Dominance, Survival, and Extinction in the Media Ecology

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This article presents an integrated model for understanding the evolution of media, aiming to go beyond the traditional reflections—which tend to reduce media history to a linear succession of technologies—to propose an integrated view of media evolution. Constructing a model of media evolution means going beyond the concepts used up until now—such as Bolter and Grusin's remediation—to integrate into a single framework analytical categories such as emergence, adaptation, survival, and extinction. In this theoretical context, the article pays particular attention to the simulation processes that occur in the different phases of the evolution of a medium. Finally, a series of critical reflections on the sequential-linear and genealogical-branched evolution models are presented to propose alternatives that represent the complexity of the media ecosystem more closely.

The objective of this article is twofold: to present an integrated model for understanding the evolution of media and to expand the theoretical framework of media ecology, a discipline that arose in the 1960s from the contributions made by researchers such as Marshall McLuhan, Neil Postman, James Carey, and Walter Ong (Lum, 2006; Scolari, 2012; Strate, 2004, 2008). Media ecologists have explored the changes over time in the media system since the origins of this research field. Harold Innis' works *Empire and Communications* (1950) and *The Bias of Communication* (1951) are good examples of the early interest of media ecologists in the evolution of communication technologies. As media ecologists have demonstrated, it is not possible to understand media ecology if we isolate it from time, in the same way that we cannot gain deep insights into media evolution if we do not take into account the relationships between one medium and the remaining media in the context of an ecology.

The first section reviews the relationships between ecology, evolution, and media and analyzes the differences from other approaches, such as media archaeology and media history. The second section proposes a media evolution model based on identifying three phases: emergence, dominance, and survival/extinction. Finally, in the third and last section, this evolution model is taken to a higher level of

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complexity by incorporating the relationships between media. Within the possible intermedia relationships, the article will focus on the simulation processes. In this way, we will obtain a new interpretive scheme that attempts to break from the sequential-linear and genealogical-branched evolution models to propose an alternative that is closer to the complexity of the media ecosystem.

Media, Ecology, and Evolution

Applying the ecology metaphor to media can be interpreted in two complementary ways: the media as *environments* or the media as *species* that interact with each other (Scolari, 2012). In the former case, researchers analyze how technologies create environments that affect the people who use them. As McLuhan (2003) put it, the effects of technology "do not occur at the level of opinions or concepts, but alter sense ratios or patterns of perception steadily and without any resistance" (p. 31). For example, television "has changed our sense-lives and our mental processes" (p. 439). In the latter case—that is, the media as *species* that live in the same ecosystem—the analysis focuses on the relationships between media. This second approach can be identified in McLuhan's tetrads (McLuhan & McLuhan, 1992) and in many passages of his books, especially *Understanding Media* (2003).

This article explores the second metaphor—the media as species—from an evolutionary perspective. As McLuhan writes,

> No medium has its meaning or existence alone, but only in constant interplay with other media. . . . Radio changed the form of the news story as much as it altered the film image in the talkies. TV caused drastic changes in radio programming, and in the form of the thing or documentary novel. (2003, pp. 43, 78)

This interpretation of the ecological metaphor could be defined as the *intermedia dimension* of media ecology.

The social sciences have applied evolution models to technological development on numerous occasions (Arthur, 2009; Basalla, 1988; Frenken, 2006; Logan, 2007; Saviotti, 1996; Ziman, 2000). It is within this theoretical context that we propose reflecting on media evolution. Why talk of media evolution and not of media archaeology or media history? Briefly describing these two fields, we see that media history is a consolidated discipline thanks to hundreds of articles, books, journals, and conferences. Its scientific production encompasses a range from very focused research works—for example, the expansion of printing in Europe in the late 15th century (Eisenstein, 1979) or the emergence of new media at the end of the 20th century (Carey & Elton, 2010)—to long-term studies that analyze media history over the centuries (Briggs & Burke, 2009). These long-term historical accounts usually generate timelines—which can cover chronologies from the invention of writing to the World Wide Web—that represent the sequence of communication technologies used by humanity.

Media archeology, however, is a field that has emerged only recently. How is media archeology different from other approaches? Huhtamo and Parikka (2011) consider that

> discontent with "canonized" narratives of media culture and history may be the clearest common driving force. Media archaeologists have concluded that widely endorsed accounts of contemporary media culture and media histories alike often tell only selected parts of the story, and not necessarily correct and relevant parts. (p. 3)

They propose constructing "alternate histories of suppressed, neglected, and forgotten media that do not point teleologically to the present media-cultural condition as their 'perfection.' Dead ends, losers, and inventions that never made it into a material product have important stories to tell" (Huhtamo & Parikka, 2011, p. 3).

Some prestigious media historians like Lisa Gitelman have preferred to remain at a safe distance from media archeology. In *Always Already New* (2006), Gitelman returns to Geer Lovink to assert that "media archaeology is first and foremost a methodology, a hermeneutic reading of the 'new' against the grain of the past, rather than a telling of the histories of technologies from past to present" (p. 11). The rejection of the storytelling of the historical narrative in media archeology is, for Gitelman, a limit:

> In short, the impulse to resist historical narrative redraws criticism as a form of "aesthetic" or "literary" undertaking at the same time that it tends to impose a temporal asymmetry. The past is often represented discretely, formally, in isolation—as for by means of anecdote—while the present retains a highly nuanced or lived periodicity. (Gitelman, 2006, p. 11)

Beyond the interdisciplinary debates, both media history and media archeology have made important contributions to media studies. The most important of these is that they have demonstrated that "all media were once new media" (Gitelman & Pingree, 2003, p. xi), repositioning the emergence of new forms of communication in a context that is much wider and less linked to the urgencies of the market and the marketing discourse. According to Park, Jankowski, and Jones (2011), "media and history are so intimately connected that the emergence of what can be called 'new media' does something more than merely provide us with new media whose histories can be described" (p. XII). Among other things, the history of new media challenges us to reconsider the meaning of "newness" or contextualizes "what is taken as new so as to establish broader and suggestive continuities in the history of communication" (Park, Jankowski, & Jones 2011, p. xii).

Beyond Linear or Genealogical Models

Now that we have briefly described these two scientific fields we can once again ask the question: Why should we talk about media evolution and not media archaeology or media history? Although both research fields—one with a long tradition (media history) and another more recent, although with a prestigious background (media archaeology)—are both inexhaustible sources of examples of media transformations of the past, they both have their limitations, which are worth considering before we return to the media evolution model. Media history is a discipline that often becomes trapped in the construction of linear (sequential) series, many of them inspired in the model popularized by Everett Rogers in his classic *Diffusion of Innovations* (1995)—for example, in Carey and Elton (2010) and Stöber (2004). Media archeology, on the other hand, rejects the historical linear narrative to propose a discreet, formal, and isolated view that makes it difficult to appreciate the sociotechnological network in all its dimensions.

It is not easy to escape from linear series when analyzing the history of any technology (not just that of communication). The studies inspired in the social construction of technology theory (Bijker, Hughes, & Pinch, 1987)—such as Neuman's *Media, Technology, and Society: Theories of Media Evolution* (2010)—start from more-or-less linear readings of the succession of media (see Figure 1). Even some researchers who have analyzed the "natural life cycle of new media evolution," such as Lehman-Wilzig and

Cohen-Avigdor (2004), have not been able to avoid a cyclic-linear model to understand the evolution of communication media forms (see next section on Media Evolution).

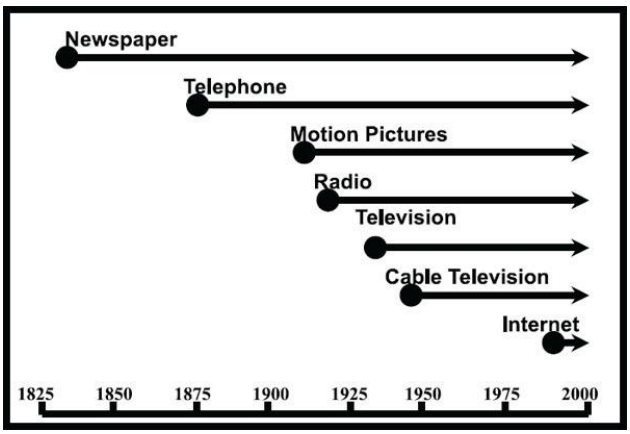

Figure 1. Timeline of American media. (Neuman, 2010, p. 3)

Although all these studies contribute fundamental information for reconstructing the evolution of media, one of the objectives of the present article is to go further than the linear or genealogical series.

Is it possible to equate media evolution to the evolution of living things? The application of biological models has its limits; according to Dimmick:

> like the biologist, the researcher interested in the . . . media cannot appeal to universal laws like those of chemistry or classical physics. . . . Like the biologist, who also studies complex living systems, the social scientist inhabits a world where prediction is difficult at best, and explanation must be won without recourse to causal laws. (2003, p. 1)

Transferring biological models to media evolution cannot be linear or mechanical. For example, the famous Darwinian struggle for survival cannot be automatically applied to media evolution. More than an individual struggle for survival, in media ecology it is possible to identify a collective struggle in which different actors—consumers, producers, political institutions, economic groups, technology companies, and so on—condition the development of a media (Scolari, 2012, p. 213).[2]

[2] Dimmick's opposition to the introduction of universal laws in the field of media sounds contradictory when compared to McLuhan's laws of media (Dimmick, 2003; McLuhan & McLuhan, 1992). It could be said that Dimmick is trying to avoid the automatic application of biological laws in the social realm, while McLuhan was looking for the epistemological recognition of his academic detractors. According to McLuhan and McLuhan (1992),

> we propose no underlying theory to attack or defend, but rather a heuristic device, a set of four questions, which we call a tetrad. They can be asked (and the answers checked) by anyone, anywhere, at any time, about any human artifact. (p. 7)

When we write that "television evolves" or that "a medium in danger of extinction will do whatever it can to adapt," we are not considering media as autonomous entities. Something similar happens when biologists write about evolution: when they say that a species "fights" for survival or "adapts" to an environment, they are not considering biological species as intelligent or autonomous entities controlling their evolution; it is, rather, the combination of variation, selection, and inheritance (the so-called Darwin machine) that models evolution. Media evolution, like biological evolution, is determined by a multiplicity of factors and cannot be reduced to an ingenious technological determinism. Despite their limitations, the evolution models created to understand the emergence, development, and extinction of living beings provide us with a metaphor and a series of categories that are useful for understanding the evolution of technology in general and media in particular.

Media Evolution

Lehman-Wilzig and Cohen-Avigdor (2004) proposed a "natural life cycle of new media evolution", a six-phase model that summarizes the transformations a medium—in their case, the Internet—undergoes during its development. This model, although it does not depart from the linear or cyclic approaches, offers a starting point for beginning on a different theoretical and analytical path. Despite the implicit linearity in their proposal, the authors are aware of the necessity to deploy an integrated view: "whereas other studies have focused generally on a specific medium, today's dynamic media world requires an intermedia approach as new media influence—and evolve into—older media" (Lehman-Wilzig & Cohen-Avigdor, 2004, p. 708) (see Table 1).

Table 1. Natural Life Cycle of New Media Evolution (Lehman-Wilzig & Cohen-Avigdor, 2004).

Phase	Description
Birth	The commencement of the "life cycle." A new medium draws on an existing technology or medium. The inventor(s) may not always foresee its real, ultimate use.
Market penetration	The new medium enters the market, developing new uses, and attracting users. From 0% to 16% of the market. If successful in passing 16% (Innovators + Early Adopters), then it moves to the next stage; if not, the new medium fades away.
Growth	From 16% to 50% of the market. Developers and users learn to exploit, apply, and expand the unique capabilities of the medium.
Maturation	The new medium (or adapting old medium) finds its place in the dynamic communications environment. From 50% to 90% of the market. Maximal use and application of the medium's capabilities.
Defensive resistance	Competition between old media and the new medium forces the former to seek new directions to preserve their traditional audiences. From 90% to 50% market (decline) for the traditional medium.
Adaptation, convergence, or obsolescence	Adaptation: The traditional medium adapts to the new situation by developing a different function and/or preserving (finding) its (new) audience.
	Convergence: The traditional medium cannot survive on its own but preserves its function by merging with or incorporating into a new medium.
	Obsolescence: The traditional medium does not successfully adapt to change; it declines or disappears.

However, the question of predicting the future evolution of the media ecosystem remains open.

To facilitate its application to different media and historical contexts, this natural life cycle model by Lehman-Wilzig and Cohen-Avigdor can be easily condensed into three phases that can be superimposed onto the six stages outlined above (see Table 2).

Table 2. The Natural Life Cycle Model Compared to the Media Evolution Model.

Natural life cycle of new media evolution	Media evolution
Birth Market penetration Growth	Emergence
Maturation Defensive resistance	Dominance
Adaptation, convergence, or obsolescence	Survival or extinction

We will now present the three phases—emergence, dominance, and survival/extinction—in more detail.

Emergence

In this phase, the new medium appears in the media ecology. Based on Rogers' classic model of innovation diffusion, Stöber (2004) describes emergence as a two-stage functional change:

> At first, various people made a smaller or greater number of inventions or discoveries. After that, society discovered that the new technology was not only an improvement of an old medium, but could be used for new purposes and forms of communication. (p. 504)

The emergence of a new communication technology—for example, cinema, television, or mobile devices—entails a series of challenges that need to be met in the only way possible: trial and error. In the early 1990s, there were no Web designers, in the same way that in 1915 nobody knew how to produce a radio program. In the emergence phase, there are no instruction manuals that explain what the medium is or institutions that teach how it works.

- **Technological devices**

  We can say that each new medium is born from the recombination of a series of previous technological devices, languages, and production/consumption grammars. From this perspective, the new medium is an interface that structures various material and symbolic components, personal experiences, and collective meanings. Biological species usually do not interbreed, and when they do their offspring are infertile. On the contrary, technospecies normally combine in a new interface to produce new technologies: for example Gutenberg printing combined a wine press, mobile types, and paper technology. The same may be said about Apple's iPhone: it extended the iPod network of components, integrating in a single device mobile phone technology, touchscreens, accelerometers, a microphone, WiFi technology, a digital camera, and a series of games and applications specially designed for the new media.

- **Production**

  The creators and producers do not know the new media. They have a vague idea of its possibilities, but they do not know how it works or how to gain economic benefits from it. A review of media history over the 20th century reveals that the first thing creators and producers do is to give a sideways glance at the old media and adopt their productive logics and business models. In Europe, cinema was born as a fair and theater show, and in the United States television reproduced the model used for radio (for example, it was organized in national stations and had a business model based on advertising) (Baughman, 1997, pp. 30–57).

- **Textual content**

  When the new medium has not yet established its own grammar, the creators don't know how to generate specific content for the new communication device. As cinema historians have repeated over and over again, the first films were almost just theater filmed without editing (Musser, 1990). The first films of the Lumière brothers did not include close-ups, traveling, flashbacks, or parallel editing: almost two decades needed to pass for cinema to establish its own language based on the works of David Griffith and Sergei Eisenstein. The construction of a cinematic space in the first films also owes much to theatrical space. According to Manovich (1995), "the early cinema's system of representation was presentational: actors played to the audience, and the style was strictly frontal" (para. 3). Similar processes occurred in the 1950s during the emergence of television: the professionals knew how to produce content for radio and cinema, but they did not know how to do it for the new medium (Baughman, 1997).

- **Reception**

  The receivers also don't know the new medium and approach it with the mental models and personal consumption experiences of the old media. In the late 19th century, the first viewers came into contact with cinema marked by their reception experiences of theater and fair entertainment. Similarly, television was adopted by families based on their radio experience. The television set replaced the radio as the structuring element of family time, located at the center of the living room (Baughman, 1997).

Case History: The Emergence of the World Wide Web

How did professionals create content for the World Wide Web in the early 1990s? Each professional—graphic designer, photographer, journalist, and so on—applied the specific know-how of their professions. The first generation of online journalists copied and pasted their articles (or just the title and a short introduction) onto the Web page and updated them once a day. Because no one knew exactly how to create content for the "new media," the Web adopted content, grammar, and communication models from the rest of the media ecology (see Figure 2). If we focus on the business model of the proto-Web, we find the same situation: the introduction of the banner in 1994 showed that digital marketers were selling little slots of the Web page surface as if they were the pages of a newspaper. It was the same business model applied to a completely different media (Singel, 2010).

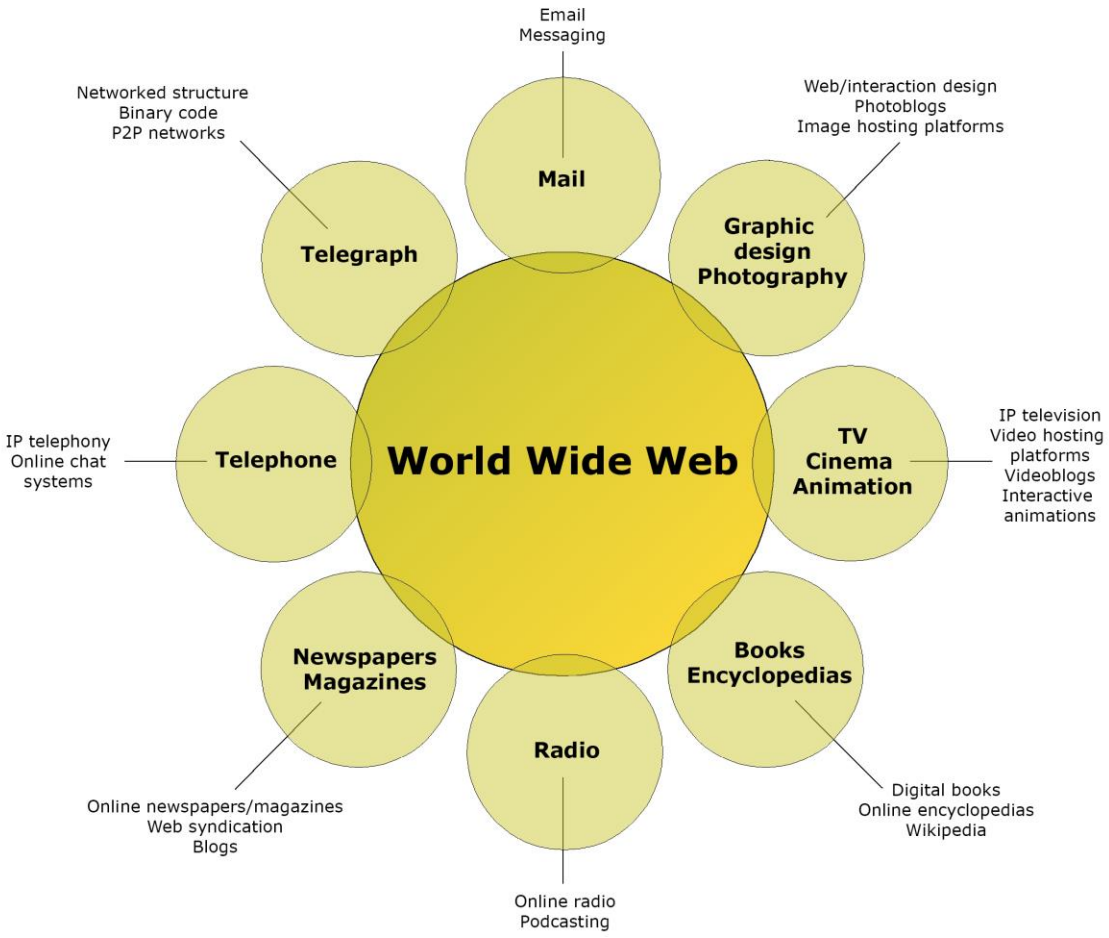

Figure 2. The emergence of the Web (Scolari, 2008).

Dominance

As in biological ecosystems, in the media ecology there are also dominant species that, during their golden age, are able to impose their own dynamics on the rest. Reviewing the experience of 20th-century media, we see they needed between one and two decades to become hegemonic media able to influence others. We would expect that in this phase the medium would be characterized by stability and equilibrium, but it is quite the opposite: as one media moves to a central position in the ecology—like radio or cinema between 1920 and 1950—it will always be subjected to tensions and imbalances generated by the other media.

- **Technological devices**

  In this phase, the technology is naturalized and the interfaces of the media disappear. If the early cinema, radio, and television experiences were carried out by pioneers who experimented with the devices (which often failed), in the dominance phase, the technology has become consolidated, reliable, and widely used in society.

- **Production**

  The production, at this stage of maturity, is industrialized. Whether cinema, radio, or television, sooner or later their production processes stop being artisanal and their own creation dynamics are consolidated. Aspects that have been studied in depth since the foundational work by Adorno and Horkheimer (1979 [1944]) become present in this phase: mass production of standardized cultural goods, work division, production routines, increasingly sophisticated business models, the Hollywood star system, market transnationalization, and so on.

- **Textual content**

  Hegemonic maturity also affects the content. In this phase, the medium finds its own language. An analysis of the evolution of cinema reveals how this medium consolidated a syntax based on editing. In this phase, each medium also adopts a series of genres that characterizes its golden age. For example, live musical performances and radio dramas in the case of radio and the news, game shows, sit-coms, and late-night talk shows in the case of television.

- **Reception**

  The act of consuming, in this phase, is naturalized and becomes a culturally accepted practice. Consumers have a mental encyclopedia not only of the competencies necessary for interpreting the content (Eco, 1979) but also of all the *frames* for interacting with the medium and its interfaces. The media experience of the 20th century shows us that, when a medium reaches the hegemonic phase, it can construct agendas and model the social conversations (McCombs & Shaw, 1993). In this phase, the medium is presented as an essential component of the mass culture, imposing its rhythms on the consumer (going to the cinema each weekend, listening to the radio drama after dinner, watching the news) as well as its worldviews.

Case History: The Dominance of Television

The emergence of television radically changed the media ecology in the late 1950s. In a few years, the "new media" attracted audiences and generated a migration from cinema and radio to television. Thousands of motion picture theaters went out of business. As McQuail put it, television broadcasting "rapidly eclipsed radio and the cinema, and overshadowed the popular book and newspaper press" (1997, p. 5). For half a century, television was the top predator of the media ecology, the big T. rex that frightened the rest of the media species. Even the early World Wide Web was afraid of television. The pressure of the television grammar and consumption practices was so strong that companies tried to introduce a broadcasting logic into the World Wide Web. In 1996, Macromedia introduced Flash, a technology used to add streamed video, audio, or animations to Web pages; the

following year Microsoft announced the Active Channel system to synchronize website content and make it possible to view it offline. According to Microsoft, users did not have to go and get their updates anymore; they could have them delivered (Microsoft Developer Network, n.d.). Even the name of the system—"channels"—goes back to the still-predominant medium: television.

Survival/Extinction

The third phase is a significant challenge to the life of the medium. The media ecology undergoes changes that may result from new technological inventions (the emergence of the talkies at the end of the 1920s), economic conditions (the consolidation of the pay-per-view model in the television of the 1980s), or social practices (the explosion of pirate radio stations between the 1960s and 1970s). But perhaps the most significant challenges that the old media must meet come from the new media. In this stage, the medium's capacity to adapt and survive is put to the test. If the medium does not manage to adapt itself to the new conditions of the media ecology, it runs the risk of becoming extinct (Scolari, 2012).

- **Technical devices**

  A medium's symptoms of technological aging are combated with more and new technologies: CinemaScope and 3-D in cinema, FM broadcasting in radio, stereo sound in recorded music, color printing in the press, and so on. The evolution of media, like that of any other industrial sector, is characterized by the constant introduction of technological innovations. It is possible that an innovation can give new life to a medium, as when the traditional electric telegraph passed to the wireless telegraph at the end of the 19th century; however, the arrival of a new technology can lead to the extinction of another technology, such as the progressive disappearance of the eight-track cartridge for sound recording.

- **Production**

  The production processes are also impacted when a medium has to face the dilemma of adaptation or extinction. Introducing technologies that allow the medium to adapt to a different environment requires new professional profiles and changes in the production routines. The case of newsrooms is a good example of this type of transformation: the emergence of online media in the 1990s made it necessary to redesign workspaces and, in many cases, opt for newsroom convergence (Deuze, 2004; Erdal, 2007; García Aviles & Carvajal Prieto, 2008; Pavlik, 2004). The professionals are also affected by these processes, because they must face reskilling to work in the new environment (Deuze, 2007). As stated above, it is possible that all these efforts for adapting are not enough and the medium ends up becoming extinct, leaving behind it a series of obsolete professional profiles—like the typesetter in the era of movable type—equipped with technical expertise and production experience that are no longer necessary.

  On some occasions, a medium on the edge of extinction manages to build its own niche and survive the competition with other media species, keeping its own production modes. Letterpress publishing has recently undergone a revival under the general banner of the small press movement. Despite the progress in digital printing techniques, there are still companies that produce set metal foundry type fonts of letters for hot foil stamping and letterpress printing. What was, in its time, a standard form of industrial production, in this new phase becomes a practice for artisans.

- **Textual content**

  A medium in danger of extinction will do whatever it can to adapt to the new ecosystem and survive. Contents and languages are no strangers to these changes. Radio renovated its aesthetic and narrative forms to deal with the advances of television in the 1950s (Fornatale & Mills, 1980). In the same way that television in the last two decades has updated its language, resulting in so-called hypertelevision—that is, television that simulates interactions through a series of audiovisual grammatical resources (see section on Simulation).

- **Reception**

  In this phase, the number of consumers of the medium tends to decrease, and the time that they do not spend on one medium they use consuming other media. An old medium may not manage to adapt, but its decline is long and drawn out; in this case, the receivers grow old and die with the medium. This was the destiny of the magic lanterns, a medium that had its moment of splendor in the 18th century until it gradually faded away at the end of the 19th century with the arrival of cinema.

  It is also possible that a medium does not totally disappear and continues to survive in a very specific niche, cultivated by a relatively closed group of users that form a subculture around it. For example, bibliophiles continue to keep alive the collection of manuscripts and incunabula from the 15th century; something similar is happening with vinyl records and may happen in the future with printed books (Carlón & Scolari, 2009).

Case History: The Survival or Possible Extinction of Newspapers

One good example of the fight for survival is the transformations occurring in the contemporary press. In newspaper pages, the length of the news articles has been shortened, the number of infographics has been increased, and the design has become more dynamic and fragmented (Cases i Associats, 2010) (see section on Simulation During Survival). We could say that printed newspapers have turned into printed Web pages. All these changes in the discursive forms are symptoms that the medium is attempting to adapt to a media ecology that is not the same as before. Will the newspaper survive? Will these mutations be enough? According to the Newspaper Association of America (NAA), the revenues from newspaper print advertising in 2012 fell to the lowest annual level of print advertising since the NAA started tracking industry data in 1950 (NAA, 2012). In Europe the situation is not so different. A recent report indicated that the traditional newspaper publishing sector in the European Union "is confronted with serious problems, as illustrated by declining employment, value added and circulation figures" (Joint Research Centre, 2012, p. 87). The decrease in readership, especially among younger generations, and the shift from print news consumption to online news consumption are considered the main causes of this decline.

This analytical model of media evolution—based on identifying three phases of emergence, dominance, and survival/extinction—has a characteristic that contradicts one of the objectives proposed at the start of this article: it is still a linear path, a sequence of phases that extracts from the media ecology a series and the sequential organization for constructing a syntagma. As mentioned above, the *media evolution* model should distance itself from linear, sequential, or genealogical historical series to propose a

view that reflects the complexity of the transformations that take place in the media ecology. Taking the model presented as a base, it is possible to progress a little further in representing the intermedia relationships and now break the linear or treelike logic to propose a model that is closer to the network idea.

The relationships between media can take on different forms. Sometimes two or more media contaminate each other and exchange their technological devices, languages, or their production/ consumption dynamics. We could say that the cinematographic language developed in parallel with the language of the comic: at the start of the 20th century, both meaning systems constructed their respective languages, interchanging the components (shots, camera angles, etc.) and compositional rules of the narrative (ellipsis, transitions, etc.). In this context, simulation should be considered a specific form of intermedia relationship.

Simulation

As noted, simulation processes can occur when a new medium tries to construct its own niche in the media ecology or when an old medium attempts to survive adverse conditions by mimicking the new media species surrounding it.

Simulation During Emergence

The emergence phase of a new media is characterized by the simulation of the hegemonic forms of communication. As McLuhan wrote, "the content of any medium is always another medium" (2003, p. 19). History offers innumerable examples of this mimicking process. For example, Gutenberg's mechanically reproduced books tried to respect, to the smallest detail, the manuscript books handwritten by medieval copyists. The prototypographers copied the characters, the design format, the abbreviation system, and the distribution of the text on the page. In the initial period, the printers did more than innovate; they pushed the simulation to the limit. It was unthinkable for the typographers to have any other attitude but to imitate. How could they imagine books that were different from the codex manuscript model, which for over a millennium was the main support for writing in the West? From the printers' point of view, the perfect reproduction of the manuscript had, on one hand, an enormous aesthetic value that gave prestige to their work and, on the other hand, guaranteed commercial success in a market made up of readers who were used to texts produced by copyists. Unlike the previous great transformation—the change from the papyrus roll to codex—the invention of the printing press did not lead to a revolution in the book interface but rather was the beginning of a slow evolution. Until the middle of the 16th century, the codex and the printed book formed part of the same history; they were different aspects of the same production process and cultural diffusion (Eisenstein, 1979; Febvre & Martin, 1998; Montecchi, 1997; Ornato, 1999; Petrucci, 1990).

This simulation process occurs each time a new communication technology emerges in the media ecology, from the daguerreotype to the radio or the World Wide Web. The first daguerreotype of the 19th century emulated the style and content of hand-painted works. A quick virtual glance at the archives of the Daguerreian Society (http://daguerreian.org) is enough to discover portraits, postmortem images, and bucolic scenes that, until then, had been the patrimony of the easel painting. In the case of the radio, in addition to creating its own scripts, the radio drama adapted all kinds of traditional theater plays and literary works, from comedies by Molière to *The War of the Worlds* by H. G. Wells.

As noted, during its emergence in the 1990s, the World Wide Web resorted to simulating media that, at that time, occupied a hegemonic position. The first online newspapers reproduced the content, the way of organizing the text, and the update rate of the printed versions in the same way that banners imitated the format and commercialization mode (depending on their surface, location, and readers/users) of printed newspaper publicity. Many years needed to pass before the online press started to find and develop the distinctive traits that currently characterize it: updating in real time, multimedia content, and interactivity (Greer & Mensing, 2004).

Simulation can range from an intersemiotic translation of the content of one medium to another medium to mimicking the interaction forms. In the first case, we could talk of a textual productive consumption during the production process—that is, the new medium feeds off the texts of an old medium. In the second case, we are faced with the process of simulating all the effects; a new medium attempts to use its own resources to do something that the old medium already does. To reinforce this interpretation of the simulation processes during the emergence phase of a medium, we will analyze a particular case in more detail: the birth of radio in Spain.

Case History: The Emergence of Radio in Spain; or, When Radio Simulated Literature and Theater

From its emergence in 1920 as a commercial medium, Spanish radio entered a period of constant technical trials, to which we can add the experimentation in content starting from 1924, with the appearance of

> the long awaited regular broadcasts directed at the entire public, which started to become consolidated in 1926 with the emergence of the sound-on-disc recordings. The three year period 1924–1926 was a crucial moment for the definitive take off of radio broadcasting. (Alonso Martín-Romo, 2005, p. 310)

This period was a search for the best content, and those that were not suitable were discarded. Using literary works fulfilled two functions: entertaining and educating the listeners.

In May 1924, Radio Ibérica became the first radio station to broadcast a daily program without interruptions; a few days later, Manuel Machado read some of his better-known poems to listeners, beginning the unstoppable spread of Spanish poetry through conferences and readings. The radio stations mainly broadcasted readings of works of the more representative authors of the area of influence of each radio station. Radio Ibérica was the first to present a complete theater play (*El Chiquillo* by the brothers Serafín and Joaquín Álvarez Quintero).

The first intention of radio stations was to put a microphone in all those places where interesting events occurred (for example, theaters); however, the distrust of the theater companies led them to ban radio stations broadcasting from their premises. The radio stations did not take long in copying foreign experiences and started to produce their own radio dramas in the studio. At this moment (1925), the process of adapting theater plays began, which soon added the production of unpublished pieces, mainly *sainetes*. The characteristics of *sainetes*—brevity, easy-to-follow linear development, and, above all, the humor of fun and entertaining situations—made them particularly attractive for the public.

With respect to literature, there were many problems involved in adapting novels to the radio medium. The radio novel was a hybrid between radio theater and serial stories. To solve the problem of the excessive length of the stories, the radio stations experimented with broadcasting the novels in chapters, based on

> the experience of serial novels and the various varieties of short novels. The question at this point was how to hold the audience's attention, given that keeping listeners expectant over several days was a complicated task as they did not yet have the habit of listening regularly. (Alonso Martín-Romo, 2005, p. 315)

The first radio novels broadcast in Spain between 1925 and 1926 belonged to the detective genre. The competition between radio stations was so great that the literary adaptations were a comparative advantage; if one novel was successful, the competitors offered a similar story by a well-known author. Over the years, the radio novel evolved, leaving behind its original format—one actor who narrated the story—to become polyphonic and include the music and sound effects of the radio drama.

Short stories also provided content during the emergence of the radio medium. Children's stories were successful due to the synergies with children's magazines such as *Chiquilín* y *Titirimundi* (Alonso Martín-Romo, 2005, p. 316). Alonso Martín-Romo concludes that literature "is one of the basic and essential supports that the communication medium which most needs imagination, the radio, has used to strengthen its implementation in society" (p. 317). Radio productively consumed the texts coming from theater and literature to feed its own production process while it simulated the consumption experiences of these media.

Simulation During Survival

The emergence of new communication technologies introduces changes into the media ecosystem that, in many cases, can radically transform the rules of the game. The development of network technologies (TCP/IP), added to the textual digitalization processes and the establishment of new information exchange protocols (HTML), generated the conditions for the World Wide Web to emerge at the beginning of the 1990s. The Web challenges the traditional definitions of what a medium is. More than a medium, it is a *metamedium* or environment that allows for the emergence of numerous communication forms, from Web pages to Wikipedia, microblogging, and social networks. These new forms of interactive digital communication transform the media ecosystem in all of its aspects, proposing new business models, fragmenting and redistributing the audiences, and promoting the Creative Commons culture and user-generated content (Scolari, 2009b). In this context, some old media, such as the press or television, have been forced to change to survive. The section on Survival/Extinction discusses how the printed press simulates Web pages to meet the challenge of online press, a new medium that offers interactive multimedia and free information. Put simply, the old media often need to simulate the new media if they want to survive. If, as McLuhan wrote, "the content of any medium is always another medium" (2003, p. 19), then we could argue that in its declining phase the content of an old medium is a new medium. In some cases, the old medium can even productively consume content of the new media—for example, when movies or cartoons are generated based on video game characters (such as *Lara Croft* or *Resident Evil*).

Case History: Hypertelevision;
or, When Television Simulates New Interactive Media

In recent years, many digital communication researchers have been so occupied by analyzing the new media that they have forgotten about the consequences of this irruption for old media. Television research was intensive in the 1990s, but it was almost exclusively TV-centered research. In other words, few researchers analyzed the transformations of television from the perspective of new media (Scolari, 2009a). It is in this context that we can talk about *hypertelevision*. What is hypertelevision? It is not interactive television but rather television simulating the interactivity of the new digital media. Some of the traits that characterize hypertelevision are:

- **Screen fragmentation:** This rhetorical construction was first applied in news transmissions to modularize information and show different interlocutors—the anchorman in the studio and the remote correspondent—at the same time. News programs also include modules to present last-minute information, financial data, weather information, or sports reports in the lower part of the screen. Series such as *24* (Fox, 2001–2010) introduced screen fragmentation to increase the sense of real time and represent the parallel development of different stories. Scholars such as Vered (2002) described this trend as the consolidation of a "windows aesthetic" in contemporary television.

- **Acceleration of rhythm and fragmentation:** The introduction in the last decade of high-speed narratives in fiction and the diffusion of short formats, such as music videos, clips, trailers, sneak peeks, webisodes, mobisodes, and promos may be considered a characteristic of hypertelevision. The frenetic succession of images, camera movements, and stories has converted fictions like *24* or *ER* (NBC, 1994–2009) into something like a 40-minute-long music video clip.

- **Endless intertextuality:** Even if intertextuality is a basic feature of any kind of textuality, citations, excerpts, tributes, and quotations are other traits of postmodern textual aesthetics that are also exploited on hypertelevision screens. This trend—that could be defined as *audiovisual cannibalism*—is present in fiction, news, and reality shows. This cannibalization of content could be complemented with another trend: the diffusion of *metatelevision* (Carlón, 2006; Olson, 1987), a second-level television structure that presents dissections or critical citations of other productions.

- **Rupture of linearity:** The inclusion of flashbacks or flash-forwards is a classic component of audiovisual grammar. However, what is new for mainstream television is constructing complete episodes with flashbacks and flash-forwards, breaking the traditional Aristotelian narrative. We can find interesting examples of these temporal breakdowns in episodes of *ER, The X Files* (1993–2002), *House M.D.* (Fox, 2004–2012), *Lost* (ABC, 2004–2010), and *The Nine* (ABC, 2006–2007).

- **Multiplication of characters and narrative programs:** Whereas traditional fictions introduced unitary and basic linear stories—for example, Inspector Columbo concentrated on one crime and the rest of the characters were secondary ones, with the exception of the criminal—hypertelevision expands the number of characters and therefore multiplies the narrative programs. Contemporary series such as *24, ER*, *The Sopranos* (HBO, 1999–2007), *Lost* (ABC,

2004–2010), *Six Feet Under* (HBO, 2001–2005), or *Grey's Anatomy* (ABC, 2005–), in which more than 10 characters are present in more than half of the episodes, are a good example of this trend.

Why has television introduced all these innovations into its rhetorical device? If every text constructs its reader (Eco, 1979), it would be useful to ask what viewer is constructing contemporary television. During its emergence, the first television—also known as *paleotelevision* (Eco, 1983)—addressed a postwar viewer formed in radio, cinema, and press consumption experience. During the phase of dominance, television—*neotelevision,* according to Eco (1983)—addressed new generations that had grown up watching television, with high interpretative competencies in audiovisual language. Hypertelevision addresses viewers with an elevated expertise in fragmented textualities and advanced skills in navigating interactive environments. In this context, contemporary television must evolve its aesthetics and content to satisfy the desires of a new generation of viewers formed in hypertextual experience. To survive, the old medium must adapt to the media ecosystem and adopt traits of the new interactive environments. In other words, hypertelevision is television simulating digital interactions (Scolari, 2009a, p. 41).

Conclusion: Media Evolution as a Network

All the phases and processes presented here can overlap and, keeping in mind the diversity of media and communication experiences, be at different moments of their development simultaneously. When a new medium emerges, other media are going through their hegemonic phase and old media are trying to adapt themselves to survive. It could be said that all media undergo simulation dynamics during their life cycle, either simulating or being simulated.

The different media develop in parallel, but, as if it were a non-Euclidean geometry, these parallel lines tend to touch. As we have seen, the evolution of each medium does not travel along a separate track; rather, it is in constant interaction with the evolution of other media. It has been widely demonstrated by researchers such as McLuhan (2003), Innis (1950, 1951), Bolter and Grusin (1999), and Manovich (2001) that media have close relationships with one another.

Reconstructing these relationships—which, as we have seen, are evident at different levels, from the content to devices, including meaning systems and the production/consumption practices—is one of the great challenges of media ecology and media evolution. The media establish relationships with the other media that coexist in the same ecology—both the old media fighting for their survival and new media in the emergence phase. In this context, the simulation relationships can take different forms (see Table 3).

Table 3. Intermedia Simulation Relationships

Level	Elements affected	Example
Content	Grammar, genres, textual structure (release rates, programming), and so on	The radio appropriated theater and literature content and adapted it to its own meaning system.
Interface	Devices for browsing, indexing, control commands, and so on	Printed books appropriated the browsing devices and indexing forms of medieval codices, papyrus rolls, and even clay tablets.
Production practice	Production mode (artisanal, industrial), production routines, business models, and so on	The television industry appropriated the organization in stations, production routines, and advertising strategies of the radio.
Consumption practice	Reception modes (individual, social, simultaneous, deferred, etc.), consumption routines, interpretation strategies, and so on	Families appropriated television based on their radio experience and incorporated it into their daily lives, displacing the radio.

This analysis has focused on simulation relationships, but it is evident that media can establish different types of interchanges and simulation is only one example. The evolution of media cannot be understood outside the relationships that the media "species" establish within an ecology. If we add up all these relationships—and others that have not been mentioned in this article; for example, when two or more technological systems merge to form a single experience (the convergence in the talkies of the projection of moving images and audio reproduction)—the model that emerges goes far beyond the linear series or branched models: media evolution is more like a 3-D network than a Darwinian tree. Although we cannot ignore the irreversible passage of time, the density of intermedia relationships is so great and varied that it is not difficult to imagine a network of interconnections that unites all media, including old, new, and even currently extinct communication forms (such as papyrus or the telegraph). To represent this complex evolutionary network, we can recover the traditional linguistic opposition between diachronic and synchronic levels (see Figure 3).

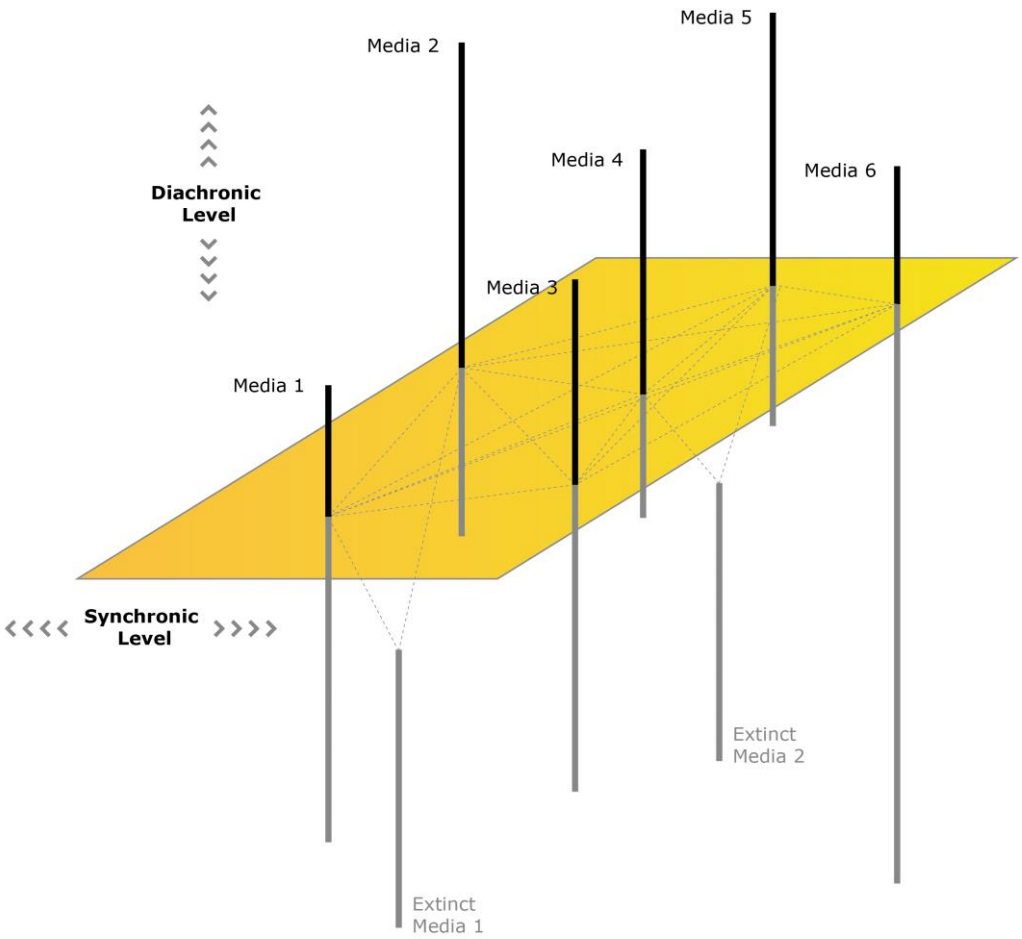

Figure 3. Media evolution understood as a network.

Moreover, if we consider media evolution based on a network model, the concept of *emergence* can be employed far beyond its metaphorical use. In this theoretical context, we can legitimately talk of the emergence of new media and phenomena such as the explosion of media (*punctuated equilibrium*) in certain periods of their evolution (Scolari, 2012, p. 214), a phenomenon already detected by Moretti (2005) in the evolution of literary genres.

From a methodological perspective, the exploration of the evolution metaphor opens the door to the application of quantitative methods such as those applied by evolutionary economics (Nelson & Winter, 1982), evolutionary epistemology (Ziman, 2000), literary criticism (Moretti, 2005), and cultural analytics (Manovich, 2007). According to Manovich (2007),

> Today sciences, business, governments and other agencies rely on computer based analysis and visualization of large data sets and data flows. They employ statistical data analysis, data mining, information visualization, scientific visualization, visual analytics, and simulation. We believe that it is time that we start applying these techniques to cultural data. (p. 1)

For example, the analysis of 44 genres in British fiction between 1740 and 1900 allowed Moretti (2005) to identify patterns, isolate major bursts of creativity (genre emergence), and describe genre extinction. If pattern recognition was one of the favorite analytical tools of Marshall McLuhan (Moretti talks about *distant reading*), now it is possible to recover this practice working with data sets coming from media content and digital traces left when people discuss, create, publish, consume, share, edit, and remix these media.

Understanding media ecology is not simple; the incorporation of the evolution model—no longer thought of as a linear series of branching technologies but rather as a network of intermedia relationships moving through the time axis—allows us to enrich the interpretation of the mediasphere while also making it possible to apply new analytical tools.

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