The Change of Medium and the Medium That Changes
Narrative Literature, Networks and the Digital

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1. Death and Its Discontents

DURING THE past half-century, several deaths have been announced in the humanist studies, in Nietzschean fashion: from Foucault's death of man (1966) and Fukuyama's death of history (1992) to the more specific deaths of the author, proclaimed by Barthes in 1967, and of art, proclaimed by Danto and Lang in 1984.[1] Following in their footsteps, Robert Coover declares books dead in a *New York Times* article published in 1992. It was almost three years after the World Wide Web was invented and one before the technology behind it was made public by CERN.[2] New types of writing and reading had already been discovered: writing for a screen and reading on a screen. It was the first time a major news outlet gave a platform to a writer talking about the presumptive end of print culture after the advent of the digital era.[3]

At that point, print had existed for more than five centuries, since Gutenberg's invention of the press around 1440. This breakthrough represented a medium mutation for literature.[4] The new medium was unexpectedly going to become widely accessible, and the propagation of literary works entered a new era. At the same time, the old medium, i.e. the spoken word, continued to exist and shape cultures, complementary to print. The appearance of the World Wide Web and network culture can be considered the second major medium mutation of literature. As others have previously stated,[5] there is no difference between text on paper and on a screen, in terms of how the reader perceives the linguistic signs, but the digital is, at its core, open to internal remodeling and upgrade. Thus, whereas in the case of print the corpus of works already published was waiting for people to become equipped with the necessary toolset for accessing them,[6] in the case of the digital, the corpus of early works[7] became gradually inaccessible, and when people started understanding and using the new medium, most of them were not easily available. The new medium also needed a new terminology, classifications, fea-

ture description. It needed to be integrated in a broader cultural paradigm and explained as part of the society and technological advancement it was generated by. That cultural paradigm was at the beginning of the 1990s postmodernism,[8] and the digital became an epitome for de-centralization. At the same time, this need for definitions created a web of terms that have consequently failed to become relevant to the study of literature as an art, because of several factors: their multitude, their overlapping and the constant updating not only of the system of analysis, but of the ways in which scholars have insisted on inventing and promoting their own denominations. This article will explore why the death of books did not take place and why digital narrative literature has yet to become a meaningful practice of literature in the eyes of the general public, taking into consideration digital access and literacy rates, defining intra-medial obsolescence, inventorying terminology literature and explaining the impossibility of a resistant canon.

2. The New Medium

WHEN AN art shifts into a new medium, the first concern is trying to explain how that art, in this specific case narrative literature, works with and is influenced by the features of the new medium (for instance interactivity or the possibility for a reader/user to directly communicate with and get feedback from the literary work and the integrated use of several media—text, image, music, video). The focus on specific features became problematic later on, because what was to become a critical characteristic of the digital, obsolescence, was largely ignored. When Marshall McLuhan describes it in *Laws of Media*,[9] obsolescence is regarded as an inter-medial aspect, i.e. when a medium prevails over another, it renders the other obsolete. The difference is that the digital, compared to radio or television, has what I will call intra-medial obsolescence. By this I mean the ability of a set of elements (software) from within the system to render each other obsolete. With the focus on the effects a newfound form of interactivity had on literature, the speed at which digital technology was to develop in the next decades was not taken into account. Therefore, a scenario similar to the following was not taken into consideration: the software X becomes outmoded with the emergence of software Z, thus 1. slowly making the literature written in software X unreadable; 2. already paving the way for software Z to become outmoded, because X and Z are variables. The internal development of the medium was greatly underestimated.

Therefore, in the 1990s, theorists such as Espen Aarseth, George P. Landow, Stuart Moulthrop or Marie-Laure Ryan tried to provide new terminologies and refurbished textual systems that would fit the new medium, without much focus on the socio-economic conditions that provided (or rather did not provide until fairly recently) access to computers and later on to the internet. At the time, before the internet and during the first decade or so after the internet became publicly available, digital literature was much the same as books before Gutenberg's printing press, i.e. inaccessible to a wide range of people. In the same way in which books became significantly cheaper after the proliferation of the printing press[10] and determined a spike in literacy, thus *creating* an audience for books, computers determined a spike in digital literacy after an ever greater number

of people gained access to the internet through dial-up and then high speed broadband connections. The fundamental difference is that when books as objects became widely available, the way in which the subject matter was presented was not changed (words were still written on paper), whereas when people gained broad access to computers and internet,[11] most of the original texts simply did not keep up with the changes.

Given the de-hierarchization that took place in postmodernism and poststructuralism, it takes longer and it is more difficult to implement terms in the field of literary studies than, for instance, in science. In mathematics, physics, biology, etc., if one discovers or invents an item/theorem/axiom, etc., its label most likely contains either the scientists' name or some distinctive feature of that discovery[12] and it does not change over time. Because in the field of literary studies the process is not similar, the new medium generated a multitude of terms that tried to replace or complete each other in fast succession, especially when it comes to narrative literature (interactive fiction, hypertext fiction, interactive narrative, multi-path narrative, etc.). Sometimes, these denominations are confusing or overlapping or overreaching, and instead of expanding the field, they create a terminological amalgam reminiscent of the historical avant-garde movements.

By the end of the 1990s, several theorists came to reject the idea that books were dying, explicitly hailing the digital as the "natural" heir of the printed book. Janet H. Murray, for instance, in her seminal work *Hamlet on the Holodeck*, argues that she is "not among those who are eager for the death of the book. . . . Nor do I fear it as an imminent event. The computer is not the enemy of the book. It is the child of print culture, a result of the five centuries of organized, collective inquiry and invention that the printing press made possible."[13] Something similar is stated by J. Yellowlees Douglas, who considers the digital an expansion of print culture, which actually endows it with new capabilities that enable the endlessness of books.[14] Around this time, the intra-medial obsolescence is finally starting to be acknowledged, and scholars provide enhanced, revised versions of their own accounts in record times.[15]

Up until now, the expected decline of the printed book has not happened, with the European book market, for instance, remaining at approximately the same level in the past 10–12 years[16] and thus the general perception of what literature is and how it is experienced also remained rooted firmly in the pre-digital era. Consequently, by and large, readers stayed loyal to the medium they were used to, whereas new types of cultural consumers, such as gamers, do not see themselves as operating inside narrative constructions that could be considered literature.

3. A Brief Exploration in Terminology

3.1. Conceptual Models

THREE MODELS are mentioned in almost all critical and theoretical approaches on the subject of literature in the digital age. Chronologically, the first one is Vannevar Bush's *memex*, a device resembling a virtual personal library that has not yet been created and will therefore be referred to as a hypothetical model. The second one is Theodor H. Nelson's *hypertext* which, due to its focus on the interconnectivity of items

and the connections that can be drawn between them will be named the technical model. The third, the cultural model, is Gilles Deleuze and Felix Guattari's much debated *rhizome* as an epitome of decentralized systems and postmodern thought.

3.1.1. Memex or the Hypothetical Model (1945)

In an article published in 1945 in *The Atlantic*, titled "As We May Think," President Franklin D. Roosevelt's science advisor and the architect of the Manhattan Project, Vannevar Bush, introduces the concept of *memex*: "A memex is a device in which an individual stores all his books, records, and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility. It is an enlarged intimate supplement to his memory."[17] In other words, a memex is an external eidetic memory archive of an individual, a device similar to what we call today an external hard drive, but imagined by Bush as serving a single person. A memex is a replica of one's brain, and that person can access any information from it at any given time, by using an incorporated algorithm that creates links between chunks of information. Bush calls this "associative indexing, the basic idea of which is a provision whereby any item may be caused at will to select immediately and automatically another"[18] and "the essential feature of the memex. The process of tying two items together is the important thing."[19] This model is a hypothetical one because even in 2019, it has not yet been created and remains just a possibility, but is still pivotal to the study of literature in the digital era due to the audacity of imagining an object that stores and links pieces of information that is more efficient than the average brain. Bush provided the original concept that was the basis for the future inventions of the hypertext model and eventually the World Wide Web.

3.1.2. Hypertext or the Technical Model (1965)

In 1965, after five years of working on his signature Project Xanadu, envisioned as a network of interconnected documents that would not resemble paper, but rather represent an alternative model, of "interactive screens,"[20] Theodore H. Nelson coined a new term, one that would define decades of digital writing:

> *Let me introduce the word 'hypertext' to mean a body of written or pictorial material interconnected in such a complex way that it could not conveniently be presented or represented on paper. It may contain summaries, or maps of its contents and their interrelations; it may contain annotations, additions and footnotes from scholars who have examined it. Let me suggest that such an object and system, properly designed and administered, could have great potential for education, increasing the student's range of choices, his sense of freedom, his motivation, and his intellectual grasp. Such a system could grow indefinitely, gradually including more and more of the world's written knowledge.[21]*

From the start, we can identify a crucial difference between memex and hypertext. Whereas the former is not a device projected for inter-personal, but for personal use, the latter is non-specific in what regards the human users and focuses on the connections between items, how they are made, and how the navigation from one object to another takes place.

Nelson is not depicting a person's brain, but an ever-growing system whose growth is not only desirable, but cannot actually be stopped. The expansion of the technical object by aiming to encompass all works ever written into the new system is what makes hypertext what I call the technical model of literature in the digital age. Even more than the text itself, relevant here are the hyperlinks, or the connections between what Roland Barthes termed *lexias*,[22] chunks of text. Hypertext is probably the most discussed of the three models when it comes to the art of literature in digital times, perhaps because it is a direct reference to the already established term "text" and because best known digital literary works are what was to be called "hypertext fiction."

3.1.3. Rhizome or the Cultural Model (1980)

One of the essential metaphors for the decentralization of the socio-cultural hierarchies during postmodernism and poststructuralism remains Gilles Deleuze and Felix Guattari's *rhizome*, theorized in their 1980 volume *A Thousand Plateaus*. The rhizome is a complex that has as fundamental feature the non-linear links between its components, i.e. any component can (and must, in their view) at any time link with another, irrespective of position. The rhizome, as described by the French philosophers, has six defining principles: connection, heterogeneity, multiplicity, asignifying rupture, cartography, decalcomania. In what regards the book in the new cultural order, Deleuze and Guattari argue that "the world has become chaos, but the book remains the image of the world: radicle-chaosmos rather than root-cosmos."[23] They imagine a one-page representation of a book, not dissimilar to the actual properties of a digital book (be it originally in print or not): "The ideal for a book would be to lay everything out on a plane of exteriority of this kind, on a single page, the same sheet: lived events, historical determinations, concepts, individuals, groups, social formations."[24]

3.2. Textual Models: Cybertext (1997) and Technotext (2002)

Cybertext is a derivate of William Gibson's 1982 *cyberspace*, defined by Espen Aarseth as "a game-world or world-game; it is possible to explore, get lost, and discover secret paths in these texts, not metaphorically, but through the topological structures of the textual machinery."[25] So we are talking about a textual world that presents the reader/user with the possibility of navigation and exploration at one's own pace and on a path personally designed by the user in a pre-modeled world. N. Katherine Hayles calls it "a functional and semiotic approach that emphasizes a computational perspective, a polemic that wants, as Stuart Moulthrop put it (echoing James Joyce), to 'kill the literary priest.'"[26] The inclusion of (video) games as instances of Aarseth's cybertext was probably the most controversial aspect of his theory, setting the foundation for a debate between narratologists and ludologists about the nature of digital games that took place at the beginning of the 2000s.[27]

Whereas *cybertext* does not have as its main focus the relationship between text and its medium, Hayles proposes a different approach by coining *technotext*, a term almost as complex, but oriented towards how the world takes shape because of the medium, not the text. Hayles classifies "Literary works that strengthen, foreground, and thematize the connections between themselves as material artifacts and the imaginative realm of ver-

bal/semiotic signifiers" as "'technotexts', a term that connects the technology that produces texts to the texts' verbal constructions."[28]

3.3. Umbrella Terms

Over time, a series of umbrella terms, or general labels, have been assigned to literature in the digital age. The broad practice of adding e (from electronic) before words in order to standardize and refer to new digital practices that stem from analog ones led to the existence of *e-commerce*, *e-sports*, and inevitably *e-books*, among many others. In this case, *e-books* or electronic books are just books in finite digital formats intended to be read on e-readers (devices designed specifically for the reproduction of an analog reading experience, but able to store hundreds of thousands of books), laptops or tablets. In no way are they referring to the types of literature this study approaches. *Electronic books* have nothing to do, for instance, with *electronic literature*, which is "a generalized term used to describe a wide variety of computational literary practices beneath one broad umbrella, defined by the Electronic Literature Organization (ELO) as 'works with important literary aspects that take advantage of the capabilities and contexts provided by the stand-alone or networked computer.'"[29] We find overlapping terms at almost every step of the way.

Up to this point, this study mentions structures like "literature in the digital age" or "digital literature," as an attempt to use the broadest terms possible, but *digital fiction*, which is only slightly different from the latter, has a more specific meaning. "Digital fiction is fiction written for and read on a computer screen that pursues its verbal, discursive and/or conceptual complexity through the digital medium, and would lose something of its aesthetic and semiotic function if it were removed from that medium."[30] Thus, *digital fiction* is *dependent* on the medium. At the same time, *digital fiction* is a genre, "under which many different subgenres or specific writing practices using digital media can be sorted: hypertext fiction, network fiction, interactive fiction, e-mail novels, and multimedia novels are among them."[31] *Digital fiction*, then, is a *category* of electronic literature that has its own subcategories. A distinction has to be drawn at this point between digitized works (books or documents originally published in print) and born-digital works (literature written and designed in and for the computer).

Furthermore, if a theorist decides to propose his own textual model (see 3.2), he might also decide to propose a new type of literature, in Espen Aarseth's case a medium-non-specific one, based on what he calls "non-trivial effort." He includes under the umbrella of *ergodic literature*, "using a term appropriated from physics that derives from the Greek words *ergon* and *hodos*, meaning 'work' and 'path'"[32,33] a multitude of works, from Apollinaire's calligrams to Borges' *Garden of Forking Paths* to Michael Joyce's *afternoon: a novel* (the first hypertext novel).

In the case that we decide to explore a different base structure and turn from "literature" and "fiction" to "narrative," the umbrella term is interactive narrative, which can be defined as "the combination of narrative, a type of meaning that captivates people in all cultures, with the active user participation afforded by digital media."[34] Marie-Laure Ryan identifies four levels of interactivity in digital media: peripheral level interactivity (interactive interface, inability to influence the story); hypertext narrative; internal

and ontological interactivity (character impersonation works or games); deep interactivity ("emergent story generated on the fly out of the data that come in part from the system and in part from the user"[35]).

3.4. Some Specific Denominations

Once we set out to become 'immersed' in the nodes of digital literature's terminological rhizome, we discover even more specifics and a series of peculiarities. For instance, *interactive fiction*, a category that should be evident through the terms alone, is used to "refer specifically to works that share the formal characteristics, though not necessarily the genre expectations, of the text adventure, a genre that focused heavily on puzzles and exploration. . . . IF in this sense refers to a piece of software that makes use of both parsed input and a model world."[36] Thus, interactive fiction is a subgenre of digital literature, not a variation for an umbrella term. Moreover, we can come across composed terms, that combine several word-items from several already defined genres and subgenres, like *interactive digital narrative*, a typology that "connects artistic vision with technology. . . . IDN promises to dissolve the division between active creator and passive audience and herald the advent of a new triadic relationship between creator, dynamic narrative artefact and audience-turned-participant."[37]

Nevertheless, *hypertext fiction* remains the most commented on, most likely because of timing (it gained popularity during the advent of the personal computers and the World Wide Web, thus providing scholars with a practice to analyze) and the fact that writers of *hypertext fiction* were themselves theorists of *hypertext fiction*. The model that is at the basis of hypertext fiction has already been explored in this study. Navigation from one *lexia* to another is the central element of the subgenre, because it allows the reader to choose a narrative path through a network. Without inquiring further into the features of hypertext, one of them needs to be brought forward: its unprintability. As a direct consequence of its nature, hypertext is unprintable, and some researchers argue that previously published printed works are indeed "hypertextable", and call them "print-based hypertext"[38] or proto-hypertext(ual) fiction.[39]

These are not the only concepts used to describe facets or genres or instances of digital literature: an ever-updating compiled dictionary should also contain, among others: net literature,[40] network fiction,[41] reader-author or w(reader),[42] location-based narrative, nonlinear writing, transmedial fiction, quest narrative,[43] multiform story,[44] multi-path narrative; branching narrative.[45] All these represent a hard-to-navigate-through terminological network.

4. Outcomes and Working Paths

DIGITAL LITERATURE seems at this point secluded and unable to penetrate broader debates about literature in general and reach an audience similar to print literature. This happens because a. the intra-medial obsolescence does not provide any of the works with the necessary time to develop into widespread and widely read works of literature; b. the terminological instability is mostly confusing and in-depth

explanations are always needed in order to understand what should be user-friendly concepts; c. any attempt at building a canon is rendered meaningless by point a.[46]

By now, it has become clear that intra-medial obsolescence cannot be avoided. Let's take, for instance, the evolution of storage devices, which became smaller and smaller while storing larger and larger amounts of data (from floppy disks and CDs to SD cards and USB flash drives) until they started vanishing altogether, with data moving into *the cloud*. The first works of digital literature were created in the age of floppy disks while today we are in the age of the cloud. The technological changes that took place in the last three decades are irreversible. The software used to project and publish the works has either become or is becoming inaccessible or has gone through systemic changes (be it Storyspace, HyperCard or Shockwave,[47] among others). This is the main reason why compilation projects such as Electronic Literature's Organization's Collection—which published a three volume anthology of digital literature (2006, 2011, 2016)[48] both on the web and in physical form, a CD in 2006 and an USB flash drive in 2011, with the 2016 physical edition still forthcoming—while useful at this point, will ultimately become just indexes of works. Hence, intra-medial obsolescence creates the need for the long-term preservation of digital literature.

Certain difficulties arise, however, when the actual ways of preservation are approached. Since it is not a recent concern, some scholars have previously debated the issue. In *Acid-Free Bits*, Nick Montfort and Noah Wardrip-Fruin identify four options for the preservation of digital literature: the conservation of old hardware, i.e. old computers, to run old software; the simulation of old systems (through new software) to run old software; the full "migration" (adaption) of old software to new systems; the in-depth documentation of systems in order to have the possibility of being reproduced at some point in the future.[49] All of these options are currently used by researchers or readers, but none of them are easily accessible, user-friendly or largely available. The first one is a museum-like experience, and it needs substantial resources to function. The simulators mentioned in the second one need constant updates, since the system as a whole changes substantially over time (and the result is an update loop—a repetitive multi-leveled update in order to access obsolete software). The third one seems at first glance the easiest for users/readers, because it requires minimal effort on their behalf, but it is highly dependent on outside factors (mainly developers, be they individuals or companies, who need to constantly update their software—which sometimes they simply abandon doing). The fourth one is an archiving process similar to the collecting and storing of a writer's manuscripts, notes, notebooks, papers, etc. Another way of conserving digital literature is the "performative preservation" put forward by Stuart Moulthrop and Dene Grigar in their project *Traversals*.[50] They try to replicate the original circumstances in which the text was read and document such a reading by recording it with multiple cameras, but such an endeavor is clearly not personal, nor interactive (the actual viewer cannot make any choices or navigate the text in any way). This experience is more similar to, for instance, watching someone play a videogame than playing it yourself.

No matter what preservation method is chosen, we find ourselves in a recursive cycle of incomplete experience of the digital works, mainly because the relationship between reader, work and the medium is significantly more interdependent than in the

case of print. With print, even if the binding or the colors of the cover or the fonts change over time, or images were added at some point, essentially the mode of presentation remained unaltered, it is still words on paper (or a paper-like surface in the case of e-books). The best option for the preservation of digital literature in order to reach the largest audience seems at this point the adaption of software and, coincidentally, of the pieces written in that software, for every new system that appears. However, the answer to the question of who is best suited to make such updates might be more complicated than expected, with companies abandoning products when they are not lucrative anymore or with developers simply starting other projects, while not giving up the rights for the last version of the software. Commercially disinterested entities like universities or research institutes and organizations such as ELO are probably the most suitable to undertake this task.

Moving on to the wide terminological web, an apparent conclusion is that it needs narrowing down. Even more, the preferred terminology should communicate with contemporary social, political and cultural theories, in order to be better integrated in the broader field of human sciences. For this, I suggest the use of the word "network" as a centerpiece for all general terms concerning or encompassing digital narrative literature (network literature, network fiction or network narrative). The concept was widely used even before the digital era in many fields of life, from economy to diplomacy to culture, but ever since the appearance of internet (a shortened form of *interconnected network*), it has become a central element in various seminal works in the human sciences. From Manuel Castells' "network society", defined as a "new social structure in the making . . . made of networks in all the key dimensions of social organization and social practice"[51] to the several theorizations of "network culture"[52] to the more recent "network aesthetics,"[53] the word seems ubiquitous in cultural, critical and literary theory. As opposed to the medium-specific hypertext fiction or to the rather confusing interactive fiction or even to ergodic literature (somewhat misleading because of its nonexistent relation with the ergodic theory), network literature could be a suitable umbrella term for all literature produced as a direct result of the "networked era," published either digitally or in print. Naturally, more specific terms can be used in case studies or in-depth analyses, such as the ones presented at point 3.4 in this essay, but in order to be experienced as literature, digital literary works should be part of a paradigm that also includes print literature.

Instead of expanding the field, digital literature is at this point more of a theoretical appendix to literary studies, and although several guides and encyclopaedias have been published,[54] in the mainstream companions[55] there is usually only a last chapter dedicated to the subject. Not to mention that the major anthologies of literature,[56] which have been updated with works from the 1990s and even the 2000s, have no entries for the digital forms of writing, with one exception, *Postmodern American Fiction: A Norton Anthology*, which includes J. Yellowlees Douglas and Michael Joyce.[57] In order to become an acknowledged part of literary studies and be perceived not only by scholars and students of literature but also by the general public as a valid paradigm, digital literature needs terminological clarification and a corpus of widely accessible and discussed works. In other words, stable definitions and a canon (even if a short-lived one). At least for

now, it remains in a similar position as the avant-garde movements of interwar Europe: ground-breaking in theory, difficult to read in practice.

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Notes

1. See Michel Foucault, *The Order of Things: An Archaeology of Human Sciences* (New York: Vintage, 1994 [1966]); Francis Fukuyama, *The End of History and the Last Man* (New York: Free Press, 1992); Roland Barthes, "Death of the Author," in *Image Music Text*, transl. Stephen Heath (New York: Farrar, Strauss, and Giroux, 1978 [1967]); Berel Lang, ed., lead essay by Arthur C. Danto, *The Death of Art* (New York: Haven Publications, 1984).
2. For a detailed "World Wide Web Timeline," see http://www.pewinternet.org/2014/03/11/world-wide-web-timeline/
3. In the article, Coover goes as far as suggesting that the then recent growth of the book market was a last-resort attempt for print culture to remain relevant: "Indeed, the very proliferation of books and other print-based media, so prevalent in this forest-harvesting, paper-wasting age, is held to be a sign of its feverish moribundity, the last futile gasp of a once vital form before it finally passes away forever, dead as God." Robert Coover, "The End of Books," *New York Times*, 21 June 1992, https://archive.nytimes.com/www.nytimes.com/books/98/09/27/specials/coover-end.html.
4. By medium I mean the way in which literature was transmitted *per se* from a person to another person on a large scale.
5. See, for instance, Espen J. Aarseth, *Cybertext: Perspectives on Ergodic Literature* (Baltimore: Johns Hopkins University Press, 1997).
6. When the printing press was first available in Europe, books did not immediately became accessible to all households. Firstly, because in the 15th century, literacy in Europe (at the time the most developed part of the world) was under 20%, and secondly, because it took some time for books to become affordable goods. For a more comprehensive timeline on the evolution of literacy in the world, see Max Roser and Esteban Ortiz-Ospina, "Literacy," published online at OurWorldInData.org, https://ourworldindata.org/literacy.
7. These works were mainly published in the 1980s and early 1990s. Examples include, among others, *afternoon: a story*, by Michael Joyce; *Victory Garden*, by Stuart Moulthrop; *Patchwork Girl*, by Shelley Jackson; *I Have Said Nothing*, by Jane Yellowlees Douglas.
8. Although later on critics such as Alan Kirby proposed a completely different paradigm for digital literature. See Alan Kirby, *Digimodernism: How New Technologies Dismantle the Postmodern and Reconfigure Our Culture* (New York: Bloomsbury, 2009).
9. For a detailed description of McLuhan's tetradric system for the understanding of media, see Marshall and Eric McLuhan, *Laws of Media: The New Science* (Toronto: Toronto University Press, 1992), 13–14.
10. See Max Roser, "Books," published online at OurWorldInData.org, 2019. Retreived from https://ourworldindata.org/books.
11. During the 1990s, less than 5% of the population of the world had access to internet, according to The World Bank, with the number reaching 10% in 2002, 28% in 2010 and 45% in 2016. See "Individuals using the Internet (% of population)," https://data.world-bank.org/indicator/IT.NET.USER.ZS. In the European Union, that number is steadily growing, getting to 89% of households connected to the internet in 2018, with 57% of the population having basic or above basic digital skills. See "Households—level of internet access,"

http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=isoc_ci_in_h&lang=en; "Individuals' level of digital skills," http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do.

12. For a comprehensive list of discoveries named after scientists, see D. W. G. Ballentyne and D. R. Lovett, *A Dictionary of Named Effects and Laws in Chemistry, Physics and Mathematics* (London–New York: Chapman and Hall, 1980).

13. Janet H. Murray, *Hamlet on the Holodeck: The Future of Narrative in Cyberspace* (New York: The Free Press, 2016), 14.

14. See J. Yellowlees Douglas, *The End of Books—Or Books Without End?* (Ann Arbor: University of Michigan Press, 2000).

15. For instance, see George P. Landow, *Hypertext: The Convergence of Contemporary Critical Theory and Technology* (Baltimore: Johns Hopkins University Press, 1992); *Hypertext 2.0: The Convergence of Contemporary Critical Theory and Technology* (Baltimore: Johns Hopkins University Press, 1997); *Hypertext 3.0: Critical Theory and New Media in an Era of Globalization* (Baltimore: Johns Hopkins University Press, 2006) or Jay David Bolter, *Writing Space: The Computer, Hypertext, and the History of Writing* (Mahwah: Lawrence Erlbaum Associates, 1990); *Writing Space: Computers, Hypertext, and the Remediation of Print*, 2nd edition (Mahwah: Lawrence Erlbaum Associates, 2001).

16. That is around 23–24 billion euros/year in revenues. See The Annual Publishers' Statistics compiled by the Federation of European Publishers.

17. Vannevar Bush, "As We May Think," *The Atlantic*, July 1945, https://www.theatlantic.com/magazine/archive/1945/07/as-we-may-think/303881/

18. Ibid.

19. Ibid.

20. For more information about Project Xanadu, its history and features, see http://xanadu.com/xUniverse-D6.

21. Theodor H. Nelson, "A File Structure for the Complex, the Changing, and the Indeterminate," in *Proceedings of the 20th National Conference* (New York: Association of Computing Machinery, 1965), 84–100, as reproduced in Noah Wardrip-Fruin and Nick Montfort, *The New Media Reader* (Cambridge, Massachusetts: MIT Press, 2010), 144.

22. In *S/Z,* Barthes defines a *lexia* as a "unit of reading." See Roland Barthes, *S/Z*, transl. Richard Miller (New York: Hill and Wang, 2000).

23. Gilles Deleuze and Felix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia*, transl. Brian Massumi (Minneapolis: University of Minnesota Press, 1987), 6.

24. Ibid., 9.

25. Aarseth, 4.

26. N. Katherine Hayles, *Writing Machines* (Cambridge, Massachusetts: The MIT Press, 2002), 28.

27. For more details about the debate, see Gonzalo Frasca, "Ludology meets narratology: similitude and differences between (video)games and arrative," *Ludology.org*, https://www.ludology.org/articles/ludology.htm; and *Game Studies: the International Journal of Computer Game Research* 1, 1 (July 2001), http://www.gamestudies.org/0101/

28. Hayles, 25–26.

29. Scott Rettberg, "Electronic Literature," in *The Johns Hopkins Guide to Digital Media*, eds. Marie-Laure Ryan, Lori Emerson, and Benjamin J. Robertson (Baltimore: Johns Hopkins University Press, 2014), 169.

30. Dani Spinosa, in the Electronic Literature Directory's *Glossary*, http://directory.eliterature.org/glossary/4965.

31. Maria Egberg, "Digital Fiction," in *The Johns Hopkins Guide to Digital Media*, 138.

32. Aarseth, 1.

33. For a more substantial debate on the terms *ergodic* and *cybertext* between, among others, Espen Aarseth, Mark Bernstein, Nick Montfort, Jill Walker Rettberg, and Noah Wardrip-Fruin, see Noah Wardrip-Fruin, "Clarifying *Ergodic* and *Cybertext*," Grand Text Auto, 12 August 2005, https://grandtextauto.soe.ucsc.edu/2005/08/12/clarifying-ergodic-and-cybertext/. Here, Aarseth directly states that ergodic literature has nothing to do with ergodic theory.

34. Marie-Laure Ryan, "Interactive Narrative," in *The Johns Hopkins Guide to Digital Media*, 292.

35. Ibid., 295.

36. Emily Short, "Interactive Fiction," in *The Johns Hopkins Guide to Digital Media*, 289.

37. Hartmut Koenitz, Gabriele Ferri, Mads Haahr, Diğdem Sezen, and Tonguç İbrahim Sezen, "Perspectives on Interactive Digital Narratives," in *Interactive Digital Narrative: History, Theory and Practice*, eds. Hartmut Koenitz, Gabriele Ferri, Mads Haahr, Diğdem Sezen, and Tonguç İbrahim Sezen (New York: Routledge, 2015), 1.

38. Murray, 56.

39. "Examples of proto-hypertextual, antilinear fiction . . . include" Lawrence Sterne, Jean Paul, James Joyce, Marc Saporta, Vladimir Nabokov, Julio Cortázar, Arno Schmidt, Milorad Pavić." Astrid Ensslin, *Canonizing Hypertext: Explorations and Constructions* (London: Continuum, 2007), 11.

40. See Peter Gendolla and Jörgen Schäfer, "Playing With Signs: Towards an Aesthetic Theory of Net Literature," in *The Aesthetics of Net Literature*, eds. Peter Gendolla and Jörgen Schäfer (Bielefeld: transcript Verlag, 2007).

41. See David Ciccoricco, *Reading Network Fiction* (Tuscalosa: The University of Alabama Press, 2007).

42. See Landow, *Hypertext*.

43. *The Johns Hopkins Guide to Digital Media*, 409–410.

44. Murray, 37.

45. See *The Routledge Encyclopedia of Narrative Theory*, eds. David Herman, Manfred Jahn, and Marie-Laure Ryan (New York: Routledge, 2005).

46. For instance, several of the works mentioned in Ensslin, need specific software to be read today, and of the 23 authors proposed, at least 14 (Michael Joyce, Stuart Moulthrop, Shelley Jackson, J. Yellowlees Douglas, Charles Deemer, Geoff Ryman, Bill Bly, Frank Klötgen, Alvar Freude, Dragan Espenschied, M. D. Coverley, Mark Amerika, Jacques Servin, Kate Pullinger) have published printed books after publishing digital literature.

47. Storyspace is at its third version: see http://www.eastgate.com/storyspace/; HyperCard was removed from the market in 2004 by Apple; Shockwave was discontinued by Adobe on 9 April 2019: https://helpx.adobe.com/shockwave/shockwave-end-of-life-faq.html.

48. See "Electronic Literature Collection," published by the Electronic Literature Organization, http://collection.eliterature.org/.

49. See part 3 of Nick Montfort and Noah Wardrip-Fruin, *Acid-Free Bits: Recommendations for Long-Lasting Electronic Literature* (Vancouver: The Electronic Literature Organization, 2004), https://eliterature.org/pad/afb.html.

50. See Stuart Moulthrop and Dene Grigar, *Traversals: The Use of Preservation for Early Electronic Writing* (Cambridge, MA: The MIT Press, 2017)

51. Manuel Castells, *The Rise of the Network Society*, vol. 1 (Chichester: Wiley-Blackwell, 2010), xviii.

52. See, among others, leading hypertext and digital author Michael Joyce's *Othermindedness: The Emergence of Network Culture* (Ann Arbor: The University of Michigan Press, 2000) or Kazys Varnelis, ed., *Network Publics* (Cambridge, MA: The MIT Press, 2008).

53. See Patrick Jagoda, *Network Aesthetics: American Fictions in the Culture of Interconnection* (Chicago: University of Chicago Press, 2016), in which the author theorizes "network novels" as a genre of print literature—with focus on Don DeLillo's *Underworld* and Neal Stephenson's *Cryptonomicon*.

54. See, for instance, *A Companion to Digital Literary Studies*, eds. Ray Siemens and Susan Schreibmann (Chichester: Wiley-Blackwell, 2013) or *The Johns Hopkins Guide to Digital Media*.

55. See *The Cambridge Companions to: Narrative*, ed. David Herman (2007); *Literature and the Posthuman*, eds. Bruce Clarke and Manuela Rossini (2017); *Postmodern American Fiction*, ed. Paula Geyh (2017); *the Novel*, ed. Eric Bulson (2018); *Narrative Theory*, ed. Matthew Garrett (2018) or *The Edinburgh Companion to Twentieth-Century Literatures in English*, eds. Brian McHale and Randall Stevenson (Edinburgh: Edinburgh University Press, 2006).

56. See *The Norton Anthology of World Literature*, ed. Martin Puchner (New York: W.W. Norton & Company, 2012) or *The Norton Anthology of American Literature,* vol. E, ed. Robert S. Levine (New York: W.W. Norton & Company, 2017).

57. *Postmodern American Fiction: A Norton Anthology*, eds. Paula Geyh, Fred G. Leebron, and Andrew Levy (New York–London: W.W. Norton & Company, 1997). See pp. 573–581 for Douglas and Joyce.

Abstract
The Change of Medium and the Medium That Changes:
Narrative Literature, Networks and the Digital

This article approaches the second major change of medium that literature went through, from print to digital, and it explores how this change influenced the reading and understanding of narratives. The appearance of the digital created the need for the definition of new terminological webs and facilitated the emergence of a corpus of literary works. This study provides a comparative description of the digital as a medium for literature and a classification of concepts used in the analysis of digital narrative literature, as well as the working paths for the preservation of digital texts and their inclusion under the proposed umbrella term of "network literature."