

Remains of the Disc, or Respinning the History of CD-ROMs and GIF 0.0

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1. A blind spot in media history

The Compact Disc Read-Only Memory (CD-ROM) epitomizes the rapid obsolescence of digital infrastructures. For a brief period in the 1990s, the gleaming silver disc seemed to reflect a new age of knowledge, becoming the primary storage solution for a novel kind of encyclopedic and multimedia information. A decade earlier, its predecessor, the Compact Disc Digital Audio (CD-DA), had introduced digital media to mass consumer markets. Now, the CD-ROM promised an audiovisual world of electronic books, interactive artworks, video games with cinematic sequences, and hypertextual reference works.

The cultural weight of the CD-ROM is evident in what remains one of the most influential studies of digital media: Lev Manovich's seminal 2001 book, *The Language of New Media*. By the time of its publication, however, the CD-ROM had already lost much of its shine. For most, it was familiar mainly as a free insert in computer magazines or as a disposable installation disc for productivity software. Yet in Manovich's analysis of the emerging digital aesthetics, the »hypermedia CD-ROM« still played a central role, embodying what he identified as the »key form of cultural expression« of new media: the database.¹

Technically, the CD-ROM was a curious hybrid of rotating mechanics and quantum physics, offering a storage capacity of 650 megabytes—immense by the standards of its day. But by the end of the 1990s, its core function as a storage device was eclipsed by a different media logic: transmission. A technological revolution, anticipated since the disc's early years, swept it aside. With the rise of high-speed Internet access, optical storage media for home use became unnecessary. Instead of inserting a disc to consult a reference work, users simply opened a webpage. To put it succinctly: Wikipedia replaced *Microsoft Encarta*.

1 Manovich, Lev (2001): *The Language of New Media*, Cambridge, MA: MIT Press, pp. 4 and 218–221.

In home entertainment, the DVD had already established itself as the CD-ROM's audiovisual successor by the mid-1990s. (It was later adopted as the storage medium for Sony's *PlayStation 2*, which became the best-selling video game console of all time.) While the CD-ROM survived as a low-cost storage option for PCs until the late 2000s, it was finally displaced by affordable flash drives and the World Wide Web. And it was not the only optical storage medium to vanish: the rise of streaming services such as Netflix spelled the end of consumer discs altogether. DVD and Blu-ray drives disappeared from computers—first from laptops like the *MacBook Air*, then from desktop computers, and eventually from living rooms.

From a media studies perspective, the short life of the CD-ROM is notable for two reasons. First, it has been largely forgotten in media historiography. Its prominence was as brief as the scholarly attention it has received since its decline in the early 2000s, with very few recent studies devoted to the format.² Second, CD-ROMs remain invaluable as objects of historical inquiry. They preserve cultural material that is often inaccessible elsewhere. Precisely because the CD-ROM as a storage medium was superseded by the Internet as a transmission medium, the format salvages what the Internet and other platforms did not preserve. CD-ROMs thus form an essential infrastructure for our knowledge about the recent digital past.

2. A very short account of the short history of the CD-ROM

To make a short story even shorter: the CD-ROM was a transitional medium that shaped digital culture only for a brief time. Measured against the long histories of other storage technologies—printed books (now approaching their 600th birthday), safety film (in use for more than a hundred years), vinyl records (spinning for over eighty years), or even flash memory (around for three decades)—the CD-ROM's heyday lasted barely five years, from 1993 to 1997. Technologically, it arrived very early in the age of personal computers, and yet it came almost too late. Its trajectory can be divided into three phases: an initial decade of latency (1983–1992); a frantic, hype-fueled five-year run (1993–1997); and a gradual but inevitable decline (from the late 1990s to the mid-2010s).

2 Cf. Lessard, Bruno (2017): *The Art of Subtraction: Digital Adaptation and the Object Image*, Toronto: University of Toronto Press; Smith, Greg E. (ed.) (1998): *On a Silver Platter: CD-ROMs and the Promises of a New Technology*, New York: New York University Press.

Latency (1983–1992)

The first phase began in 1983, the year the CD-ROM's direct precursor, the CD-DA, was introduced to European and North American markets as the first mass-market digital medium. That same year, Japan's *Sony Corp.* and the Dutch conglomerate *Philips* collaborated to define the specification of the new optical storage format, the ›System Description Compact Disc Read Only Memory‹, later published as the so-called *Yellow Book*. In other words: CD-DA and CD-ROM were developed almost simultaneously.

The CD-ROM was conceived as a medium for personal computers and other digital devices. Because the CD-DA was already a digital format, it was a small technological step to adapt its encoding standard beyond music. The format had another advantage: it could piggyback on the existing industrial infrastructure for manufacturing audio CDs. Moreover, its ›read-only‹ character—as the name implies—seemed to promise a technological solution to the problem of unauthorized copying. The computer industry in particular considered the CD-ROM a way to transform the personal computer from a business machine into a household device: the multimedia computer. Yet the timing was problematic. In 1983, the IBM PC was just two years old, the Apple Macintosh had not yet been released, and Microsoft Windows was still on the horizon. In the first half of the 1980s, the graphics and sound capabilities of computers were rudimentary. For instance, the widely used Enhanced Graphics Adapter for IBM PCs supported a resolution of just 640×350 pixels in its ›high resolution‹ mode—and only in 16 colors.

Nevertheless, when the CD-ROM was introduced to the public in 1984, it was heralded as the imminent future of digital knowledge and multimedia. An article in *New York* magazine, titled ›The Everything Disc‹, emphasized its then astonishing storage capacity: ›Each disc holds 540 to 600 megabytes. That's equivalent to about 1,200 floppy discs, nearly half a million typed pages, the text of a 50-volume encyclopedia, or every video game ever written.‹³ The article also celebrated the disc's integrative function: ›Each compact disc is a multimedia device. It can store a rich combination of high-resolution graphics, still-video frames, digital audio, and computer data.‹⁴ What the CD-ROM promised was nothing less than the total integration of the digital media infrastructure: ›This is finally going to wed computers and video and audio technology into a single multifunction system.‹⁵

It was not, however, the entertainment industry—nor even Sony or Philips, the inventors of the disc—that secured the CD-ROM's place in the market. The format's

3 Hoban, Phoebe (1984): ›The Everything Disc‹, in: *New York*, Nov. 1984, pp. 22–25, here p. 22.

4 Ibid.

5 David Lachenbruch, quoted in *ibid.*, pp. 24–25.

most important advocate was the computer industry, led by Microsoft. Under Microsoft's initiative, a consortium of companies developed a standard file system (the *Yellow Book* had left this issue open). Starting in 1986, the company also hosted annual international conferences to promote the new format and establish it within the industry. To coincide with the inaugural conference in 1986, Microsoft published *The New Papyrus*, a book that introduced the CD-ROM to the public while situating it in a longer media-historical perspective.⁶ Its subtitle boldly proclaimed the CD-ROM to be not just the next digital medium, but the »current and future state of the art«, a technology that would unify all previous media forms. In his foreword, Bill Gates underscored the format's significance: »CD ROM [sic] is quite different from any other medium in existence, whether it be television, movies, video, slides, audio, books, or personal computers. In fact, one might look at CD ROM as the summation or combination of almost all of these.«⁷

The historical model for this grand vision of multimedia was the encyclopedia. The CD-ROM was intended to integrate all types of knowledge in a single new format. Appropriately, the book's first chapter reprinted Vannevar Bush's 1945 essay »As We May Think«—a foundational text for the utopian ideal of networked information infrastructure. The first major CD-ROM product, also presented at the 1986 conference, was itself an encyclopedia: Grolier's *The Electronic Encyclopedia*, a digital version of its 20-volume printed *Academic American Encyclopedia*, comprising some nine million words across 30,000 entries. And until its decline at the end of the following decade, the notion of a comprehensive—or even universal—summary of knowledge remained one of CD-ROM's defining characteristics.

Even so, widespread adoption came only gradually. Although the discs were inexpensive to manufacture, the PC drives required to read them were costly, restricting early uptake of the technology largely to institutions such as corporations and libraries rather than individual consumers.⁸ Furthermore, the computers of the mid-1980s lacked the necessary graphics and sound capabilities to fully realize the CD-ROM's multimedia promise. Finally, the format faced competition from CD-i, an alternative specification developed by Philips, which lingered until its eventual failure in the mid-1990s.⁹

In its initial phase, then, the CD-ROM functioned above all as a database medium. Growth was slow: from fifty titles available in 1985, the global catalog ex-

6 Lambert, Steve/Ropiequet, Suzanne (eds.) (1986): *CD ROM. The New Papyrus: The Current and Future State of the Art*, Redmond, WA: Microsoft Press.

7 Gates, Bill: »Foreword«, in Lambert/Ropiequet: *CD ROM*, p. xi.

8 Regazzi, John (2015): *Scholarly Communications: A History from Content as King to Content as Kingmaker*, Lanham: Rowman & Littlefield, pp. 105–117.

9 Rosen, David (1986): »History in the Making: A Report from Microsoft's First International Conference on CD ROM«, in: *Educational Technology* 26:7, pp. 16–19.

panded to only just under one thousand titles by 1990.¹⁰ Most discs were collections of scientific, bibliographic, or statistical data, texts (like legal libraries and encyclopedias), images (such as NASA datasets), or software, rather than true multimedia experiences.¹¹ Notable exceptions included the interactive music analysis *CD Companion to Beethoven's Ninth Symphony* and the game *The Manhole*, an early forerunner of the famous *Myst*.

Hype (1993–1997)

The CD-ROM's real boom began in the early 1990s, as personal computers became fixtures in households across industrialized nations. By then, hardware and software had matured enough to make multimedia genuinely viable. Intel's 486 and Pentium processors, Yamaha's FM-synthesis sound chips, and the VGA graphics standard made higher-quality audio and visuals possible. The release of Windows 3.0 in 1990 established the graphical user interface as the norm for IBM-compatible PCs. A year later, the Multimedia PC Marketing Council, an industry consortium, defined the »Multimedia PC« specification, which, among other things, made a CD-ROM drive mandatory.¹²

Pinpointing the exact start date of the CD-ROM boom is difficult, but 1993 stands out both economically and culturally. That year, sales of CD-ROM titles and drives skyrocketed,¹³ transforming the long-struggling medium into a »must-have« feature for computer owners. Rapid growth was fueled by falling hardware prices, with many units being sold as part of affordable »multimedia upgrade kits« that also included a sound card. Manufacturers such as Mitsumi reduced costs through innovations like the IDE interface (instead of the more expensive SCSI) and tray-loading drives (replacing cumbersome caddies, i.e. protective disc cartridges). Reflecting on the year, *PC Magazine* praised manufacturers for »making CD-ROM drives standard features with most of their machines«.¹⁴

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- 10 Helgerson, Linda W. (1986): »CD-ROM: A Revolution in the Making«, in: *Library Hi Tech* 4:1, pp. 23–27, here p. 23; Armstrong, Chris J./ Large, J. Andrew (1990): *CD-ROM Information Products: An Evaluative Guide and Directory*, Aldershot: Gower, pp. 417.
 - 11 Armstrong/Large: *CD-ROM Information Products*, pp. 367–417.
 - 12 Jones, Mitt (1991): »CD-ROM Drives: Finally up to Speed«, in: *PC Magazine* 10:18, pp. 283–300, here p. 285.
 - 13 Rassuli, Kathleen M./Tippins, Michael J. (1997): »History and Cyberspace. A Marketing History of the CD-ROM Book Industry«, in: *Journal of Macromarketing* 17:1, pp. 89–106, here pp. 91 and 95.
 - 14 Seymour, Jim (1994): »The Best of 1993: Thumbs up, Thumbs Down«, in: *PC Magazine* 13:1, p. 154.

By the summer of 1993, the CD-ROM was hailed as the »Mass Medium at Last«, according to a Bloomberg News headline.¹⁵ While only a few hundred titles had been available at the beginning of the decade, thousands were now released annually. The market grew large enough to sustain a dedicated U.S. magazine, *CD-ROM Today*, which offered reviews of new releases, hardware advice, and industry reports. At this point, further patronage by Microsoft was no longer needed: the company had already discontinued its series of promotional conferences the previous year.

A cultural shift was equally evident. As Bloomberg News observed, the predominant ways of using the CD-ROM had changed: »Early on, computer makers figured that CD-ROM [...] would be good for storing databases, documents, directories, and other archival information that would not need to be altered. Customers would be libraries and businesses.«¹⁶ In practice, however, the medium flourished with different content: »Today, the growth in CD-ROM is coming from interactive programming—such things as multimedia encyclopedias, live-action games, and troves of educational material.«¹⁷ Among the many new titles of 1993, there were a number of landmark releases that cemented the format's place in popular culture. These included iconic games like *Myst*, *Star Wars: Rebel Assault*, and *The 7th Guest*; artistic projects like Peter Gabriel's *Xplore1* and an interactive edition of the Beatles film *A Hard Day's Night*; educational works like the richly produced *Who Built America?*; and the first edition of Microsoft's *Encarta*, an encyclopedia series that would remain successful for years.

As the latter two examples show, the database format remained an important part of CD-ROM production, with countless map collections, literary anthologies, telephone directories, art galleries, and atlases covering everything from the US road network to human anatomy. But the medium's breakout success came from multimedia content that took advantage of the era's improved graphics and sound. By the mid-1990s, the best-selling discs were video games and entertainment titles.¹⁸ At its peak, the CD-ROM market was a vibrant space for both commercial consolidation and artistic experimentation. The Voyager Company continued to release ambitious projects like *The Complete Maus* (1994).¹⁹ Brøderbund, in collaboration with Ran-

15 Schwartz, Evan I. (1993): »CD ROM: A Mass Medium at Last«, in: Bloomberg Businessweek (18.07.1993). Online: <https://www.bloomberg.com/news/articles/1993-07-18/cd-rom-a-mass-medium-at-last> (last access: 31.08.2025).

16 Ibid.

17 Ibid.

18 Ulanoff, Lance (1995): »The Top 100 CD-ROMs«, in: PC Magazine 14:12, pp. 102–165, here pp. 103–104.

19 Maher, Jimmy (2021): »The Best of Voyager«, The Digital Antiquarian (18.06.2021). Online: <https://www.filfre.net/2021/06/the-best-of-voyager-part-1/> (last access: 31.08.2025); Brown, Geoffrey (2012): »Developing Virtual CD-ROM Collections: The Voyager Company Publications«, in: International Journal of Digital Curation 7:2, pp. 3–20, here p. 4.

dom House, launched the *Living Books* series (1994–1998), interactive versions of children's classics, soon followed by Disney's *Animated Storybooks*.²⁰ Musicians also embraced the format: Prince released *Interactive CD-ROM* (1994), while David Bowie presented *Jump* (1994). Avant-garde artists like Chris Marker (*Immemory*, 1997) and Valie Export (*Bilder der Berührungen*, 1998) explored the format's creative potential. Entire magazines, with titles like *Blender* and *Substance*, appeared exclusively on CD-ROM (only to disappear a few years later).²¹ Even conventional books were accompanied by discs, most notably Bill Gates' *The Road Ahead* (1995).

By the end of its short boom in 1997, the CD-ROM had been fully normalized. Discs were sold at supermarket checkouts and bundled with a wide range of magazines. Beyond multimedia titles, the format had become the standard for software distribution, as applications and operating systems had outgrown floppy disks.²² When Apple introduced the first iMac in 1998 without a floppy drive, the move caused only a minor stir. By then, PCs and laptops were routinely shipped with CD-ROM drives, with OEM units priced below a hundred dollars. In just five years, the number of installed drives in the United States alone had increased more than tenfold, reaching roughly 160 million.²³ In the gaming sector, the CD-ROM (in slightly modified form) served as the standard medium for consoles such as Sony's Playstation (1994), Sega's Saturn (1995), and Dreamcast (1998). And while the recordable CD-R was technically a distinct format, the arrival of affordable CD-R drives in the latter half of the decade gave the silver disc yet another push, extending its everyday presence into home recording and personal archiving.

Decline (late 1990s to mid-2010s)

No sooner had the CD-ROM conquered the digital public sphere than the hype was over, ushering in the third phase of its life: a slow, gradual decline. As with its rise, cultural factors contributed to its fall, but the decisive causes lay in the technological limitations of the medium itself.

Ironically, the cultural forces that undermined the CD-ROM were tied to its own success. By the late 1990s, the format had become ubiquitous in PC computing, and

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- 20 Madej, Krystina/Lee, Newton (2020): *Disney Stories: Getting To Digital*, Cham: Springer International Publishing, pp. 143–146.
 - 21 Smith, Ernie (2016): »A Magazine You Can't Bend«, Tedium (23.02.2016). Online: <https://tedium.co/2016/02/23/cd-rom-magazines-launch-blender/> (last access: 31.08.2025).
 - 22 Anyone without a CD-ROM drive had to install Windows 95 from thirteen separate floppies; Office 95 required even twenty-three; see Chen, Raymond (2005): »How Many Floppy Disks Did Windows 95 Come On?«, in: *The Old New Thing* (19.08.2005). Online: <https://devblogs.microsoft.com/oldnewthing/20050819-10/?p=34513> (last access: 31.08.2025); see https://archive.org/details/microsoft-office-95_agustus-1995 (last access: 31.08.2025).
 - 23 Anon. (1997): »The CD-ROM Drive Sales Index«, in: *EMedia Professional* 11:7, p. 12.

the number of titles available had multiplied rapidly. Yet the quality lagged behind the quantity. The early promises of multimedia spectacle and radically new forms of interactivity largely went unfulfilled. Artistic experiments by Peter Gabriel, David Bowie, and Prince were abandoned after disappointing initial attempts. »Ground-breaking« CD-ROM magazines like *Blender* folded after only a handful of issues.²⁴ And in 1997, the Voyager Company—responsible for many of the format's most ambitious and acclaimed titles—was forced to shut down.²⁵ Increasingly, CD-ROMs were filled not with innovative multimedia projects, avant-garde artistic projects, or deluxe editions of games, but with second- and third-rate software and free promotional supplements.

The technological reasons that sealed the format's fate were manifold, but they all traced back to its predecessor. The CD-ROM was built on the decade-old foundation of the CD-DA and therefore essentially outdated already in its heyday. In the PC sector, several hardware generations had come and gone, but the CD-ROM could not overcome the mechanical limitations of its optical drive technology. Although manufacturers eventually managed to boost read speeds to fifty-two times the original rate, the crucial seek time—the delay in accessing random data—lagged far behind advances in hard disk technology.²⁶ Moreover, the once astonishing capacity of 650 megabytes proved insufficient for storing high-quality video.²⁷ These limitations were hardwired into the format and could not be significantly improved, even with faster drives or the recordable CD-R.

For industry observers, the format's decline was therefore no surprise. Even at the height of its popularity, it was clear that the CD-ROM was a transitional medium for a new digital age. As one critic noted in 1996: »The current CD-ROM standard will not be a mass medium for multimedia entertainment or information. Its technical limitations of access speed, data rate, and capacity are too restrictive to make possible aesthetic standards that rival those of other familiar media forms.«²⁸ At same time that the format was enjoying commercial success, a fundamental shift was underway in digital media. The local storage of information on physical media was giving way to its transmission over electronic networks like *CompuServe* and *America Online* (AOL), bulletin board systems (BBS), and, above all, through the rapidly expanding commercial Internet and World Wide Web. It was certainly no bold statement by Nicholas Negroponte in 1995 that the »longer-term view of multimedia [...]

24 Smith: A Magazine You Can't Bend.

25 Brown: Developing Virtual CD-ROM Collections.

26 Maher, Jimmy (2016): »A Slow-Motion Revolution«, in: The Digital Antiquarian (30.09.2016). Online: <https://www.filfre.net/2016/09/a-slow-motion-revolution/> (last access: 31.08.2025).

27 Chesher, Chris (1996): »CD-ROM's Identity Crisis«, in: Media International Australia 81:1, pp. 27–33, here p. 28.

28 Ibid., p. 33.

is not based on that fifty-cent piece of plastic, 5 billion or 50 billion bits, but will be built out of the growing base of online systems that are effectively limitless in their capacity.«²⁹

After the grand prophecies from Sony, Philips, and Microsoft in the 1980s, the telecommunications industry had anticipated this shift at the beginning of the 1990s, framing the CD-ROM as »a warm-up for the real thing: a fully digital nationwide network«; this »vast ›information superhighway‹«, it predicted, »could render the CD-ROM obsolete. [...] Digital networks will one day give consumers ›random access to movies and virtually anything that is currently on CD-ROMs‹.«³⁰ By the end of the decade, even the format's advocates could no longer ignore its built-in constraints and impending end: »Already it feels like a single CD-ROM is not enough. As I eject and substitute individual discs while playing a five CD-ROM game, I am reminded of turning vinyl records over on my now-defunct turntable, and I can feel the imminent obsolescence of the new medium.«³¹ All three domains that the CD-ROM had once seemed poised to transform—databases, multimedia, and interactive entertainment—were soon overtaken by more advanced technologies. The World Wide Web displaced encyclopedic reference works like *Encarta*; the DVD set the new standard for home video in 1997; and video game consoles like Sony's *Playstation* and PCs equipped with 3D graphics cards relied on CD-ROMs only as inexpensive storage media for increasingly complex game worlds.

The first obituaries for the CD-ROM were written at the peak of its commercial success—a success that had taken a very different form than many early proponents had imagined. The much hyped »everything disc« and »multimedia device«³² was often reduced in practice to a mundane distribution format for data from telephone numbers to clipart pictures and software utilities. The »summation and combination of almost all«³³ media could deliver little more than short, low-resolution video clips and animations. Most discs served as mass storage, installation media, or containers for promotional material. Yet it was precisely in this last role that the CD-ROM built a veritable bridge to the Internet age. In 1996, AOL began distributing its free trial software on CD-ROMs.³⁴ The discs arrived unsolicited in mailboxes, tucked in cereal boxes, slipped into Blockbuster video rentals, bundled with books at Barnes & Noble, or even placed on stadium seats at major sporting events and

29 Negroponce, Nicholas (1995): *Being Digital*, New York: Alfred A. Knopf, p. 68.

30 Schwartz: CD ROM.

31 Smith, Greg E. (1998): »Introduction: A Few Words about Interactivity«, in: Greg E. Smith (ed.): *On a Silver Platter: CD-ROMs and the Promises of a New Technology*, New York: New York University Press, pp. 1–34, here p. 4.

32 Hoban: *The Everything Disc*, pp. 22, 24–25.

33 Gates: Foreword, p. xi.

34 Swisher, Kara (1998): *aol.com: How Steve Case Beat Bill Gates, Nailed the Netheads, and Made Millions in the War for the Web*, New York: Random House, pp. 99–103.

served with in-flight meals on air travel. This marketing campaign not only made AOL a household name but also solved the practical problem of reaching potential customers who still lacked Internet access to download the software. By 2006, the company had distributed more than a billion discs and grown its subscriber base from 200,000 to over 25 million. According to AOL, the scale of this ›carpet bombing‹ was such that, at one point in the late 1990s, half of all CD-ROMs produced world-wide bore its logo.³⁵ In the guise of the AOL disc, the CD-ROM acted as a midwife to the commercial Internet and, paradoxically, hastened its own disappearance.

The AOL campaign demonstrates that CD-ROMs did not disappear overnight with the turn of the millennium. On the contrary, their numbers continued to rise, especially with the spread of their successors, the CD-R and DVD-ROM. It is therefore difficult to name a single year that marked the beginning of the format's decline. However, if one considers the cultural and technological factors discussed, 1997 seems a plausible choice: the collapse of the Voyager Company, on the one hand,³⁶ and the rapid growth of Internet traffic, on the other,³⁷ together signal the beginning of the end for the CD-ROM.

3. A source criticism of CD-ROMs as historical remains

Challenges and promises

As artifacts of digital culture, CD-ROMs now belong to history. The question, then, is what they can contribute to the writing of history. What place might they occupy in historiography and historically oriented media studies? Like any cultural artifact, CD-ROMs are potential sources for historical inquiry. Given the right perspective, research questions, and methods, they reveal themselves as valuable documents of their era. As mass storage media, they contain large amounts of information across a remarkable range of materials: software like applications and games, interactive artworks, and, perhaps most importantly, data in the form of texts, numbers, im-

35 Edwards, Phil (2015): »In Memoriam: AOL CDs, History's Greatest Junk Mail«, Vox (12.05.2015). Online: <https://www.vox.com/2015/5/12/8594049/aol-free-trial-cds> (last access: 31.08.2025). The discs that have survived live on today as coveted objects for hobby collectors; Cf. Pardes, Arielle (2015): »Inside the Intense, Insular World of AOL Disc Collecting«, Vice (07.10.2015). Online: <https://www.vice.com/en/article/inside-the-weird-world-of-aol-disc-collecting-511/> (last access: 31.08.2025), and the Facebook group *AOL Disk Collectors*, <https://www.facebook.com/groups/1965462353668737/> (last access: 31.08.2025).

36 Brown: Developing Virtual CD-ROM Collections.

37 Coffman, Kerry/Odlyzko, Andrew (1998): »The Size and Growth Rate of the Internet«, in: First Monday 3:10. Online: <http://dx.doi.org/10.5210/fm.v3i10.620> (last access: 31.08.2025).

ages, video, and sound. For the period stretching from the mid-1980s to the turn of the millennium, they preserve a rich archive for the study of digital culture.

CD-ROMs are not, of course, traditional sources such as manuscripts, statistics, or photographs, and they present the historian with distinctive challenges in terms of their readability, representativeness, and availability.³⁸ First, they are subject to the same issues of physical decay that plague other digital media (»disc rot«),³⁹ compounded by the difficulty of finding compatible hardware and software to read them.⁴⁰ Second, they pose questions of classification, as their sheer abundance makes a comprehensive overview impossible; at best, directories, catalogs, best-seller lists, and other compilations can provide insights into specific manufacturers, genres, time periods, and geographical areas.⁴¹ Third, many discs are inaccessible to research today, as copies have been discarded, destroyed, or recycled, while libraries and archives rarely collected them systematically. As a result, surviving copies are often preserved only in private hands or niche collections.

Once these obstacles are overcome, what kind of historical knowledge can CD-ROMs provide? Historians began to engage with this question at the height of the format's hype in the mid-1990s. At the time, however, CD-ROMs were primarily treated as educational tools or repositories of digitized sources.⁴² In terms of German historiography, they were understood as a new kind of *tradition* (»Tradition«)—materials deliberately created to transmit knowledge of the past. A good example is the aforementioned *Who Built America?* (1993), an electronic history textbook developed in collaboration between the Voyager Company, the American Social History Project, and the Roy Rosenzweig Center for History and New Media.

Decades later, however, it is clear that CD-ROMs of this kind have not played a significant role in historiography. Instead, their importance as *remains* (»Über-

38 For an introduction to digital sources, see Owens, Trevor/Padilla, Thomas (2020): »Digital Sources and Digital Archives: Historical Evidence in the Digital Age«, in: *International Journal of Digital Humanities* 1:3, pp. 325–341. Online: <http://dx.doi.org/10.1007/s42803-020-00028-7>.

39 Smith, Ernie (2017): »When Discs Die«, *Tedium* (02.02.2017). Online: <https://tedium.co/2017/02/02/disc-rot-phenomenon/> (last access: 31.08.2025).

40 Brown: *Developing Virtual CD-ROM Collections*, pp. 6–7.

41 See the series *The CD-ROM Directory* by TFPL Publishing, published between 1986 and 1995, and *CD-ROMs in Print* by Meckler, published in 14 editions between 1987 and 2004; for further examples, see Walnut Creek CDROM Inc. (1995): *The 1995 Fall/Winter Catalog*. Online: http://bitsavers.informatik.uni-stuttgart.de/pdf/walnutCreekCDROM/1995_Fall_Winter_Catalog.pdf (last access: 31.08.2025); Ulanoff, Lance (1994): »The Top 100 CD-ROMs«, in: *PC Magazine* 13:15, pp. 113–175; Trant, Jennifer/Large, Michael (1994): »CD-ROM Resources for Art and Design«, in: *Art Documentation: Journal of the Art Libraries Society of North America* 13:3, pp. 131–138.

42 Cf. for example Rosenzweig, Roy (1995): »So, What's Next for Clio? CD-ROM and Historians«, in: *The Journal of American History* 81:4, p. 1621.

reste»)—the complementary term to tradition—is growing with each passing year. Unlike traditions, which are explicitly created for posterity, remains are sources that have survived as testimonies of their time without design or curation. By this definition, almost all surviving CD-ROMs—games, art projects, software installation discs, and so on—are best understood as remains. They serve less as intentional histories and more as unfiltered fragments of a recent digital past, preserving a wealth of cultural material that has often disappeared from the World Wide Web and other platforms. As such, they represent vital, and still largely untapped, resources for historical research.

Historiography and media studies have only recently begun to take an interest in digital storage media as historical remains.⁴³ What CD-ROMs can offer in this capacity depends, of course, on the digital objects they contain. Unlike CD-DAs and DVDs, CD-ROMs are general-purpose storage media and can hold virtually any form of digital information. This range makes it difficult to know where to begin. Which titles should historians focus on? Judging by the attention they have received from both public and scholarly circles, the first CD-ROMs that come to mind are the ›big‹ titles in entertainment (like *Myst*), reference (like *Encarta*), education, and the arts—works often produced with considerable resources by large corporations like Microsoft and Disney. In terms of reach and sheer quantity, however, one might instead look to the countless CD-ROMs that served as installation discs for software, from operating systems to Internet clients. Both categories reflect the polished, commercial façade of digital culture.

More revealing, however, may be the ›small‹ titles, which offer a backdoor into the everyday online culture of the 1990s and 2000s. A typical example of such CD-ROMs—produced in vast numbers but now largely forgotten—is the shareware collection. Shareware refers to software distributed for free on a trial basis, with payment typically required for a full version.⁴⁴ In the 1990s, before high-speed Internet made downloads easy, the CD-ROM was the preferred medium for distributing shareware. Small, independent publishers like Night Owl would compile hundreds, sometimes thousands, of shareware titles onto a single disc and sell it at a low price. The quality of these programs was often so poor that the compilations were disparagingly called ›shovelware‹: ›old and/or weak programs shoveled onto a CD to turn a quick buck‹.⁴⁵ Yet these discs contained more than just

43 For floppy disks, see Roeder, Torsten (2022): ›Rescuing Diskmags: Towards Scholarly [Re]digitisation of an Early Born-Digital Heritage«, in: *Magazén* 3:1. Online: https://edizionicafoscari.unive.it/media/pdf/article/magazen/2022/1/art-10.30687-mag-2724-3923-2022-05-006_toli4qB.pdf (last access: 31.08.2025).

44 The most famous shareware in history is probably the computer game *Doom* (1993).

45 Miller, Chuck (1994): ›The Shiny New Face of Shareware«, in: *Computer Gaming World* 114, pp. 128–130, here p. 128.

outdated games, utilities, and miscellaneous software. In their search for royalty-free content, publishers frequently drew material from online services like bulletin board systems (BBSs), preserving not only programs from independent developers but also digital texts, images, and other files shared within these early networked communities. This brings us, finally, to a concrete example of how CD-ROMs can serve as historical sources, offering rare insight into the visual culture of early digital communication—much of which has not survived in any other form.

GIF 0.0: A sketch of a case study

The remains of the early 1990s preserved on CD-ROMs allow us to reconstruct the history of digital images in electronic networks with greater accuracy than before. Central to this story is the Graphics Interchange Format (GIF)—another transitional medium or format whose early significance has been largely overlooked.

Conventional accounts of the GIF often distinguish between two phases. The first one, sometimes labeled ›GIF 1.0‹, associates the format with the early World Wide Web: auxiliary graphics, decorated buttons, and small animated logos. The second one, dubbed ›GIF 2.0‹ in reference to Web 2.0, marks its resurgence and renaissance as a medium for Internet memes and short video clips on social media platforms such as Facebook, Tumblr, and Twitter.⁴⁶ This narrative, however, is flawed, or, at the very least, incomplete. CD-ROMs help correct the historical record. They fill in what is missing in the schematic discourse on GIF 1.0 and GIF 2.0 by documenting a forgotten prehistory of the format. In fact, the established historiography of the GIF begins nearly a decade too late. As should be well known, the format did not originate with the launch of the World Wide Web in 1991, nor with the graphical Mosaic browser in 1993, and certainly not with Netscape Navigator's support for animated GIFs in 1995. Before GIF 1.0 and 2.0, there was GIF 0.0.

The GIF was developed and introduced in 1987 by CompuServe, one of the early online portals that predated the rise of the public Internet. It established what was arguably the first universal standard for exchanging digital images across different computer and display systems. By the time ViolaWWW became the first browser

46 See for example Eppink, Jason (2014): »A Brief History of the GIF (so Far)«, in: *Journal of Visual Culture* 13:3, pp. 298–306; Miltner, Kate M./Highfield, Tim (2017): »Never Gonna GIF You up: Analyzing the Cultural Significance of the Animated GIF«, in: *Social Media + Society* 3:3. Online: <https://doi.org/10.1177/2056305117725223> (last access: 31.08.2025); Strauven, Wanda (2019): »Let's Dance: GIF 1.0 Versus GIF 2.0«, in: Marek Jancovic/Axel Volmar/Alexandra Schneider (eds.): *Format Matters: Standards, Practices, and Politics in Media Cultures*, Lüneburg: Meson Press, pp. 47–63; Baumgärtel, Tilman (2020): *GIFs*, Berlin: Klaus Wagenbach; Wentz, Daniela (2020): »Das GIF. Geschichte und Geltung eines Formats aus dem Geist des Tanzes«, in: *Zeitschrift für Medienwissenschaft* 22:1, pp. 42–52.

capable of displaying the format in 1992,⁴⁷ GIF images had already been circulating in electronic networks for over five years. Because CompuServe published the GIF's specification openly and without licensing restrictions, and because its compression algorithm kept file sizes small, GIF images quickly spread far beyond the company's proprietary platform. They migrated from CompuServe's forums and software libraries into the wider ecosystem of bulletin board systems and networks such as FidoNet and Usenet, which served as multipliers for the format. »Most of the GIFs in circulation during the late 1980s could be traced back to one of a dozen or so BBSs.«⁴⁸ Until the mid-1990s, when JPEG and broadband Internet established new standards, GIF was the dominant format for exchanging digital images in consumer and hobbyist circles.

Because CompuServe, most BBSs, and much of Usenet no longer exist, the first years of the GIF cannot be reconstructed *in situ*. But soon after CompuServe had released the first specification of the GIF in 1987, the CD-ROM started to gain traction—a medium that has preserved traces of GIF o.o to this day. GIF files quickly became popular with publishers of shareware CD-ROMs, who collected images in bulk, often from BBSs, and compiled them for their products. What served publishers as an attractive, inexpensive, and easily sourced commodity offered buyers of the discs considerable savings in time—and thus in telephone and provider fees—since they no longer had to download each image individually. This advantage of the medium, the ability »to retrieve information rapidly from a disk whose contents would take an entire week to transmit via 1,200-bit-per-second modem«,⁴⁹ had already been emphasized when the CD-ROM was introduced in 1986. At first, the new physical storage medium complemented, and sometimes even replaced, the still rudimentary infrastructure of online transmission. For historians, this is a stroke of luck: CD-ROMs save the remains of digital networks that have long since disappeared. Files drawn from BBSs and similar sources, archived on shareware and shovelware discs, are among the few surviving traces of that early online culture and can thus help close a gap in our historical knowledge.

GIF images appeared on commercial CD-ROMs as early as 1990. One of the first was C.A.R.R.S. from Night Owl's Publisher Inc., which spawned the popular *Night Owl's Shareware* series that ran until 1997.⁵⁰ Alongside a wide range of shareware programs, C.A.R.R.S. contains over 600 GIF images. Other publishers and titles fol-

47 See the source codes of early browsers at <https://browsers.flanigan.us/browsers.html> (last access: 31.08.2025).

48 Driscoll, Kevin (2022): *The Modem World: A Prehistory of Social Media*, New Haven, CT: Yale University Press, p. 129.

49 Stark, Craig L. (1986): »CD-ROM Conference: Lured by 600 Megabytes on Disk«, in: *PC Magazine* 5:8, p. 42.

50 See https://archive.org/details/C.A.R.R.S._CD-ROM_1990 (last access: 31.08.2025).

lowed, and soon entire discs were devoted exclusively to GIF images: *GIFs Galore* CDROM (1992, 6,683 files); *GIF-Galaxy, Volume 1* (1993, 4,138 files); *Perfect Pictures* (1994, 2,163 files); and *Nothing but GIFs* (1995, 3,128 files).⁵¹ At the height of the CD-ROM boom in the mid-1990s, however, the market for GIF collections on optical media dried up. The web and the new JPEG image standard now dominated digital visibility in electronic networks and assigned the GIF a new place in the ecosystem of digital image formats. The era of GIF 0.0 ended, and GIF 1.0 began.

How, then, can historians access this material today? Where can one find discs like *Night Owl's Shareware*, which have been out of print for decades and were never systematically collected by libraries or archives? In an ironic twist of history, the Internet—the very infrastructure that rendered CD-ROMs obsolete—has become the repository of their afterlife. On sites such as the Internet Archive and others maintained by enthusiasts, thousands of titles have been preserved.⁵² They are accessible either as browsable copies of their original file structures or as downloadable ISO disk image files, which can be mounted directly, burned to a CD-R to recreate a physical CD-ROM, or read using virtual drives. What becomes visible when studying these discs of GIF images from 1990 to 1993? Let us conclude our overview with a brief digital source criticism of said CD-ROMs and their contents.

The origins of many CD-ROM titles can no longer be reconstructed with certainty. Most publishers from that era have disappeared, and little information about them survives. The situation is even more difficult with the images themselves. Beyond often cryptic file names (limited under the ISO 9660 standard to eight-plus-three simple ASCII characters) and date and time stamps of questionable validity, metadata is usually absent. For most images, essential details cannot be determined: when, where, and by whom an image was created; the purpose and context of its production; the computer and software used to encode it as a GIF; where it was first published; and how it ended up on a CD-ROM. At best, some discs include lists with keyword-like descriptions (»1ST_1.GIF 34827 06-09-90 First hubble space telescope image«⁵³). Most CD-ROMs also provide no information whatsoever about how their contents were selected or organized. Files are typically spread across multiple directories, sometimes labeled with descriptive names giving categories—from »ab-

51 See https://archive.org/details/GIFs_Galore_CD-ROM_Walnut_Creek_August_1992; <https://archive.org/details/gifgal>; <https://archive.org/details/perfect-pictures>; <https://archive.org/details/nothing-but-gifs> (last access: 31.08.2025).

52 See, for example, the collection at <https://discmaster.textfiles.com/cd-rom> (last access: 31.08.2025).

53 See the list for *Night Owl's PDSI-004-1* (1990): https://archive.org/download/Night_Owls_CD-ROM_-_PDSI-004-1_1990/Night_Owls_CD-ROM_-_PDSI-004-1_1990.iso/TEXT%2FDIR28 (last access: 31.08.2025).

stract« to »fantasy« and »nature« to »vietnam«. ⁵⁴ But overall, the discs give the impression of random, haphazard compilations. Some discs at least include catalog files with thumbnail previews, offering a quick overview of their contents (see Fig. 1).

Fig. 1



The two GIF specifications from 1987 and 1990 explicitly allow for so-called »extension blocks«, which can be used to embed metadata in the files.⁵⁵ In practice, however, few GIF images made use of this feature. A source criticism of these files, therefore, depends largely on what the images themselves reveal. Such clues may include the artist's name (see Fig. 2), a date (see Fig. 3), a brief description (see Fig. 4), information about the BBS through which the file was distributed (see Fig. 5),⁵⁶ and, in exceptionally rare cases, even a history of the image's creation (see Fig. 6). Technical details such as image dimensions, color values, or the fonts of drawing programs used for generating labels can also indicate the hardware and software by

54 See the categories list on *GIFs Galore* CDROM (1992): https://archive.org/download/GifsGalore_Aug92/GifsGalore_Aug92.cdr/GIFS%2Ffoo_DIRS.TXT (last access: 31.08.2025).

55 CompuServe Incorporated (1987): »Graphics Interchange Format(TM): A Standard Defining a Mechanism for the Storage and Transmission of Raster-Based Graphics Information« (15.06.1987). Online: <https://www.w3.org/Graphics/GIF/spec-gif87.txt> (last access: 31.08.2025); CompuServe Incorporated (1990): »Graphics Interchange Format(sm) Version 89a« (31.07.1990). Online: <https://www.w3.org/Graphics/GIF/spec-gif89a.txt> (last access: 31.08.2025).

56 Driscoll: The Modern World.

way of which a file was created. For instance, an image size of 640×350 pixels with a specific 16-color palette suggests the Enhanced Graphics Adapter (EGA) of IBM-compatible PCs (see Fig. 7).

Fig. 2



Fig. 3

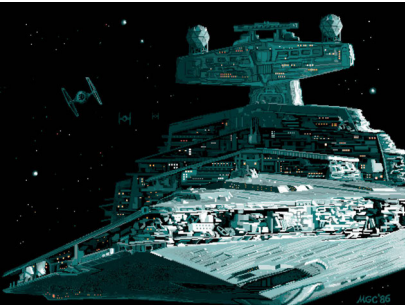


Fig. 4

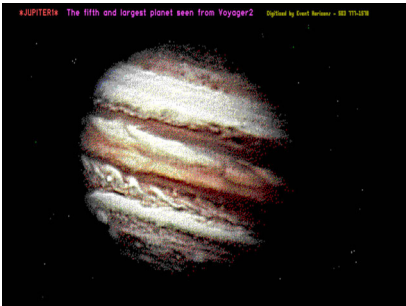


Fig. 5



Fig. 6

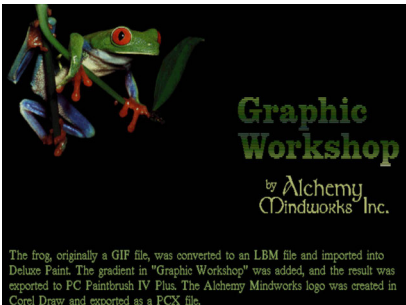


Fig. 7



Although a thorough source criticism of early GIF images is often extremely difficult, a brief survey of the collections preserved on CD-ROMs from around 1990 shows that conventional narratives in media history, which posit a development from GIF 1.0 to GIF 2.0, are misleading. Viewed primarily with the Internet and the World Wide Web in mind and traced in parallel with the transition from the ›original‹ Web 1.0 to the ›social‹ Web 2.0, two assumptions naturally arise. First, one might conclude that GIF images only became ›social‹ in their second generation. Second, the near-exclusive focus in media studies on animated GIFs encourages a linear, progressive history of the format—from static graphics to simple animations in Web 1.0 to video clips in Web 2.0—in line with the broader ›videofication‹ of the Internet by platforms such as YouTube, TikTok, and Netflix.

However, both assumptions are misleading because they overlook the format's early history: GIF 0.0. As the surviving CD-ROM collections clearly illustrate, GIF images predate not only Facebook, Twitter, and Tumblr but also the early web. Some twenty years before the memetic clips of Web 2.0, GIFs circulated widely in digital networks according to their own technologies, practices, economies, and aesthetics. The sheer variety of styles—ranging from simple clip art and diagrams to elaborate bitmap drawings, 3D graphics, digitized photography, and TV stills—demonstrates that the GIF was originally conceived, as CompuServe's specification stated, as a universal standard for ›high-quality, high-resolution graphics‹ of all kinds (within the technological limitations of the time).⁵⁷ It was only with the popularization of the web, nearly a decade after its invention, that the GIF was reinterpreted as an auxiliary format for Hypertext Markup Language (HTML). At that point, GIF files were demoted and reduced to just one element within the web's modular design system. On HTML-based websites combining text, graphics, images, animations, and sound, the GIF was relegated to a niche role. From then on, it appeared in the guise of display color bars, logos, banners, counters, arrow icons, rotating globes, flying letters, flashing ›New!‹ stickers, and ubiquitous ›Under Construction‹ signs.

4. Resurfacing digital media history artifacts

The CD-ROM is a textbook example of the rapid obsolescence of digital media. Introduced in the mid-1980s and reaching its commercial and cultural peak in the mid-1990s, it was hailed as the ›summation or combination‹ of all previous media ›into a single multifunction system‹.⁵⁸ For a brief span, from 1993 to 1997, it seemed to fulfill that promise. By the end of the decade, however, the format had been eclipsed by the rapid rise of the World Wide Web and rendered obsolete. The very

57 CompuServe Incorporated: Graphics Interchange Format(TM).

58 Gates: Foreword, p. xi; Lachenbruch, David, quoted in Hoban: The Everything Disc, p. 22.

qualities that once made the CD-ROM appealing—its large capacity for local storage and its ability to deliver data without relying on slow and costly networks—also tied it to a specific technological moment. As dial-up connectivity spread and broadband access followed, the governing principle of digital culture shifted from local storage on physical media to the global transmission of information across electronic networks. The historical irony is that the CD-ROM, displaced by the infrastructure of the Internet, also helped to popularize it: AOL's ›carpet bombing‹ campaign of free trial discs provided millions of users with the client software they could not yet download themselves. In this sense, the CD-ROM was truly a transitional medium, bridging the gap between the offline computer and the networked age that would ultimately replace it.

If the CD-ROM failed to deliver on the grand promises of the 1980s, its very obsolescence has made it an important object of research today, with the potential to transform non-knowledge into knowledge. The discs that survive from the 1990s and early 2000s can become part of a historiographical infrastructure for understanding our recent digital past. More than being just technological curiosities, they constitute an archive of digital artifacts and information that either disappeared from pre-WWW networks or was never preserved elsewhere. Their significance lies less in the prestige of ›big‹ titles such as *Myst* and *Encarta* or in deliberate historical traditions like *Who Built America?* than in their capacity to serve as remains (›Überreste‹) that testify to the everyday digital culture of the time. The prehistory of the GIF format—GIF 0.0, documented in shareware discs of the early 1990s—offers one striking example of how CD-ROMs can reframe our perspective on digital media history. Yet the historiographical value of the format extends well beyond this single case. Collectively, the surviving discs form a mosaic of digital culture before the spread of high-speed Internet access and the always-on connectivity of social media: from grassroots programming and ephemeral online exchanges to the aesthetics of low-resolution graphics and the commercial strategies of independent software publishers. To engage with CD-ROMs as historical remains is therefore to move beyond linear tales of technological progress—from Web 1.0 to Web 2.0 or from GIF 1.0 to GIF 2.0—and toward a more nuanced genealogy of digital media, one that acknowledges discontinuities, dead ends, and forgotten artifacts as essential parts of our recent past.

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Fig. 5: AUTUMN2.GIF (stretched to 4:3 aspect ratio), *CARRS* (CD-ROM), 1990, https://archive.org/download/cdrinc_CARRS_Shareware_CD-ROM_Collection_PDSI/CARRS%20-%20Shareware%20CD-ROM%20Collection%20-%20PDSI.ISO/030A%2FAUTUMN2.GIF

Fig. 6: EXAMPLE3.GIF (stretched to 4:3 aspect ratio), *GIFs Galore CDROM* (CD-ROM), 1992, https://archive.org/download/GifsGalore_Aug92/GifsGalore_Aug92.cdr/GIFS%2FFROGS%2FEXAMPLE3.GIF

Fig. 7: PARROTS.GIF, (stretched to 4:3 aspect ratio), *GIFs Galore CDROM* (CD-ROM), 1992, https://archive.org/download/GifsGalore_Aug92/GifsGalore_Aug92.cdr/GIFS%2FBIRDS%2FPARROTS.GIF