

# CARING FOR PAST MEDIA FROM BELOW: BOTTOM-UP PRACTICES AND NETWORKS SUPPORTING OBSOLETE BROADCAST TECHNOLOGIES

Sergio Minniti 

Department of Humanities and Social Sciences  
Universitas Mercatorum

[sergio.minniti@unimercatorum.it](mailto:sergio.minniti@unimercatorum.it)

Roberta Spada 

Department of Philosophy, Sociology, Education and Applied Psychology  
University of Padova

[roberta.spada.1@unipd.it](mailto:roberta.spada.1@unipd.it)

**Abstract:** This paper examines grassroots practices of care for obsolete broadcast technologies through the lens of Maintenance and Repair Studies and Science and Technology Studies, focusing on two case studies: the preservation of U-Matic video technology and the reappropriation of CRT displays in retrogaming communities. Through qualitative analysis, the study investigates how these practices operate across three dimensions of care – object, network, and ecosystem – revealing the interplay between material work, distributed expertise, and the broader ecosystems that support technology persistence. The analysis focuses on the heterogeneous actors operating outside formal institutions, including former users, retired professionals, and amateurs, and shows how their practices of care are not merely preservational but also generative. In doing so, the paper underscores their crucial role in preserving obsolete media, framing media persistence as a fragile yet productive achievement of care work.

**Keywords:** care practices, cathode-ray tube displays, maintenance and repair, obsolete media, retrogaming, technological obsolescence, U-Matic

## 1 Introduction

Engaging with a broadcast archive as a user typically entails accessing its content, often without direct awareness of the material substrates that mediate such access. When this process unfolds seamlessly, the infrastructural mechanisms that sustain it remain largely invisible. However, moments of disruption – whether due to technological obsolescence, degraded media, or shifting access protocols – render these mediating supports perceptible, prompting critical inquiries into the conditions of access, the legibility of outdated formats, and the material contingencies that shape what remains retrievable and what risks being lost. The obsolescence of media technologies thus emerges not only as a technical challenge but as an epistemic and historiographical issue, revealing how historical knowledge and

memory are shaped by the durability of storage media and the affordances of the retrieval process.<sup>1</sup> In response to this issue's call for experimental engagements with the archive, we seek to foreground not only institutionalised broadcast repositories but also the often-overlooked vernacular and creative archiving practices that intervene in processes of media preservation. Practices like restoration, re-enactment, and digitisation expand how media past is accessed and reimagined, opening alternative historiographical pathways. By attending to the dynamic interplay between institutional and vernacular archiving, we aim to explore how broadcast media history is not only retrieved but continuously rewritten through acts of engagement with its surviving traces.

The continued accessibility of broadcast media relies on practices of maintenance, repair, and adaptation, which are crucial not only for preserving content but also for sustaining the material supports that underpin its circulation and historical legibility. Recent scholarship, particularly within media archaeology, has foregrounded the significance of the material and sensory dimensions of media, emphasising how reconstructing media genealogies necessitates engaging with obsolete and overlooked formats. Re-enactments of 'old' media serve a dual function: they expand scholarly knowledge while also re-sensitising users to the materiality of obsolete technologies. Through hands-on encounters with once-familiar devices these experimental engagements reveal the tacit knowledge embedded in historical media operations, making tangible the interplay between technological infrastructures, sensory experiences, and cultural memory.<sup>2</sup>

Building on this framework, this paper examines practices of care for obsolete technologies beyond institutional settings, focusing on initiatives led by lay practitioners, amateurs, and former users. Drawing on two research projects conducted in Italy between 2022 and 2024, we examine how informal networks and bottom-up knowledge circulation support the maintenance and continued accessibility of past media.<sup>3</sup> Through two empirical cases – the preservation of obsolete broadcast video formats such as U-Matic and the reappropriation of cathode-ray tube (CRT) monitors and television sets within retrogaming communities – we highlight the role of grassroots interventions in sustaining technological afterlives and shaping alternative pathways for media preservation.

Both of our case studies are situated in Italy, a privileged context for observing practices outside and in relation to, and beyond, institutional broadcast archives. Italian archives preserving audiovisual materials that reflect the country's rich demo-ethno-anthropological heritage – such as Archivio LUCE, Teche Rai, and the Istituto Centrale per i Beni Sonori e Audiovisivi, to name a few – have systematically relied on digitisation to preserve their collections and make them accessible. At the same time, they have also questioned the status of audiovisual heritage in relation to the specific legal status of heritage assets in Italy.<sup>4</sup> Alongside and often in dialogue with these institutions, a wide array of expert and amateur enthusiasts apply their knowledge and technical skills to recovering obsolete media and making their content legible.

Through the analysis of these two cases, the paper explores how bottom-up practices contribute to the persistence of technological infrastructures, enriching our understanding of the networks that sustain access to past media. While institutional practices are fundamental, they represent only part of the broader picture. By examining grassroots practices, the paper highlights how informal networks of care contribute to the ongoing viability and repurposing of obsolete technologies.

## **2 Caring for Obsolete Technology at the Intersection of Continuity and Change**

### **2.1 Broadcast Archives, Heritage, and Technological Obsolescence**

Broadcast archives are tasked with preserving audiovisual materials across a wide spectrum of formats and media supports, ranging from the most recent and commonly used to the rarest and most obsolete. Obsolete formats span a wide range, from wax cylinders and film reels to outdated CDs, cassettes, and digital file types.

For broadcast archives, the conservation and restoration of both these supports and the corresponding playback devices and infrastructures are essential to ensure continued access to the audiovisual content they hold. Without such efforts, vast portions of broadcast history risk becoming inaccessible or permanently lost. Broadcast archives, like libraries and museums, serve as custodians of historical memory, which encompasses both technical artefacts and the content they carry. Their preservation efforts contribute to the broader construction of cultural heritage – understood as a shared legacy from the past intended for future generations.<sup>5</sup> In this way, they play a crucial role in safeguarding the historical trajectories of media technologies and their history.

As tangible heritage, audiovisual materials raise museological questions concerning the ontology of heritage itself: while media content – be it a movie, TV or radio programme, audio recording, digital data, or software – is often regarded as immaterial and accessible only through its reproduction, the physical support on which it is inscribed remains undeniably material.<sup>6</sup> Thus, preservation efforts must address not only the content but also its material substrate, as both are integral to the media artefact's social and historical significance. The support serves to contextualise the media object, anchoring it within the sociotechnical frameworks that shaped its production, circulation, and reception.

For this reason, the preservation of past media within broadcast archives become particularly significant when these technologies have reached obsolescence. In such cases, preserving audiovisual documents necessitates the reactivation of 'disused' devices and the reversal of technological decline. Despite its relevance to media and STS studies, obsolescence remains underexplored in research on technological change, with few exceptions. One such exception is the volume *Technologies in Decline*, edited by Koretsky and colleagues, which reconceptualises decline as more than the opposite of innovation. Rather, decline encompasses a temporal and material dimension that invites attention to the ambiguous space between persistence and disappearance – a space that is shaped by ongoing effort and negotiation.<sup>7</sup> As Stegmaier observes in the volume, further analysis is required to understand where and how obsolescence – as a process of technological decline – is desired or resisted, strategically implemented or passively accepted, and how it intersects with normative and political imaginaries concerning the acceleration, halting, or redirection of technological trajectories.<sup>8</sup>

From this perspective, obsolescence can be understood as a reconfiguration of the sociotechnical practices in which a technological artefact is embedded, leading to the decline of its production, distribution, use, and repair.<sup>9</sup> What breaks down, therefore, is not only the artefact per se, but the broader social and material environment that sustains its functionality. As Krebs and Weber argue, this encompasses both the materiality of artefact and the cultural expectations that shape its use and value.<sup>10</sup> Consequently, maintenance and repair are essential not only during the period of a technology's widespread circulation but also after it has fallen into disuse, when such practices can reactivate technologies previously considered obsolete. Both processes involve sociomaterial networks of actors who engage in complex practices requiring specialised skills, expertise, and relationships.

Moreover, giving technology an afterlife requires finding appropriate materials (e.g., spare parts, components, infrastructures) and recovering dispersed or forgotten know-how. It also entails the creation of new networks and the development of new forms of knowledge, as well as the integration of old and new technologies enabling obsolete systems to function within or alongside contemporary technological environments. One example is the development of innovations ensuring 'backward compatibility'.<sup>11</sup> These processes can be regarded as forms of innovation centred on the re-appropriation of technology, in which users actively engage as designers, producers, distributors, and technical support.<sup>12</sup> In these practices, persistence and change are inextricably intertwined: innovation emerges precisely through the effort to maintain, adapt, and revive obsolete technologies. Such dynamics are evident in 'retromedia' practices<sup>13</sup> and the collecting of past technologies, where enthusiasts and amateurs devote significant effort to the maintenance and repair of obsolete technologies that are the object of their affection, such as antique cars,<sup>14</sup> film cameras,<sup>15</sup> and early videogame systems.<sup>16</sup> A defining feature of these preservation efforts is the emergence of distributed, heterogeneous networks of people and objects that collectively sustain declining technologies.

Consequently, networks and infrastructures for obsolete media extend beyond institutional archives. Like other heritage institutions, archives often rely on external expertise to restore and preserve outdated formats, prompting collaborations with heterogeneous actors who operate outside formal organisations. This raises a central question: who are the individuals and communities involved in these decentralised preservation networks, and how can their contributions be meaningfully understood? A second, equally important, question concerns the nature of the practices themselves: how can we conceptualise the forms of engagement, knowledge production, and technical improvisation that characterise such activities, which are often situated at the intersection of professional expertise, vernacular practice, and material experimentation?

## 2.2 Caring for Broadcast Heritage Beyond the Archive

The concept of care, emerging from feminist studies, has gained increasing prominence in recent scholarship, being applied to the domains of maintenance, repair, and heritage studies. Maintenance and care share a foundational attentiveness to the intrinsic tendency of material things towards decay or breakdown.<sup>17</sup> Indeed, maintenance can be considered as a form of care work ‘because it takes into account decay and the vitality of matter’.<sup>18</sup> This framing directs analytical attention to the entanglement between material fragility and the bodily, affective, and technical commitment to resist it. Conceptualising maintenance as care also foregrounds the relational dimension between maintainers and the technologies they support,<sup>19</sup> and encompasses not only technical operations but also the broader socio-cultural and organisational dynamics associated with these activities.<sup>20</sup>

In the case of museums, care practices are oriented both towards collections and the communities surrounding these institutions.<sup>21</sup> Fernando Domínguez Rubio provides a detailed account of maintenance as care in heritage institutions, describing an ecology of human and non-human actors – technicians, curators, artefacts, infrastructures – whose coordinated efforts respond to the ‘relentlessness of things’ to ensure that artworks keep fulfilling their aesthetic meanings through careful processes of mending, adjusting, restoring, and adapting.<sup>22</sup> His analysis of time-based media art conservation at the MoMA underscores the institutional need to migrate works based on obsolete technologies, like CRTs and floppy disks, into newer technological ecologies in order to ensure their survival.<sup>23</sup> However, this process is fraught with challenges: while digital formats are often considered a default preservation standard, they are in fact highly unstable and prone to rapid obsolescence. Indeed, Domínguez Rubio notes,

Technologies that were ubiquitous barely a decade ago, like floppy disks or CRT monitors, now look like archaeological relics. It only takes a few years, if not months, for software environments to be replaced by newer versions, often with limited backward compatibility.<sup>24</sup>

The question of how to stabilise obsolete media for the sake of heritage preservation has thus become central to both institutional and scholarly agendas.

What emerges in both fields is that care work relies on networks of support. Heritage institutions inevitably depend on complex assemblages of knowledge, skills, and practices that often extend beyond their formal organisational boundaries.<sup>25</sup> Within the museum sector, this reliance on external collaboration has been increasingly recognised, both in museological literature and institutional practice. Many museums now actively engage with interested publics, expert volunteers, and users as active partners in their mission.<sup>26</sup> The recent definition of ‘museum’ adopted by the International Council of Museums (ICOM) reflects this shift, explicitly recognising community participation and the value of pluralism.<sup>27</sup> In this context, the shared objective of caring for heritage encourages forms of collaboration that transcend institutional boundaries. Woodham et al. conceptualise these configurations as ‘communities of care’, referring to heterogeneous collectives that may include amateurs, collectors, retired professionals, and other enthusiasts who contribute to the ‘care’ of heritage at the margins of formal institutions.<sup>28</sup>

In the case of broadcast archives, the reliance on such external networks becomes particularly visible when dealing with obsolete media formats and supports. The variety of audiovisual supports, each with unique material properties, internal functioning, and histories of use, means that institutional expertise alone is often insufficient. In many cases, the individuals capable of restoring these media are not formally trained conservators, but grassroots experts and hobbyists whose specialised knowledge often derives from previous professional experiences. These actors repurpose their skills and resources to maintain obsolete technologies, motivated by a deep affective and material *attachment* to these artefacts.<sup>29</sup> As Van de Leemput and Van Lente show in their study of the maintenance of Tacita Dean's film-based work at Tate Modern, sustaining a declining technology entails both technical interventions and the nurturing of social and material networks.<sup>30</sup> Here, maintenance is understood not simply as functional repair, but as a collective, future-oriented effort to maintain technological continuity and cultural meaning.

Research on media heritage has predominantly focused on institutional practices, often privileging well-funded organisations with the means to maintain specific media objects or archival collections. However, this focus risks overlooking the role played by grassroots initiatives in reconstructing networks of support for obsolete technologies, essential to sustaining the distributed knowledge required for the long-term accessibility of media archives. In this article, we aim to shift the focus beyond institutional frameworks to illuminate the contributions of these 'communities of care', composed of passionate individuals – often former users – who mobilise their expertise in the preservation of declining media technologies.<sup>31</sup>

The two cases presented here highlight the crucial role played by these enthusiasts in activating networks of care supporting obsolete media. Drawing on legacy knowledge and skills from their prior engagements with these technologies, they repurpose and redistribute this expertise to reverse technological obsolescence. This happens in collaboration with broadcast archives, which are often integral part of the network of care, and outside them, where practices of reviving obsolete technologies are part of amateurs' everyday life. These actors range from repairers to collectors of vintage technologies such as radio sets, televisions, and computers. Their motivations are frequently articulated in terms of the need to preserve a vanishing material memory, an urgency rooted in their *attachment* to media technologies and associated practices, which, in turn, evolves into the development of an ethos and concrete practices of care.<sup>32</sup>

These communities thus operate at the intersection of heritage conservation and broader forms of resistance to technological obsolescence. Our analytical approach frames bottom-up initiatives as sociotechnical practices, aiming to trace the material, symbolic, and cognitive-performative elements that emerge through heterogeneous networks of care.<sup>33</sup> We analyse two case studies drawn from distinct research projects, both focused on the care for obsolete technologies, yet articulating this care in different ways and contexts. The first case concerns the preservation of audiovisual heritage on obsolete video formats. It focuses on the U-Matic system, which was the first videocassette format and was widely adopted in broadcasting and other professional fields.<sup>34</sup> The second case examines retrogaming practices, which involve the ongoing use and reconfiguration of obsolete computers and gaming systems.<sup>35</sup> In this context, a device originally developed for broadcasting – the professional CRT video monitor – has been reappropriated and revalued as a core component by gaming enthusiasts. Together, the two cases illustrate how diverse practices and networks of care emerge across different domains, reflecting distinct approaches to the preservation and revitalisation of obsolete media technologies through care work.

### 3 Case Studies

In this article, we adopt a qualitative case study approach to investigate bottom-up practices of care for obsolete broadcast technologies. Grounded in the conceptualisation of care as a sociotechnical practice, the analysis traces the material, symbolic, and performative dimensions through which practices and networks of care emerge around

declining media technologies.<sup>36</sup> The two case studies, while situated in different empirical contexts, explore how actors engage in practices of maintenance, repair, and reappropriation, mobilising knowledge and infrastructures that challenge technological obsolescence.

We adopt qualitative methods, such as short-term ethnography and semi-structured interviews, because they are particularly suited to capture the situated and ‘invisible work’ that characterises maintenance and repair.<sup>37</sup> Ethnography enables the study of material practices in situ, tracing how disruptions are handled through embodied routines and improvisation, while interviews provide access to practitioners’ own accounts of how they make sense of care.<sup>38</sup> This combined approach goes beyond materiality to examine how repair also re-establishes sociotechnical order, how caregivers mobilise networks and negotiate across different domains, and how these practices reveal a broader politics of care, which raises questions about what should be cared for, by whom, and at what scale.<sup>39</sup> In short, qualitative methods uncover repair as inquiry, negotiation, and politics, showing how caregivers reconfigure everyday worlds.

The first case study is based on a short-term ethnography conducted in 2023 in the laboratory of Gabriele Coassin, a former professional video producer and user of U-Matic video equipment.<sup>40</sup> The research focused on Coassin’s role as a ‘caregiver’ of his personal collection and as a key figure in a broader network of care. Drawing on observations and informal conversations, the study documents how former users with professional backgrounds can act as intermediaries between consumers, amateur communities, and cultural institutions, contributing to the preservation and rearticulation of technical knowledge and artefacts across multiple domains.

The second case study draws on qualitative data collected through 18 semi-structured interviews conducted between July 2022 and October 2023 with members of Italian communities dedicated to arcade videogaming. Coin-operated arcade games, once central to digital culture from the 1970s to the 1990s, later declined with the disintegration of supporting networks and practices.<sup>41</sup> In recent years, however, interest in arcade gaming has resurfaced as part of the broader and expanding phenomenon of retrogaming. Interviews traced the trajectories of arcade enthusiasts from early exposure to their current involvement in retrogaming communities, while also examining their associated practices of acquisition, maintenance, repair, use, and circulation. The analysis of this case centres specifically on practices of care developed around professional CRT video monitors, devices originally designed for broadcasting that have come to play a central role within retrogaming communities. These monitors have acquired significant symbolic value and are now considered essential tools for ensuring an ‘authentic’ gaming experience, contributing to the emergence of complex and diversified practices of care.

### 3.1 Caring for the U-Matic

This case study examines the practices of care developed by Gabriele Coassin, a former professional video producer whose work has shifted from media production to preservation. Beginning his career as a photographer and reporter during secondary school, Coassin later collaborated with Venice’s first cable television station and subsequently worked as a cameraman for the Italian public broadcaster RAI. In the late 1970s, he transitioned to electronic video production, building a portfolio spanning documentaries, commercial and experimental films. He currently runs a laboratory offering video digitisation, repair services, and training (see figure 1). Drawing on his expertise as a former professional user, Coassin has become a key figure in the preservation of obsolete video formats, supporting individuals, communities of video enthusiasts and institutions. While his work encompasses various obsolete systems, his expertise is particularly focused on the U-Matic.





Figure 1. Part of Gabriele Coassin's laboratory (photo by G. Coassin).

Released by Sony in 1971, the U-Matic was the first widely adopted videocassette system, replacing open-reel tapes with enclosed  $\frac{3}{4}$ -inch cassettes and offering a more compact, portable, and user-friendly solution for video recording and playback. Although originally intended for home use, the U-Matic quickly became a professional standard in broadcasting, education, corporate communication, and news media, significantly reducing the cost and time of video production.<sup>42</sup> Despite its key role in early video production and hobbyist video culture,<sup>43</sup> U-Matic remains underrepresented in business and media histories, which have predominantly focused on the 'format war' between VHS and Betamax – a rivalry that came to symbolise the emergence of the home video revolution.<sup>44</sup> This marginalisation extends to archival practices as well, where video formats like U-Matic are often neglected, with few exceptions, such as in the preservation of selected media artworks.<sup>45</sup>

At the core of Gabriele Coassin's current engagement with obsolete video technologies lies what he explicitly defines as a 'mission' – a personal imperative to intervene against technological obsolescence. This sense of urgency stems from his refusal to passively witness the disappearance of the tools and knowledge that shaped his professional career. Instead, Coassin has mobilised his expertise to preserve these technologies, framing his work within an ethics of care that informs not only his technical practices but also his broader orientation toward media heritage. As he notes:

These formats document our recent history and allow us to rediscover it, which is why they are so important. The further back in time we go, from hieroglyphics to scrolls, paper and so on, the more durable the materials are. The more recent we go, the less durable they are. So there is an absolute urgency to start recovering the more recent materials.

As Van de Leemput and Van Lente argue, caring for obsolete technologies requires knowledge and action on multiple levels.<sup>46</sup> A central dimension of care involves the implementation of conservation strategies, which include three key components: maintaining and repairing the technical artefacts themselves; maintaining the care network that supports these artefacts; and cultivating a broader environment that ensures their continued functionality.

At object level, care for the U-Matic extends to both the cassette tapes and the devices used for recording, playback, and editing. In the case of cassette tapes, the most common challenges include mould, physical tape breakage, and the so-called ‘sticky-shed syndrome’. Sticky-shed syndrome refers to a chemical deterioration process in which the binder holding the magnetic particles to the tape backing absorbs moisture and becomes tacky, resulting in playback failure, clogged video heads, and damage to both tape and equipment. Addressing these issues requires a combination of technical knowledge, improvised tools, and peer-shared solutions.

Mould contamination is especially concerning, as it not only damages the affected tape but can also spread to other tapes and equipment:

Mould is a disaster because it goes everywhere. If I don't notice it or underestimate it and put the tape inside a VCR, maybe I might be able to read the tape with some problems, but the next tape I put inside gets mould.

To mitigate this risk, Coassin uses a toothbrush with non-abrasive bristles to gently remove surface mould and has constructed a DIY cleaning box equipped with a compressor and a handheld vacuum cleaner (see figure 2). These tools allow for the removal of contaminants, helping to prevent cross-contamination.



Figure 2. On the left, a U-Matic cassette tape contaminated by mould (photo by G. Coassin).  
On the right, Coassin's homemade cleaning box (photo by S. Minniti).

This cleaning process is typically followed by what video enthusiasts refer to as ‘baking’, a controlled heat treatment that eliminates residual moisture and temporarily stabilises degraded tapes. The procedure is essential for making tapes playable and thus suitable for digitisation or transfer. Detailed ‘recipes’ are widely circulated within video enthusiasts’ communities. As Coassin explains:

On average, tapes take 8 hours. You start at room temperature and slowly increase to 50–52°C within an hour. Maintain a constant temperature, fluctuating between 50 and 52 degrees. Then, gradually cool to room temperature for at least one hour. The tape must be digitised within 24 hours in winter or 48 hours in summer. From my observations, this process can slightly alter the signal, so it's best to digitise as soon as possible.

While the International Association of Sound and Audiovisual Archives (IASA) recommends the use of scientific ovens capable of maintaining a stable 50°C,<sup>47</sup> practitioners often rely on DIY solutions such as modified food dehydrators or modified domestic ovens. Coassin, for instance, uses a repurposed consumer oven equipped with a thermostat to ensure precise temperature control throughout the process (see figure 3).





Figure 3. The non-professional oven modified by G. Coassin (photo by S. Minniti).

The repair and maintenance of recording and playback devices require a similar blend of improvised techniques and collaborative expertise. Coassin routinely opens and cleans U-Matic VCRs – some weighing over 30 kg – using printer paper soaked in isopropyl alcohol and a magnifying glass to inspect residue. He also employs a vacuum cleaner to remove fine particles and mitigate dropouts caused by tape oxide deposits.

When devices require more extensive repairs, Coassin relies on a small but committed network of collaborators, including two retired technicians who assist with diagnostics and electronic interventions using professional tools such as oscilloscopes and vectorscopes. This arrangement exemplifies a form of *distributed care* in which former users and professionals collectively mobilise their expertise to preserve declining technologies.<sup>48</sup> Within this care network, knowledge is developed collaboratively, drawing on both individual experience and shared problem-solving. This small group of former users and technicians functions as a ‘connector generation’, maintaining and translating past technologies for contemporary use.<sup>49</sup>

Care practices extend beyond the repair of objects to include the ongoing maintenance of a network capable of sustaining obsolete technologies over time. The importance of this network becomes particularly evident when replacement parts are needed, as the limited or complete unavailability of components often forces Coassin to develop multiple care strategies. These include forging connections with a diverse range of actors, at both national and international levels, as well as accumulating machines from which parts can be extracted. In this context, informal networks are not only sources of knowledge but also crucial infrastructures for material sourcing. Donations play a vital role in this process. As Coassin explains, many organisations are eager to discard obsolete equipment, either because of its bulk or because they no longer ascribe value to it. These differing 'regimes of value' between professional organisations and lay caregivers are central to understanding how resources circulate within the care network.<sup>50</sup>

Donations often arrive from TV stations discharging their analogue equipment. Such gear is often well-maintained and sometimes given away freely by broadcasters keen to offload it. However, these recoveries are not always successful:

One of the mourners of these gifts was the RAI in Venice. When they transitioned from analogue to digital equipment, the director contacted me and said I could come and collect the old stuff. It was a mountain of equipment, beautiful, well-maintained equipment. But at the time I lacked the space, the truck and the manpower to move it all. I asked for more time to find a suitable place, but when I called back he said they had to clear out the warehouse and had thrown everything away.

As broadcasting technologies become obsolete, the storage facilities of media institutions increasingly function as 'provisional spaces of ruination', where outdated equipment accumulates in states of material and functional decline, yet retains the potential for recovery.<sup>51</sup> For activists like Coassin, these spaces constitute strategic opportunities: temporary windows in which still-functional or repairable devices can be salvaged prior to their disposal.

One of Coassin's key strategies is rescuing equipment – often non-functional – and dismantling it for reusable components. As he notes, it is often 'easier to find a recorder board that has always worked, but whose mechanics are ruined, and replace the whole board' than to locate specific electronic parts. To ensure redundancy, he maintains at least two units of each machine:

I was asked for this [U-Matic] by RAI in Naples last autumn. I have two of them but refused to sell one, because I keep at least two machines per type, because if one breaks down, I have parts for the other. And I told them, 'Once you had at least ten [of them],' and they replied, 'Yes, but that was 15 years ago, we threw them all away.' Well done.

Another strategy involves the custom fabrication of components, in which technical collaboration plays a central role. For example, Coassin and a fellow retired technician produce hard-to-find cables using online schematics and salvaged parts, which he describes as 'rustic' cables that do not meet standards.

These bottom-up networks of care effectively replace the formal infrastructures and supply chains that once supported obsolete broadcasting technologies. They exemplify how care can shift from centralised systems to distributed forms of engagement grounded in shared expertise, local resourcefulness, and personal commitment.

The case of Coassin exemplifies how these networks operate and the extent to which their success relies on grassroots initiative. However, the study also reveals the significant challenges involved in establishing and sustaining such networks. These include differences in the symbolic value attributed to obsolete technologies across different actors and contexts, the physical and logistical burdens associated with maintaining, storing and moving bulky equipment, and the complexity of the technical skills required to ensure functionality. Rather than presenting a stable or fully realised infrastructure, the network surrounding Coassin emerges as a fragile, evolving system.

The most significant challenges occur at the ecosystemic level of care, regarding the cultivation of an environment that enables technology persistence.<sup>52</sup> At this scale, Coassin's efforts starkly contrast with the relative institutional neglect surrounding technoscientific heritage, which includes media heritage.<sup>53</sup> As he has recounted on multiple occasions,

he has repeatedly attempted to secure institutional support to transform his archive of photographic and video equipment into a public museum. Yet, despite initial interest from public institutions, shifting political priorities have stalled the project, and his collection remains in a private storage space provided by volunteers. While his workshop actively serves a range of publics – including individual clients, enthusiast communities, and institutions such as the Cineteca di Bologna – his main collection remains confined to a provisional, non-public space, underscoring both the contributions and the precarity of bottom-up preservation efforts.

### 3.2 Caring for CRT Displays

The second case study investigates practices of care in the field of retrogaming, focusing on the maintenance and repair of cathode-ray tube (CRT) displays. These include commercial TV sets, computer monitors, and professional broadcast monitors, which have become central to retrogaming. Retrogaming encompasses a variety of practices that reappropriate past videogame technologies, from home consoles and computer games to coin-operated arcade machines.<sup>54</sup> The study focuses on the latter, examining how arcade videogames have been reappropriated in the Italian context and how this process has given rise to grassroots practices of care.

In recent years, arcade gaming has re-emerged as a key strand of retrogaming, where the reappropriation of obsolete hardware and software is framed as a way ‘to reclaim videogaming from the mainstream’ through forms of ‘hardcore fan resistance’.<sup>55</sup> This resurgence intensified during the COVID-19 pandemic, reflecting a worldwide surge in videogaming.<sup>56</sup> Originally emerging as a grassroots phenomenon driven by users,<sup>57</sup> retrogaming has subsequently attracted interest from major industry actors, such as Nintendo and Sega, who have begun releasing commercial ‘retro’ products.<sup>58</sup>

The reappropriation of arcade videogames has unfolded across multiple dimensions. It began with the development of emulation platforms such as MAME (Multiple Arcade Machine Emulator), which practitioners frame as a collective effort in ‘digital archaeology’ aimed at preserving videogame heritage. Emulation allows games to run on contemporary hardware, making them accessible despite the obsolescence of their original systems. It achieves this by ‘tricking the game code into believing that it is running on the original arcade cabinet’, producing ‘zombie code running without knowledge of its platform’s death’.<sup>59</sup> Following software-based preservation efforts, attention has shifted toward both the reappropriation of arcade cabinets, intended to restore the material and embodied dimensions of play, and the development of new contexts of use that, while different from the original arcades, re-establish the shared, co-present gaming experience now framed in contrast to online multi-playing.<sup>60</sup> Like other retromedia phenomena, this process of reappropriation combines past and present sociotechnical components, involving a dynamic interplay of persistence and innovation.<sup>61</sup>

In this context, CRT displays have become essential, as practitioners believe they uniquely preserve the visual and tactile ‘feeling’ of original arcade gameplay – something that modern LCD screens fail to replicate. As an interviewee explains:

With a system that was as close as possible to the original, you could output from MAME at exactly the same resolution and in the same mode as the actual arcade machine. That was the challenge: interfacing with an old TV or a monitor. Clearly, if you have the same input and deliver the same output, you can achieve the same result. (Francesco, male, 47 y.o.).

The use of CRTs is thus instrumental in ensuring a gameplay experience that is technically and visually faithful to the original, achieving what arcade enthusiasts refer to as ‘arcade perfect’. However, the significance of CRT technology extends beyond visual fidelity:

The *feeling*... if you want to fully awaken the memory as much as possible, you need to have the cabinet, drop the coin, and really feel the moment the credit loads. You need the coin dropping, a cathode-ray tube, and the original [electronic] board. (Emiliano, male, 47 y.o.).



Here, the CRT is not merely a visual interface but a crucial component in the multisensory, affective, and material reconstruction of what is perceived as the ‘authenticity’ of the arcade experience. Even when interviewees reference the technical advantages of CRT technology – such as the capacity to adjust visual parameters in order to better align the image with one’s memory of past gameplay – they frequently emphasise the material and sensory qualities of interaction with CRTs. These displays are often idealised as the ‘Holy Grail’ of gaming:

Pixels were softened on a CRT, whereas on an LCD they become squared off, and that’s a big problem. Another beautiful thing is the colour intensity, the slightly dull glow of the CRT, that luminescence that really makes you remember the old days. The warmth of CRT colours will never compare to the coldness of LCDs... Beyond that, there’s also the 15-kilohertz noise from the monitor, that faint high-pitched whine. And the possibility of tweaking the image – left, right, up or down. The frequency, brightness, contrast, which slightly changes when you move it. For someone who loved that era, this is the Holy Grail. *There can be no videogame without a CRT monitor.* (Carlo, male, 50 y.o.).

The significance of CRT technology is both technical and symbolic: it supports the native resolution and analogue signal formats for which videogames were originally designed, while also embodying a form of technological fidelity that is deeply intertwined with generational memory and affective attachment. However, its continued use presents practical challenges, as CRTs are bulky, fragile, and increasingly scarce. Their maintenance requires specialised skills and access to obsolete components, prompting the emergence of dedicated care practices at multiple levels.

At object level, care for CRT displays entails the maintenance and repair of their most fragile components. A foundational form of intervention is the so-called ‘recap’ of electronic boards, which involves replacing all the capacitors. As one interviewee explains:

Recapping means replacing all the capacitors. Since they’re old, they’ve exhausted the liquid inside and tend not to function properly anymore. By replacing them all, you’re sure that 50% of the components on the board will keep working. (Carlo, male, 50 y.o.).

This form of care is widely performed by practitioners with informal technical knowledge. As one interviewee explained: ‘I don’t have a strong background in electronics, so I’ve limited myself to a more experiential approach’ (Ugo, male, 47 y.o.). In contrast, another interviewee, a former radio and television technician who has since become one of the leading specialists in the repair of obsolete game technology and now serves the entire community, emphasised that ‘real’ repair involves using all the senses to ‘follow the signal through the circuit’s maze’:

Boards may all look alike, but each one has its own specific defect. The technician has to look at it, and by just observing it, he must be able to identify the affected area—because that’s where you need to intervene. You can’t just work on the entire board. So you need to know how to interpret it visually. Then there’s smell, too. When a capacitor leaks its dielectric fluid, it smells like cat urine. And then there’s sound. There are things you need to hear, for instance when a switching activates, there’s an oscillation. I’m 52 now, soon I won’t hear it anymore, but I still do now. (Egidio, male, 52 y.o.).

This account illustrates how care relies on ‘sensible encounters of maintenance’: sensorial explorations through which caregivers carefully scrutinise the state of things.<sup>62</sup>

Another technique adopted by retrogaming enthusiasts to restore the performance of aging CRT displays is known as ‘CRT Rejuvenation’.<sup>63</sup> This process uses a special device to apply a controlled high voltage to the cathode of the tube to remove oxidation and revive electron emission, significantly improving picture brightness and colour clarity and extending the life of degraded tubes:

CRT Rejuvenators are cleaning devices. They connect to the CRT contacts and are calibrated according to the specific type of monitor. Then they apply a voltage higher than the nominal one to the electrodes for a certain period, so that oxidation or any rust particles or other residue that have formed inside the CRT can be



cleared away. It's a bit like polishing yellowed car headlights. That's the idea. The electron gun, which fires the electron beam, needs to be free to operate. If a layer of oxide forms on the front, electricity can't pass through as it used to. That's when you start seeing dim colours, low contrast, blurry images, issues that cause CRT malfunctioning. (Lucio, male, 48 y.o.).

The analysis of such practices reveals notable differences among practitioners in informal repair networks. Those with prior technical expertise – such as the former radio and television technician mentioned earlier – often describe repair as a form of 'research', developing complex interventions and treating each dysfunctional device as unique. This approach resonates with what can be termed the 'Anna Karenina principle': as Jackson observes in relation to repair, 'To repurpose Tolstoy, "All working technologies are alike. All broken technologies are broken in their own way"'.<sup>64</sup> In contrast, less experienced practitioners rely on simpler, more standardised methods. A common example is 'recapping', which involves replacing all the capacitors on a circuit board without conducting an in-depth diagnosis of the individual device. While widespread among enthusiasts with limited expertise, this approach is often criticised by more experienced practitioners, who argue that 'changing components wholesale does not mean restoring' (Ugo, male, 47 y.o.). These divergent approaches highlight the heterogeneity of grassroots care networks, while also showing that all contribute to the persistence of technology.

As with the U-Matic case, the care of CRT displays depends not only on object-level intervention, but also on the maintenance of a support network. The network becomes crucial whenever components are damaged beyond repair and must be substituted rather than restored. Also in this context, practitioners adopt the strategy of acquiring multiple machines to be used as donor parts, as noted by one interviewee: 'Electronic components can still be found, but with great difficulty. You just have to hope to find another board and salvage something from it... use two to make one' (Nunzio, male, 41 y.o.).

Maintenance thus involves the careful management of material stocks alongside relationships with individuals who possess rare parts or expertise. For instance, CRT maintenance often relies on exchanges with professionals and hobbyists at both national and international levels. Several interviewees pointed to a key actor in Spain, 'one of the greatest CRT repairers in Europe', who supplies hard-to-find spare parts: 'We're in touch whenever we need anything' (Lucio, male, 48 y.o.). Another described the vital role of this contact in providing what he called 'the beating heart' of the CRT display, the FlyBack Transformer (FBT):

When that breaks, the whole thing would usually be discarded. Luckily, there's a little company in Spain that still sells replacements, so we can keep buying and replacing them. Once it's replaced, the CRT can last another twenty years. (Carlo, male, 50 y.o.).

International sourcing also extends to China, where producers manufacture 'universal' electronic boards that can substitute for defunct originals:

The main issue with CRTs is that for certain models, you just can't find spare parts. In China, they make electronic boards – those are usually the real problem. In most cases, 95% of the problem is with the electronic boards. These Chinese boards aren't truly universal, but they're compatible with a wide range of CRTs. (Lucio, male, 48 y.o.).

Through these networks, CRT maintenance emerges as a collective, translocal effort rooted in shared cultural values. These infrastructures involve heterogeneous actors, from amateur tinkerers to former broadcasting professionals, each contributing distinct forms of knowledge, skill, labour, and material artefacts. Several community members have turned their expertise into small-scale businesses, offering services such as building or restoring arcade cabinets for individual clients and organisations. Especially since retro gaming communities have begun to reappropriate the materiality of the arcade cabinet – moving beyond mere emulation on modern platforms – multiple forms of 'reinvention' have emerged.<sup>65</sup>

These practices innovatively combine old and new elements to recreate the arcade's sensory experience. A paradigmatic example of such user-driven innovation is the creation of the MAMECAB: a cabinet that replicates the physical structure of traditional arcade machines, while running software provided by MAME, installed on a compact

PC connected to a display (typically a CRT for purists, or an LCD for other end users) and integrated controllers (see figure 4). All components – whether old or new, original or custom-built – are selected to recreate the physical and technical characteristics of classic arcade systems. As stated in a detailed guide to MAMECAB self-construction published on the forum of Italy's largest arcade community, 'replaying the old arcade glories on their cabinet – whether original or generic – is an experience that no other machine can offer'.<sup>66</sup>



Figure 4. A DIY MAMECAB (photos provided by one of the interviewees; used with permission).

While CRTs remain the preferred display technology among 'purists', most MAMECABs are equipped with LCD screens due to their lower cost, easier replacement, and greater availability. To replicate the distinctive visual aesthetics of CRTs – particularly the horizontal scanlines characteristic of analogue raster displays – enthusiasts have developed both software and hardware solutions. Software-based scanline emulators simulate the line structure of CRT imagery on modern displays, enabling a retro-styled visual output. Some practitioners have gone further by engineering custom hardware interfaces to approximate CRT output with greater fidelity:

One of us is a video producer, and together we created an interface device that allows us to reproduce the image as closely as possible on modern TVs. It's not a software filter with fake scanlines, it's a real hardware that recreates pixel-perfect resolution, the blur, and all those details. (Fabrizio, male, 45 y.o.).

These activities show that technological persistence involves a dynamic interplay of memory and innovation, beyond mere conservation. In this respect, innovation and obsolescence can be understood as reconfigurations of sociotechnical practices, where continuity and discontinuity coexist.<sup>67</sup> In the case examined here, this process is visible in how arcade videogames have acquired renewed meaning through contrast with contemporary gaming, getting imbued with an aura of 'authenticity', as well as in the innovative practices that surround them. It is equally evident in how grassroots practices



have integrated technical objects from outside the original domain of gaming. Among these, professional broadcast monitors have acquired a particularly elevated status within retrogaming communities due to their advanced image control capabilities, which are absent in commercial CRT displays (see figure 5).



Figure 5. A Sony broadcast monitor used to play an arcade video game on a DIY device (photo provided by one of the interviewees; used with permission).

These features make them especially valuable for testing game boards and for reproducing the visual characteristics of vintage videogames with the highest possible fidelity. As one interviewee explains:

The most sought-after models are studio monitors like the Sony PVM and BVM. They were primarily used in TV studios, because they're reference monitors. If properly calibrated, the colours you see are exactly the ones you're transmitting. For a TV station, controlling the output was crucial. They were also used in old medical equipment... These were true professional monitors. No one, not even the biggest spender, would have bought one of these as a home television back in the day. But they produce an amazing image, and their discovery came much later. (Alvise, male, 42 y.o.).

This ability to integrate and repurpose heterogeneous objects points to the ecosystemic dimension of care. Compared to the U-Matic case, communities devoted to CRT and arcade videogames have developed a more robust ecosystem around obsolete media. The global consolidation of retrogaming has fostered a dense support infrastructure for its reappropriation. Since the early 2000s, this infrastructure has enabled a wide community of practitioners to recognise the value of past technologies and engage in complex practices that combine preservation with innovation. This is evident not only in the reframing of arcade videogames as 'authentic' counterpoints to contemporary games, but also in the emergence of new practices that integrate components from different temporal and technical contexts. This integrative capacity reflects the ecosystem's resilience and fragility. Despite its vibrancy, the Italian context remains overall marked by institutional neglect of videogame heritage. In response, enthusiasts have established grassroots organisations and volunteer-run spaces – such as the Museum of Electronic Entertainment in Avezzano, and the Videogame Art Museum in Bologna – dedicated to preserving this heritage. Ecosystemic care involves navigating a fundamental paradox: sustaining a technology that is materially and affectively valuable, while acknowledging its finite and entropic material basis. As one interviewee observed:

We really hope that someone will start producing this technology again. It's difficult because CRTs contain very expensive components, like copper. We hope someone resumes production, otherwise the situation will be dramatic. CRTs are polluting, can't be repaired easily, and involve very high voltages... The purist, noble as their intent may be, will never be fully satisfied. A compromise will always be necessary. In this case, the compromise is the LCD monitor, the conversion, the little computer that replaces the arcade hardware... (Fabrizio, male, 45 y.o.).

As shown across both case studies, care for obsolete technologies is both retrospective, aiming to preserve access to the past, and prospective, anticipating future scarcity, failure, and potential extinction. Grassroots ecosystems demonstrate resilience in sustaining these technologies, yet their reliance on scarce resources and limited institutional support make them inherently fragile.

## 4 Conclusion

This paper examined grassroots practices of care for obsolete broadcast technologies through two case studies: the preservation of U-Matic video system and the reappropriation of CRT displays within retrogaming communities. By analysing the three dimensions of care – objects, networks, and ecosystems – we have highlighted how actors who operate outside formal institutions engage in complex practices to sustain declining technologies. Former users, professionals, and amateurs develop strong 'attachment' to the technologies they once used, often turning this affective bond into a mission to resist obsolescence. In doing so, these actors cultivate an ethics of care that informs both their technical engagements and their broader commitment to media preservation. Through hands-on practices, improvised infrastructures, and the formation of distributed support networks, they articulate alternative trajectories for the survival of technoscientific heritage, complementing institutional preservation frameworks.



At object level, ensuring access to obsolete media requires a complex interplay of technical interventions, material engagement, and knowledge circulation. While both case studies reveal the importance of keeping ageing technologies operational, they do so in distinct ways. In the case of U-Matic, care practices are directed primarily toward preserving the material and technical functionality of devices and cassettes in order to recover and render audiovisual content accessible. In contrast, care for CRT displays in the context of retrogaming centres less on content retrieval and more on the reconstruction of an embodied and affective experience of play. Here, the aim is not only to maintain devices but to recreate the sensory fidelity of arcade gaming, often through innovative user-led developments in both hardware and software.

Despite these differences in orientation – archival access versus experiential authenticity – the two cases converge in their reliance on heterogeneous forms of knowledge. In both domains, care is enacted by a ‘connector generation’ who draw on layered epistemologies cultivated through past and ongoing engagements with obsolete media. This connective role extends beyond material preservation: it also involves transmitting the specific ‘media grammars’<sup>68</sup> acquired during the period of mass use to younger generations, shaping how new actors engage with these technologies. Research on retrogaming shows that extending the life of obsolete technologies through grassroots practices creates sites of intergenerational encounter – and sometimes tension – where the media grammars of older and younger actors intersect<sup>69</sup>. For example, arcade enthusiasts report friction when younger users, unfamiliar with the ‘golden age’ of arcades but accustomed to modern consoles, expect touchscreen functionality or use controllers according to contemporary logics. From this perspective, past knowledge, embodied in media grammars and shaping users’ performance, is crucial for negotiating the use and meaning of ‘revived’ technologies.

However, the knowledge mobilised in practices of care is not solely rooted in the past. From an analytical standpoint, and drawing on concepts with different disciplinary origins but valuable for heuristic purposes, we can distinguish three main forms of knowledge emerging from the case studies: ‘legacy knowledge’, coming from past use;<sup>70</sup> ‘experiential knowledge’, developed through hands-on tinkering;<sup>71</sup> and ‘networked knowledge’, shared among peers and emerging from networks of actors, institutions, and technologies rather than individual actants. Taken together, these forms of knowledge provide a useful framework for describing the maintenance and repair of obsolete technologies in their empirical complexity.

Such forms of expertise are not static repositories but what can be defined as a dynamic process of ‘learning by caring’,<sup>72</sup> continuously refined through material encounters with deteriorating technology. The absence of comprehensive documentation and the idiosyncrasies of ageing formats often necessitate improvisation and adaptation, turning maintenance into a space of experimental problem-solving. Whether dealing with the complex interplay of outdated video standards or the fragility of CRT components, practitioners must navigate uncertainty with an embodied and situated mode of knowing – one that resists formalisation yet proves essential for technological persistence.

In terms of networks, both cases reveal how actors engage in distributed and heterogeneous communities of care, developing strategies that are not only technical but profoundly relational. In both contexts, practitioners mobilise networked practices of care aimed at building and sustaining connections – among people, knowledge, and materials. These strategies often involve the identification, recovery, and repurposing of components and devices extracted from ‘provisional spaces of ruination’ where obsolete technologies accumulate in states of neglect. Rather than viewing these spaces as endpoints of technological decline, caregivers treat them as latent resources to be reactivated and re-integrated.

However, the two cases differ in the density and resilience of their respective networks. The network supporting U-Matic preservation tends to be smaller, more fragmented, and highly dependent on localised forms of knowledge exchange and material circulation. Its continuity often hinges on a limited number of key actors. By contrast, retrogaming communities have developed more robust, transnational infrastructures. These differences shape the sustainability of care networks, with broader implications for the long-term viability of the practices they support.

At the ecosystemic level, the contrast between the two cases becomes more pronounced. Both ecosystems are resilient yet fragile. U-Matic preservation efforts have fostered some collaboration with institutions, yet they remain largely unsupported, revealing tensions in how different actors assign value to obsolete technologies. These conflicting ‘regimes of value’ shape the circulation and potential patrimonialisation of obsolete media. Conversely, retrogaming has gained a degree of cultural legitimacy, generating hybrid innovations and drawing interest through community-led museums and other initiatives. Nevertheless, the divide between institutional and grassroots practices is not clear-cut; rather, they are often complementary. Several archives and museums have in fact emerged from bottom-up initiatives, suggesting that, in the case of restoring storage media, the boundary between institutional and vernacular care is more fluid than it may appear in other contexts, such as fine arts restoration. ‘Amateur expertise’ proves fundamental to institutional conservation and restoration, since heritage professionals often lack the legacy, experiential, and networked knowledge that grassroots actors have accumulated over years of practice and attachment to storage media – whether or not originally related to their patrimonialisation.<sup>73</sup>

What emerges is that care for past technologies is not merely preservational but generative. It produces new social configurations, rearticulates knowledge hierarchies, and forges alternative trajectories for technological persistence. While these ecosystems remain fragile – undermined by resource scarcity, institutional inertia, and the material finitude of obsolete media – they also underscore the capacity of grassroots actors to reimagine media heritage in ways that resist dominant narratives of innovation and obsolescence.

This study’s scope is limited by its focus on the Italian context, which is characterised by distinctive institutional frameworks and cultural orientation towards media and technoscientific heritage. Nonetheless, the analysis offers valuable insights into broader sociotechnical configurations of care, especially in contexts where responsibilities for preservation are unevenly allocated and often situated outside formal institutions. As the two case studies illustrate, caring for obsolete technologies is intrinsically dual in orientation: retrospective in its efforts to safeguard access to the past, and prospective in its anticipation of material degradation and potential disappearance. This underscores the paradoxical coexistence of vitality and fragility within bottom-up ecosystems of care.

## Acknowledgments

Whilst the article has been collaboratively discussed and structured, in line with Italian academic conventions, the authors acknowledge that Roberta Spada authored Sections 1, 2, 2.1, and 2.2, and Sergio Minniti authored Sections 3, 3.1, 3.2, and 4.

## Notes

1. Katharina Niemeyer and Valérie Schafer, Stocker. “Penser et placer le stockage au cœur des pratiques médiatiques et communicationnelles”, *Le Temps des médias* 39, fasc. 2 (2022): 6–14.
2. Andreas Fickers and Annie van den Oever, *Doing Experimental Media Archaeology: Theory* (De Gruyter, 2022), 4; 23–25, <https://doi.org/10.1515/9783110799774>; Nick Hall and John Ellis, eds., *Hands on Media History: A New Methodology in the Humanities and Social Sciences* (London: Routledge, 2020).
3. These projects were personal, non-funded research initiatives undertaken by Sergio Minniti through qualitative fieldwork and interviews, building on a line of inquiry into obsolete media technologies developed over more than a decade.
4. Fabrizio Magnani, “Le documentazioni audiovisive nelle schede di catalogo per i beni culturali demoetnoantropologici”, in *Le voci, le opere e le cose: la catalogazione dei beni culturali demoetnoantropologici*, ed. Roberta Tucci (Roma: Ministero dei beni e delle attività culturali e del turismo, 2018).
5. Laurier Turgeon and Yves Bergeron, “Heritage”, in *ICOM Dictionary of Museology*, ed. François Mairesse (London: Routledge, 2023).

6. Simone Natale, Ross Perry and Petrina Foti, *Narrating Histories of Computing and Digital Media in Museum Environments* (Loughborough: Centre for Research in Communication and Culture, Loughborough University, 2022), 36.
7. Zahar Koretsky, Peter Stegmaier, Bruno Turnheim and Harro van Lente, eds., *Technologies in Decline: Socio-Technical Approaches to Discontinuation and Destabilisation* (London: Routledge, 2022).
8. Peter Stegmaier, "Conceptual Aspects of Discontinuation Governance", in *Technologies in Decline: Socio-Technical Approaches to Discontinuation and Destabilisation*, eds. Zahar Koretsky et al. (London: Routledge, 2022), 95–96.
9. Koretsky et al., *Technologies in Decline*.
10. Stefan Krebs and Heike Weber, eds., *The Persistence of Technology: Histories of Repair, Reuse and Disposal* (Bielefeld: transcript Verlag, 2022), 17–18.
11. Francesco Schiavone, *Communities of Practice and Vintage Innovation: A Strategic Reaction to Technological Change* (New York: Springer, 2014), 51–59.
12. Christina Lindsay, "From the Shadows: Users as Designers, Producers, Marketers, Distributors, and Technical Support," in *How Users Matter: The Co-Construction of Users and Technologies*, eds. Nelly Oudshoorn and Trevor Pinch (Cambridge: MIT Press, 2003).
13. Paolo Magaudda and Sergio Minniti, "Retromedia-in-Practice: A Practice Theory Approach for Rethinking Old and New Media Technologies", *Convergence* 25, 4 (2019): 673–693.
14. David N. Lucsko, "'Proof of Life': Restoration and Old-Car Patina", in *The Persistence of Technology: Histories of Repair, Reuse and Disposal*, eds. Stefan Krebs and Heike Weber (Bielefeld: transcript Verlag, 2022).
15. Sergio Minniti, "'Buy Film Not Megapixels': The Role of Analogue Cameras in the Rematerialization of Photography and the Configuration of Resistant Amateurism", in *The Camera as Actor*, ed. Amy Cox Hall (London: Routledge, 2020), 79–102.
16. Sergio Minniti, "'Vade retro, gamer!' La riappropriazione creativa del videogioco arcade in Italia", *Studi culturali* 21, 3 (2024), 301–328.
17. Mark Thomas Young and Mark Coeckelbergh, "Keeping Things Going: Maintenance and Philosophy of Technology", in *Maintenance and Philosophy of Technology*, eds. Mark Thomas Young and Mark Coeckelbergh (London: Routledge, 2024), 15.
18. Jérôme Denis and David Pontille, "Material Ordering and the Care of Things", *Science, Technology, & Human Values* 40, 3 (2015): 16.
19. Krebs and Weber, *The Persistence of Technology*.
20. Christopher R. Henke, "The Mechanics of Workplace Order: Toward a Sociology of Repair", *Berkeley Journal of Sociology* 44 (1999): 55–81.
21. Anna Woodham, Rhianedd Smith and Alison Hess, eds., *Exploring Emotion, Care, and Enthusiasm in "Unloved" Museum Collections* (Amsterdam: Amsterdam University Press, 2020); Nuala Morse, *The Museum as a Space of Social Care* (Abingdon and New York: Routledge, 2021); Jennifer Newell, Libby Robin, and Kirsten Wehner, eds., *Curating the Future: Museums, Communities and Climate Change*, Routledge Environmental Humanities (Abingdon and New York: Routledge, 2017).
22. Fernando Domínguez Rubio, *Still Life: Ecologies of the Modern Imagination at the Art Museum* (Chicago: University of Chicago Press, 2020).
23. Domínguez Rubio, *Still Life*, 301–324.
24. Domínguez Rubio, *Still Life*, 304.
25. Dirk van de Leemput and Harro van Lente, "Caring for Decline. The Case of 16mm Film Artworks of Tacita Dean", in *Technologies in Decline: Socio-Technical Approaches to Discontinuation and Destabilisation*, eds. Zahar Koretsky et al. (London: Routledge, 2022), 186–187.
26. Viv Golding, "Collaborative Museums: Curators, Communities, Collections", in *Museums and Communities: Curators, Collections and Collaboration*, ed. Viv Golding and Wayne Modest (London and New York: Bloomsbury Academic, 2013), 13–31; Bernadette T. Lynch and Samuel J.M.M. Alberti, "Legacies of Prejudice: Racism, Co-Production and Radical Trust in the Museum", *Museum Management and Curatorship* 25, no. 1 (2010): 13–35; Markus Tauschek, "Imaginations, Constructions and Constraints: Some Concluding Remarks on Heritage, Community and Participation", in *Between Imagined Communities and Communities of Practice: Participation, Territory and the Making of Heritage*, eds. Nicolas Adell, Regina F. Bendix, Chiara Bortolotto and Markus Tauschek (Göttingen: Universitätsverlag Göttingen, 2015), 291–306.
27. "Museum Definition", ICOM, 2021, <https://icom.museum/en/resources/standards-guidelines/museum-definition/>.
28. In line with Woodham et al., we approach the term 'amateur' not in its common derogatory sense, but as a category that challenges assumptions about who is entitled to 'care' for collections. Woodham et al., *Exploring Emotion, Care, and Enthusiasm in "Unloved" Museum Collections*, 11–13.
29. Emilie Gomart and Antoine Hennion, "A Sociology of Attachment: Music Amateurs, Drug Users", *The Sociological Review* 47, S1 (1999): 220–247.
30. Van de Leemput and Van Lente, "Caring for Decline. The Case of 16mm Film Artworks of Tacita Dean".
31. Woodham et al., *Exploring Emotion, Care, and Enthusiasm in "Unloved" Museum Collections*.
32. Gomart and Hennion, "A Sociology of Attachment".



33. Elizabeth Shove, Mika Pantzar and Matt Watson, *The Dynamics of Social Practice: Everyday Life and How It Changes* (London: Sage, 2012).
34. Joshua M. Greenberg, *From Betamax to Blockbuster: Video Stores and the Invention of Movies on Video* (Cambridge: MIT Press, 2010).
35. Michael Thomasson, "Retrogaming", in *The Routledge Companion to Video Game Studies* (Routledge, 2014).
36. Shove et al., *The Dynamics of Social Practice*.
37. Henke, "The Mechanics of Workplace Order: Toward a Sociology of Repair", 69–74.
38. Philippe Sormani, Alain Bovet and Ignaz Strebel, "Introduction: When Things Break Down", in *Repair Work Ethnographies: Revisiting Breakdown, Relocating Materiality*, eds. Ignaz Strebel, Alain Bovet and Philippe Sormani (Singapore: Springer Nature, 2019), 1–27.
39. Christopher R. Henke, "Negotiating Repair: The Infrastructural Contexts of Practice and Power", in *Repair Work Ethnographies: Revisiting Breakdown, Relocating Materiality*, eds. Ignaz Strebel, Alain Bovet and Philippe Sormani (Singapore: Springer Nature, 2019), 255–282.
40. Sarah Pink and Jennie Morgan, "Short-Term Ethnography: Intense Routes to Knowing", *Symbolic Interaction* 36, 3 (2013): 351–361.
41. James Newman, *Best Before: Videogames, Supersession and Obsolescence* (London: Routledge, 2012).
42. Nick Lyons, *The Sony Vision* (New York: Crown Publishers, 1976), 150.
43. Greenberg, *From Betamax to Blockbuster*, 18–29.
44. Michael A. Cusumano, Yiorgos Mylonadis and Richard S. Rosenbloom, "Strategic Maneuvering and Mass-Market Dynamics: The Triumph of VHS over Beta", *The Business History Review* 66, 1 (1992): 51–94.
45. Lisa Conte et al., "Overcoming Obsolescence: The Examination, Documentation, and Preservation of Nam June Paik's TV Cello", *The Electronic Media Review* 2 (2013): 1–9.
46. Van de Leemput and Van Lente, "Caring for Decline. The Case of 16mm Film Artworks of Tacita Dean".
47. C. Fleischhauer and K. Bradley, *Guidelines for the Preservation of Video Recordings*, London, IASA-TC 06 (IASA, 2019), [https://www.iasa-web.org/sites/default/files/publications/IASA-TC\\_06-C\\_v2019.pdf](https://www.iasa-web.org/sites/default/files/publications/IASA-TC_06-C_v2019.pdf).
48. Christophe Lejeune, "Interruptions, Lunch Talks, and Support Circles: An Ethnography of Collective Repair in Steam Locomotive Restoration", in *Repair Work Ethnographies: Revisiting Breakdown, Relocating Materiality*, eds. Ignaz Strebel, Alain Bovet and Philippe Sormani (Singapore: Springer Nature, 2019), 221–251.
49. Jonathan Openshaw, *Postdigital Artisans: Craftsmanship with a New Aesthetic in Fashion, Art, Design and Architecture* (Amsterdam: Frame Publishers, 2015).
50. Arjun Appadurai, ed., *The Social Life of Things: Commodities in Cultural Perspective*, (Cambridge: Cambridge University Press, 1988), 4.
51. Eduardo H. Luersen and Mathias Fuchs, "Ruins of Excess: Computer Game Images and the Rendering of Technological Obsolescence", *Games and Culture* 16, 8 (2021): 1087–1110.
52. van de Leemput and van Lente, "Caring for Decline. The Case of 16mm Film Artworks of Tacita Dean".
53. As underlined by many Italian scholars and practitioners in history of science and technology and in museum and heritage studies of technoscience, the Italian heritage landscape has been predominantly focused on artistic and archaeological heritage, which has historically been considered as something to safeguard and valorise much before technoscientific heritage. See, for instance: Elena Canadelli, "Per la storia di un 'eccetera'. Patrimonio e musei scientifici in Italia", in *Da cimeli a beni culturali. Fonti per una storia del patrimonio scientifico italiano*, eds. Elena Canadelli and Paola Bernadette Di Lieto (Milano: Editrice Bibliografica, 2024), 11–23.
54. Thomasson, "Retrogaming".
55. James Newman, *Videogames* (London: Routledge, 2004), 53.
56. Oliver Pretl-Drummond, "How COVID Broke the Retro Game Market", *Yahoo! Life*, April 30, 2021, <https://www.yahoo.com/lifestyle/covid-broke-retro-game-market-200733764.html>.
57. Zach Whalen and Laurie N. Taylor, eds., *Playing the Past: History and Nostalgia in Video Games* (Nashville: Vanderbilt University Press, 2008).
58. Jennifer Scott, "Retro gaming: Why players are returning to the classics", *BBC*, June 28, 2017, <https://www.bbc.com/news/uk-40427838>.
59. David Murphy, "Hacking Public Memory: Understanding the Multiple Arcade Machine Emulator", *Games and Culture* 8, 1 (2013), 44–45.
60. Minniti, "Vade retro, gamer!".
61. Magaudo and Minniti, "Retromedia-in-Practice".
62. Jérôme Denis and David Pontille, "Cultivating Attention to Fragility: The Sensible Encounters of Maintenance", in *Ecological Reparation. Repair, Remediation and Resurgence in Social and Environmental Conflict*, eds. Dimitris Papadopoulos, Maria Puig de la Bellacasa and Maddalena Tacchetti (Bristol: Bristol University Press, 2023), 344–361.
63. Tim Owens, "CRT Rejuvenation", *Throw Out The Manual*, February 18, 2020, <https://blog.timowens.io/crt-rejuvenation/>.

64. Steven J. Jackson, "Rethinking Repair", in *Media Technologies: Essays on Communication, Materiality, and Society*, eds. Tarleton Gillespie, Pablo J. Boczkowski and Kirsten A. Foot (Cambridge: MIT Press, 2014), 228.
65. Minniti, "Vade retro, gamer!"
66. Arcadeltalia, "Guida al MAMECAB" [Guide to the MAMECAB], <http://wp.arcadeitalia.net/guida-al-mamecab/>.
67. Magaudda and Minniti, "Retromedia-in-Practice".
68. Gary Gumpert and Robert Cathcart, "Media Grammars, Generations and Media Gaps", in *Critical Studies in Mass Communication* 2, 1 (1985): 23–35.
69. Minniti, "Vade retro, gamer!"
70. The notion of 'legacy knowledge', originating in management and organization studies, broadly refers to the body of knowledge and practices accumulated by workers in a given business over time and passed on to younger colleagues. This transmission forms the core knowledge upon which new experiences are built. See, for instance: "Capturing knowledge legacy: passing on staff knowledge", in *Practical Knowledge and Information Management*, eds. Katharine Schopflin and Matt Walsh (London: Facet, 2018), 91–107.
71. The STS approach has extensively problematised the implicit epistemic hierarchy between theoretical knowledge (typically held and mobilised by recognised experts) and experiential knowledge, which is increasingly acknowledged as a form of authoritative knowledge in its own right. See, for instance: Brian Wynne, "May the Sheep Safely Graze? A Reflexive View of the Expert–Lay Knowledge Divide", in *Risk, Environment and Modernity: Towards a New Ecology*, eds. Scott Lash, Bronislaw Szerszynski and Brian Wynne (London: Sage, 1998), 44–83.
72. The notion of 'learning by caring' draws from Nathan Rosenberg's concept of 'learning by using', which he introduced to describe how users acquire knowledge through direct engagement with complex technological systems over time. See: Nathan Rosenberg, *Inside the Black Box: Technology and Economics* (Cambridge: Cambridge University Press, 1982).
73. It is also important to consider that such interaction between institutionalised and amateur figures may raise ethical concerns regarding the potential abuse of voluntary labour in heritage institutions. While this issue lies beyond the scope of this article and is not reflected in our empirical results, it nevertheless signals the ambivalence of care and calls for a thorough reflection on how museums, archives, and libraries that rely on amateur expertise can balance caring for collections and caring for communities. See, for instance: Morse, *The Museum as a Space of Social Care*.

## Biographies

**Sergio Minniti** is Senior Assistant Professor in the Department of Humanities and Social Sciences at Universitas Mercatorum in Rome, where he teaches Sociology of Digital Media. His research interests lie in the fields of Science and Technology Studies (STS) and Media Studies, with a critical focus on innovation processes.

**Roberta Spada** is postdoctoral research fellow at the University of Padua (Italy). She obtained her PhD in 2024 at Politecnico di Milano and the Museo Nazionale Scienza e Tecnologia Leonardo da Vinci with a dissertation on radio objects from 1930s Italy and the role of artefacts in science museums in constructing narratives about the media history. She is interested in the role of science and technology museums and heritage in the public performance of science, technology, and their history.