

# Sound Souvenirs

Audio Technologies, Memory and Cultural Practices

Edited by Karin Bijsterveld & José van Dijck

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The series *Transformations in Art and Culture* is dedicated to the study of historical and contemporary transformations in arts and culture, emphasizing processes of cultural change as they manifest themselves over time, through space, and in various media. Main goal of the series is to examine the effects of globalization, commercialization and technologization on the form, content, meaning and functioning of cultural products and socio-cultural practices.

New means of cultural expression, give meaning to our existence, and give rise to new modes of artistic expression, interaction, and community formation. Books in this series will primarily concentrate on contemporary changes in cultural practices, but will always account for their historical roots.

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## Contents

Acknowledgements	7
List of Figures	8
<b>Introduction</b>	11
Karin Bijsterveld and José van Dijck	
 <b>PART I • STORING SOUND</b>	
 <b>Chapter One</b>	
Storing Sound Souvenirs: The Multi-Sited Domestication of the Tape Recorder	25
Karin Bijsterveld and Annelies Jacobs	
 <b>Chapter Two</b>	
Tape Cassettes and Former Selves: How Mix Tapes Mediate Memories	43
Bas Jansen	
 <b>Chapter Three</b>	
The Preservation Paradox in Digital Audio	55
Jonathan Sterne	
 <b>PART II • AUDITORY NOSTALGIA</b>	
 <b>Chapter Four</b>	
Taking Your Favorite Sound Along: Portable Audio Technologies for Mobile Music Listening	69
Heike Weber	
 <b>Chapter Five</b>	
The Auditory Nostalgia of iPod Culture	83
Michael Bull	

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## Chapter Three

# The Preservation Paradox in Digital Audio<sup>1</sup>

Jonathan Sterne

## Introduction

Perhaps it is historians' special way of shaking a fist at the image of their own mortality, but every generation must lament that its artifacts, its milieu, will largely be lost to history. One can find countless laments in the early days of recording about what might have been had we just been able to get Lincoln's voice on a cylinder, or the speeches of some other great leader. But one can just as easily turn to one's own professional journals, such as the *Historical Journal of Film, Radio and Television*. Here is Phillip M. Taylor, a historian at Leeds, making the case for "preserving our contemporary communications heritage" in 1995:

In 2095, when history students look back to our century as we now look back to the nineteenth, they will read that the twentieth century was indeed different from all that went before it by virtue of the enormous explosion in media and communications technologies.... But when they come to examine the primary sources for this period, they will alas find only a ramshackle patchwork of surviving evidence because *we* currently lack the foresight, let alone the imagination, to preserve our contemporary media and communications heritage. By not addressing the issue now, we are relegating our future history to relative obscurity and our future historians to sampling and guesswork (Taylor 1996, p. 420).

Later in the piece Taylor writes that "even the [British] National Film and Television Archive was only able to preserve just over 25 percent of the total broadcast output of ITV and Channel 4 in 1993-94. That means 75 percent lost for posterity ... only a fragment of our contemporary record" (Taylor 1996, p. 424).

Taylor's suppositions are relatively straightforward. We live in a world saturated with media. In some cases, they define contemporary experience. Yet, if the

goal of history is to reconstruct the experience of the past, and most of the past is lost, there is no hope of recovering that lost experience. The logic seems impeccable, so long as one believes that history is about reconstituting lost experience in its fullness and that the route to this lofty goal is best taken through an archive that approaches some ideal of completeness. Our lives are awash in documents that will be rinsed away long before the historians of 2095 come to examine them. I will disagree with Taylor below, but let us hold on to his assumptions for a moment longer.

As it goes for media in general, so it goes for sound recordings and digital sound recordings in particular. Consider the following broad categories of issues in the preservation of digital music “documents” encountered by archivists: digital music documents exist in varying formats, which may correspond to scores, to audio recordings, or “control formats,” such as MIDI or MAX/MSP algorithms that are essentially performance instructions for computers. The storage media themselves are unstable. Even if an old hard drive or disc were properly preserved, its “readability” is an open question, given the wide range of software and operating systems in use at any given time. Even then, issues of intelligibility arise: much of what makes digital audio work today relies upon some kind of “metadata,” whether we are talking about the names of songs and albums in CDDB or the information on preferred tracks and takes in a multitrack recording (Lee 2000). As in the case of Van IJzendoorn, the Dutch recording enthusiast who lost the notebook indicating the placement of songs on long reels of tape (see Bijsterveld and Jacobs’ chapter 1), a collection itself is at best laborious to use without a guide. Even that analogy is inexact, since without metadata, digital files may simply be unplayable, or even impossible to identify as sound files: it would be as if Van IJzendoorn not only lost his notebook, but forgot that his audio tapes actually *were* audio tapes. Even if all of the technocultural considerations were covered, the archivist would still be confronted with the usual set of archival problems. Is the document worth keeping? Is it representative or special in some way? And is it worth elevating as an exemplar of some aspect of the past? For an obsessive collector or hobbyist, this is perhaps less of an issue than for an institution with limited space and budget and the need for some kind of guiding collections policy.

### Collecting and Forgetting

One can only imagine the lamenting historian’s horror at this state of affairs. The world is populated with an unprecedented number of recordings, yet they exist in countless different formats and with seemingly endless preservation problems. It’s cruel. We have made recordings more portable and easier to store than ever before, but in so doing we have also made them more ephemeral. Most of them will be lost to posterity, and despite the efforts of archivists, there is really not much we

can do about it. But of course, there is more than one way to think about forgetting. Here is Friedrich Nietzsche, who offers a very different perspective on the matter from Taylor’s:

Anyone who cannot set himself down on the crest of the moment, forgetting everything from the past, who is not capable of standing on a single point, like a goddess of victory, without dizziness or fear, will never know what happiness is.... A person who wanted to feel utterly and only historically would be like someone who was forced to abstain from sleep or like the beast that is to continue its life only from rumination to constantly repeated rumination” (Nietzsche [1873]1957).

Nietzsche was writing against what he felt to be a paralyzing historicism that dominated German scholarship in his lifetime. While he is probably not the first or best stop for political or aesthetic advice, Nietzsche does offer a useful reminder that forgetting is also an important part of living. It is perhaps too much to say that historians ought to be happy about forgetting, but in order to do their work, and in order for archives to make sense, in order for a document like a recording to have any historical value, a great deal of forgetting must happen first.

Forgetting is both personal and collective. It is sometimes unconscious and sometimes willful. Nietzsche ties it to life, Marc Augé (2004) ties it to death, and Paul Ricoeur (2004) ties it to forgiveness. The term is broad and unwieldy, but for the purposes of this paper, we may think of the collective forgetting that makes a given recording historical, meaningful, or valuable as that which subtends Taylor’s drive toward the impossible task of preserving everything. From the point of view of archival institutions, selection and memory are willful acts that define the nature and range of objects available in a given collection. But outside the institution the reality is considerably more messy. Lost master tapes of famous recordings, stacks of unsold compact discs taken to a landfill, or for that matter, a poorly documented file on someone’s hard drive are all small moments that may not in themselves constitute a form of willful forgetting, but in the aggregate certainly lead to forgetting nonetheless. Why are some recordings available to us today and others not? The answer has much to do with will and selection choice, but also with broader cultural attitudes about recordings and the sound they contain.

Countless writers have commented that recording in one way or another destroys sound’s ephemeral qualities. Sound itself, they write, was rendered durable and repeatable by Edison. Thanks to recording, sound exists in the memories of machines and surfaces as well as the memories of people. Certainly, this is one of the almost magical powers of recording. As Bijsterveld and Jacobs remind us in chapter one, it has been a selling point for new recording technologies at different

times. And certainly, the possibility of preservation opens up the fantasy of cheating time – and death – through an unbroken chain of preservation. But the fantasy that we can commune with the voices of the dead, that what is recorded today will be preserved forever, is just that, a fantasy. Sound recording is an extension of ephemerality, not its undoing. The same could be said of any form of recording, whether we are talking about ancient tablets, dusty account files in a file cabinet, tape backups of the university's mainframe, or the CD-R I burned yesterday. Most records available today are simply waiting to become lost records.

More and more of my friends – whether or not they are serious about music – are unloading their collections of CDs and LPs, preferring instead to keep their collections readily available on hard drives. In making this simple move, while retaining the music for themselves in the near term, they make it much less likely that any part of their collections will outlive them, given the short lifespan of hard drives. What will happen when this comes to pass and their collections either fade away or disappear rapidly? If it happens too soon, they will recognize their loss and perhaps seek to replace the missing music. But the lack of durability also means that their collections are less likely to outlive them and therefore to recirculate through various kinds of used markets or other people's collections. In turn, they will never make it into archives. This process is less a simple kind of forgetting, like forgetting where one left one's car keys; it is more properly a forgetting of forgetting. Our descendants won't even know what is missing.

In important ways, the “forgetting of forgetting” already structures the history of recording. The preciousness that characterizes all recording is perhaps most apparent in early examples of surviving phonography. Originally used to describe early printed books, especially those from before 1500, media archivists have expanded the term “incunabulum” to include early examples of any recording medium. In the case of sound recordings, an incunabulum is any recording from before 1900 (Smart 1980, p. 424). Relatively few recordings from this period exist, and those that do are treated like treasures by archivists. James R. Smart, Library of Congress archivist, puts it thus in a 1980 article:

They are historic documents in sound which, more than any photograph or paragraph, illustrate nineteenth-century performance styles in music, in vaudeville routines, in dramatic readings. They teach us, more than any book can, just what our ancestors enjoyed in popular music, what appealed to their sense of the ridiculous or their sense of the dramatic (Smart 1980, p. 424).

Smart's point here is that old recordings, when they are preserved and properly curated, become living documents of history in the present, a point he makes even more emphatically elsewhere in his essay. Even though no playable recordings exist from the first ten years of sound recording's history, he writes that

we now have a large and priceless heritage of recordings reaching back a full ninety years. When one considers that many early performers were already fifty years old when they recorded, then it can be realized that we have the means of studying the styles and techniques taught as far back as the Civil War. Gladstone and Tennyson, both contemporaries of Abraham Lincoln, are represented on now nearly worn-out recordings, but Pope Leo XIII, born 169 years ago [counting back from 1980–JS], can be heard on two good recordings (Smart 1980, p. 422).

For Smart, the rarity of early recordings is paired with the rarity of memory itself. He partakes of an ideology of transparency that has been widely criticized by sound scholars, myself included, and yet it is undeniable that one of the reasons people find recordings precious is because they offer some kind of access to lost or otherwise inaccessible moments (Williams 1980; Altman 1992; Lastra 2000; Auslander 2008 [1999]; Sterne 2003). The curated recording is a hedge against mortality, the fragility of memory, and the ever-receding substance of history. The interplay between a *bit* of access and large sections of inaccessibility are precisely what makes the past intriguing, mysterious, and potentially revelatory. Thus, the idea that recordings can provide access to the past requires two important prior conditions: 1) as Smart himself argues, it presupposes that certain recordings will be elevated to the status of official historical documents and curated in an appropriate fashion; and 2) in order for that process to occur, there must be an essential rarity of recordings from the period. Most recordings must become lost recordings before any recordings can be elevated as historical documents. Given the wide range of recordings made, the only way for a recording to become rare is if most of the recordings like it are lost.

### Permanence and Ephemerality

It may seem odd to think that most of the recordings ever made must be lost before any of them can be found and made into historical documents. But in fact the vast majority of recordings in history are lost. For all the grandiloquence about messages to future generations and hearing the voices of the dead, most recordings have (and I would argue, are still) treated by their makers, owners, and users as ephemera, as items to be used for a while and then to be disposed of. This has been a fundamental condition of recording throughout its history. As D.L. LeMahieu wrote of the gramophone in Britain, “popular records became almost as transitory in the marketplace as the ephemeral sounds which they preserved.... Within a few generations, records produced by the thousands and millions became rare items. Many were lost altogether” (LeMahieu 1988, p. 89).

Sound recording did as much to promote ephemerality as it did to promote permanence in the auditory life of a culture. Inasmuch as we can claim it promoted

permanence, sound recording also helped to accelerate the pace of fashion and turnover in popular music. "Songs which a few generations before might have remained popular for decades now rose and fell within a year, or even months" (LeMahieu 1988, p.89). The fundamental classification of recordings as ephemera continues down to the present day, as record collections are routinely mistreated, disposed of, and occasionally recirculated (Keil and Feld 1996; Straw 2000).

In this way, sound recordings became quite typical modern commodities, and the fluctuation of their commercial and historical value depends on their mass disposal and disappearance. Michael Thompson's very interesting book *Rubbish Theory* chronicles the life cycles of similar modern commodities. Thompson argues that mass-produced ephemera begin their lives at a relatively stable level of economic value which diminishes over time as they lose the luster of newness and become increasingly common and available. This loss in value eventually results in their becoming worthless, at which point most of the objects in question are thrown out. Once the objects become relatively rare – through this process of devaluation and disposal – they can again begin to accrue value for collectors through their oddity or rarity. Thompson is interested in old houses, Victorian keepsakes, consumer packaging, and a whole range of odds and ends because of the relationship between their symbolic and economic value (Thompson 1979). His thesis applies equally well to the ebb and flow of cultural value for sound recordings, which were often treated poorly by their owners to begin with. Even when cherished, analog recordings could be worn out or destroyed simply through loving use. Either way, for all the talk of permanence, the careers of individual recordings followed the pattern of ephemera for most of recording technology's history.

Scarcity is a fundamental condition of possibility for historicity, but that scarcity has to be created from a condition of abundance. When history is not struggling with loss, it must struggle with plenitude. That is to say, many recordings must be lost in order for a few recordings to be "found." And plenitude is on the minds of many archivists today because at first blush, it would seem that we have denser saturation than ever before in the history of sound recording. Over forty thousand albums are released each year, worldwide, and in a given month over 1.5 billion music files are exchanged on the Internet. With digital recording, one would think that recording is more plentiful than ever, that in a certain sense it is harder than ever to "lose" recordings. Instead, their ubiquity has become the main point of interest: as MP3s became popular in 1999 and 2000, writers began to put forward the idea of the Internet as "celestial jukebox" where every recording ever made would be available to anyone, anytime, and anywhere.<sup>2</sup> While this imaginary plenitude of recordings continues to be a selling point for online MP3 services, it also raises new issues of selectivity and indexing. After all, no single person can listen to a meaningful fraction of everything ever recorded.

Consider the case of an illegal recording genre such as mashups.<sup>3</sup> A mashup is made by combining two or more recordings and beat-matching them in such a way that they "work" together as a new kind of song. Strictly speaking, mashups are illegal because they are made without any kind of permission or sample clearance. Many of them are anonymous and circulate through file sharing services that are themselves of controversial legality in some countries. Although such recordings are available in abundance and for free, I know of no legitimate archival institution that has begun the process of collecting them despite the fact that many music libraries and sound archives – including national archives – now understand the importance of preserving popular music (a key basis for the kinds of cultural memory explored in Van Dijck's contribution to this volume).

In many cases, current selection and collection policies would actively preclude archival institutions like the U.S. Library of Congress from collecting and cataloging mashups. Thus, an important popular cultural form of the current decade will remain largely undocumented. Eventually, many of the currently popular mashups will move out of circulation and perhaps even disappear from most of their owners' collections if they are not cared for and backed up. A few dedicated collectors will no doubt keep meticulously organized collections, and perhaps, a few decades hence, one such collection will find its way into a major archival institution that exists in a world of more enlightened intellectual property laws. One person's idiosyncratic collection could thus become an important historical resource for anyone interested in what mashups might tell them about the first decade of the 2000s. If this story sounds strange or speculative, recall that the condescension of archival institutions toward popular culture in the early part of the twentieth century meant that they collected nothing for decades. Highly idiosyncratic collections, such as the Warshaw Collection at the Smithsonian National Museum of American History in Washington, D.C., have since come to play important roles in current historiography, despite the fact that the collections themselves had no clear logic of acquisition beyond the collectors' idiosyncratic tastes.

Thus, in many ways, the reaction to digital sound recording is a replay of attitudes that emerged a century ago, in the earliest ages of recording. People hail the possibility for keeping, cataloguing, and making available all of the world's music, all of the world's recorded sound, at the same time that they lament the passing of time and the decline of the available material into obscurity. These laments often go hand-in-hand with practices that actually hasten the disappearance of the music itself. In drawing parallels between the turn of the twentieth century and the present, in deliberately blurring the two periods, Mike Featherstone writes of "an expanding consumer culture and the genesis of world cities that leads to the globalization of culture and the increase in the volume of cultural production and reproduction beyond our capacity to recover the various cultural objects, images and fragments into a framework through which we can make sense of it" (Feath-

erstone 2000, p. 163). For Featherstone, the torrents of media ultimately point to “the failure of subjective culture to deal adequately with the problem of selectivity...” (Featherstone 2000, p. 162). “If everything can potentially be of significance should not part of the archive fever be to record and document everything, as it could one day be useful? The problem then becomes, not what to put into the archive, but what one dare leave out” (Featherstone 2000, p. 170).

### Selecting and Forgetting in the Digital Age

Featherstone describes the crux of the problem for collector cultures: there’s too much to collect and not enough of a sense of, or agreement about, what should be collected. Current criteria for archival selection are quite underdeveloped. For instance, the National Library of Australia’s Guidelines for the Preservation of Digital Heritage are woefully vague, suggesting simply that institutions should preserve materials based on the material’s value in “supporting the mission of the organization taking preservation responsibility”; that since future costs of preservation are unpredictable, it would be “irresponsible” to refuse materials that are difficult to preserve; and that some exemplary ephemera should be included with materials that have clear, obvious importance at the present moment (National Library of Australia 2003). The problem with this approach, as with all archival selection, is that it is not future-proof in any meaningful way. The values that guide archival collecting today may be irrelevant to future users of the same material – certainly this has been the case in the past. When you add the seemingly endless permutations of recording formats, software updates and reference-quality standards, even the most basic decisions about preservation become incredibly complex.

Perhaps, by accident, or at least by becoming less stable than their analog predecessors, digital recording formats are less *aides-memoir* than *aides-oubliez*. They will help us forget. While such a proposition would horrify Taylor, there are other ways to consider it given that more recordings now exist – by far – than at any other time in human history. In his essay “Forgetting is a Feature, Not a Bug,” Liam Bannon argues that with the massive proliferation of information occasioned by digital technologies, design must be oriented toward forgetting as well as remembering (Bannon 2006). Though his examples are banal, the self-destructing tape of spy movies, “digital shelters” that jam electronic signals, and “sweeper” technologies that indicate whether a recording device is present, his larger point is that the overemphasis on memory is actually debilitating. He is not alone. In 2005, the art group monochrom held a “Magnetism Party” to delete performatively data from hard drives, room cards, audio and video cassettes, floppy discs, drivers licenses, etc. The performance was a critique of information overload, but as Melanie Swalwell points out, it was merely an extreme version of a more basic bu-

reaucratic imperative to delete. Swalwell gives the example of calling the records managers of a regional office of the New Zealand Customs Department in search of a now-defunct system for importing drivers’ licenses (the system was important for her research on the history of the game industry). The managers responded, with quite some delight in their voices, that the system was lost to history, because “they don’t *have* to keep anything longer than seven years” (Swalwell 2007, 261).

Considering digital technologies primarily in terms of preservation also often begs the question of what exactly is being preserved. Perhaps alluding to personal photography and recordings, Bannon writes that “the issue of what is being preserved when we do make some form of record of an event is also open to question, as usually it is the personal experience of *being there* that is valued, not simply the visual or aural signal captured by the machine” (Bannon 2006, p. 12). Certainly, a good deal of audio recording, if not most, is now about “the recording itself” and not preserving an external event. But this distinction fades a bit as we telescope forward to the recording’s life in an archive at some future date. Materials in archives live on as evidence, meaning that for historians, they tend to point toward things outside themselves, and thus even the totally self-contained recording that was never meant as a representation of a live event (as much recorded music now is) comes to represent some aspect of “being there” in the history. This is exactly why Taylor is so worried about the loss of television broadcasts. Without the mediatic dimension of everyday life, without its flow, he worries that future historians will not be able to capture accurately the sense of “being here” in the present.

We can already see this process at work in the preservation of early digital games. Swalwell describes the problems facing the curation of “Malzek,” a 1981 arcade game:

this game still cannot be played as it was intended: no one has seen it working for 20 years, no one knows the correct colours, collisions are not working, and there is no sound. Anyone can download a copy of this (sort of) mass-produced digital work, but in this case redundancy does not ensure the survival of the game (Swalwell 2007, p. 264).

The same conditions apply to digital audio. Not only will metadata be lost, so too might aspects of the files themselves. Archival specialists also expect that preserving digital sound recordings will require more in resources than preserving their analog counterparts. The added expenses come not from storage, since digital storage continues to become cheaper, but rather all the things that come with digital storage: duplication and backup, the need to maintain proper equipment and expertise for “reading” the digital files in whatever format they exist, and all other aspects of infrastructure and maintenance (Russell 1999).



Though there are really no data upon which we can rely with absolute certainty, estimates for the durability of digital media are relatively low. Unused hard drives fail within a few years, and CD-R lifespan is the subject of a broad international debate. Even optimistic industry estimates for the lifespan of compact discs are relatively short by archival standards. A public relations piece for Roxio, a company that makes software for burning CDs and DVDs, estimates the lifespan of a compact disc at seventy to two hundred years (Starrett 2000). A 1996 report by Yale preservation librarian Paul Conway argues that there is a general decline in durability of recorded media over the history of recorded text (Conway 2005). Though he is primarily concerned with written documents, the same reasoning applies to recording: a Berliner zinc or shellac disc will likely be playable long after a compact disc.

Apart from the physical issues associated with decay of digital media, there are a variety of other forces that work against any kind of preservation. Foremost among these is digital rights management (DRM), a generic name for anti-piracy algorithms built into digital files. DRM can limit the number of copies that can be made of a file or the range of media on which a file can be played. For instance, some compact discs are now released with DRM which make them unplayable on computers. This is especially problematic for preservation because all archived sound recordings are, sooner or later, "reformatted" due to the speed with which recordings undergo physical decay (Brylawski 2002). DRM that prevents copying and transfer to new formats will effectively render it impossible to recover or preserve digital files beyond the life spans of their original formats and the companies that control the DRM embedded in the recordings. The life span of a recording with DRM is in the order of years, and perhaps decades, not centuries (Gillespie 2007).

### The Preservation Paradox

Although digital technology allows for unprecedented ease in the transfer and stockpiling of recordings, the current condition of plenitude is something of an illusion. If early recordings were destined to become lost recordings, digital recordings move in the same direction, but they do so more quickly and more fitfully. For while a damaged disc or magnetic tape may yield a little information – it may be possible to hear an old recording through the waves of hisses or crackles of a needle as it passes through damaged grooves – digital data have a more radical threshold of intelligibility. One moment they are intelligible, but once their decay becomes palpable, the file is rendered entirely unreadable. In other words, digital files do not age with any grace. Where analog recordings fade slowly into nothingness, digital recordings fall off a cliff from presence into absence.

We can go a step further to argue that the very thing that makes digital record-

ings so convivial, so portable, and so easily stored is their relative ephemerality. It would be wrong to compare digital media with their analog counterparts to argue that digital "dematerializes" recorded sound. On the contrary, the materiality of digital storage is what makes it fragile and ephemeral. The fading ink on the CD-R, the fading magnetic pattern on the surface of a hard drive are banal chemical and physical processes, and not at all related to the "discontinuity" or "disembodiment" attributed to digital audio in other texts (Evans 2005; Sterne 2006a).

So what should we make of a future where most digital recordings will be lost, damaged, unplayable, or separated from their metadata, hopelessly swimming in a potentially infinite universe of meaning? We could follow Taylor's lament and shed some tears for a future that will never be able to reconstruct the fullness of the present we inhabit. But how much history really does that? The conceit behind Taylor's account is that the historian is merely a poorer ethnographer, an ethnographer whose subjects cannot talk back. But Taylor confuses a fantasy of historical writing with its reality. History deals in fragments, with traces, and whereas the fundamental condition for the ethnographer is some kind of co-presence, the fundamental condition for the historian is absence. Most of human history is only available for present analysis in extremely skewed and partial form. We make use of the traces left behind, interpreting them, imposing our own frameworks and questions, and making them speak to our present. As with Bas Jansen's account of the mix tape (see chapter 2), the referent of historical recordings are not the selves "as characters" so much as what he calls the "what-it-was-like." Our fate will be no different for the future, and whatever recordings do survive will be part of that history writing process. They will be open to interpretation and subjected to questions and frameworks we cannot imagine and of which we might not approve – or know to approve. But the future does not need our consent or approval. This is not an abdication of the responsibility to preserve or to remember. It is only an acknowledgement that history, like all forms of memory, is first predicated on forgetting.

### Notes

1. Thanks to Jeremy Morris for the title suggestion and important research assistance, to the volume editors for their helpful suggestions, and to Carrie Rentschler for a much-needed read. Additional thanks to Matthew Noble-Olson for help with final edits.
2. See for example, Jenelle Brown, *The Jukebox Manifesto*, 13 November 2000, Salon.com. <http://www.salon.com/tech/feature/2000/11/13/jukebox/> (accessed 12 December 2005).
3. This discussion is based on a personal conversation with Samuel Brylawski, former head of the Recorded Sound Division at the Library of Congress, and Mark Katz, "The Second Digital Revolution in Music," Music Library Association Meeting, Pittsburgh 2007.



19. Dutch art historian Van Os' conviction (2005) that a feeling of estrangement increases the receptivity for a historical experience is in accordance with this view.
20. Runia distinguishes two kinds of metonyms: active ones that immediately display their uncomfortable nature, and dormant ones that hide it because we have gotten so used to them. *Alle Namen*, we might say, aims to awaken and render effective the dormant (Runia 2006a, p. 248) metonym of the cemetery.
21. Quadrophony is the use of four speakers in the corners of a square with the listener in the middle (Interview Op den Camp 2005). This system was one of many supposed to produce a relatively realistic immersive listening experience. See, for instance, Pope, Holm, and Kouznetsov 2000.
22. All, "Timeschedule week 38" (n.d.); Muijres in Fieldwork 22 February 2005.
23. Paul Coenjaarts cited by Frusch in: All, Annual Report 1997. The engineer Arno op den Camp indicates the limits of visually hiding speakers in terms of the quality of the sound (Interview Op den Camp 2005).
24. All, File "Alle Namen," "Letter from Johan Luijmes to L. Hilkens, secretary advisory committee action programme cultural reach, n.d., no page numbers.
25. All, File "Alle Namen," "Letter Intro | in situ to Mrs. Hilkens," 30 August 2004; Interview Termeer 2007.
26. All, File "Alle Namen," "Letter Intro | in situ to Mrs. Hilkens," 30 August 2004.
27. Intro | in situ later invited the schools to come to the playing of *Alle Namen* and offered to arrange bus transportation for the children. But most of the schools did not take up the offer, and only a few children visited *Alle Namen* individually. Intro | in situ speculated that the children did not come because the letters were sent to the heads of the schools rather than to individual teachers (personal communication, Luijmes and Muijres, 21 August 2007), but a teacher pointed out that the children who had participated in the project had already left the school when *Alle Namen* was played in September (Interview Termeer 2007).
28. All, File "Alle Namen," "Letter Johan Luijmes to the adopters of the war graves at Margraten," 2 May 2004.
29. All, File "Alle Namen," "Letter Johan Luijmes to teachers primary school," 22 March 2004.
30. All, File "Alle Namen," "Letter Intro | in situ to Mrs. Hilkens," 30 August 2004.

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