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Keywords
media archaeology; network-based art conservation; internet art; telematic art; dead media; second original

In the spring of 2015, the Avignon-based ‘Preservation & Art—Media Archaeology Lab’ (PAMAL) 1 organised an exhibition entitled Une archéologie des média 2. Upon entering the space, the visitor would discover a piece of internet art from 1997, Les Secrets, by Nicolas Frespech. At the time of its creation the work had been bought by the-then Languedoc-Roussillon Regional Contemporary Art Fund (FRAC), and consisted in asking web users to share their secrets via a website. However, when a secret is distributed across the internet, it is no longer a secret and this revelation marked the beginning of what became a politicised news story in the south of France with the right-wing Front National deeming the work ‘immoral’. Given the party’s position in the Languedoc-Roussillon regional council, the website was shut down in 2001 and the company hosting the website deleted the data without creating a backup file. Thus visitors to the 2015 exhibition who expected to see Frespech’s work were instead directed to a web page with the message: ‘NOT FOUND. The requested URL/secrets was not found on this server’.3

What remains of this artwork today? There is not much left of Les Secrets insofar as a website’s conservation implies at least the preservation of the domain name and some kind of data retention—in this case the original website is no longer available and, more importantly, it cannot receive any new secrets. The 2015 PAMAL exhibition presented screenshots gathered by Internet Archive web crawlers at the time of censorship (including articles, blogs etc.).4 and this served as documentation to give both an overview of the website and how its database had been shut down. Such a story doesn’t only amount to political censorship, it also reveals the extent to which an institutional structure was incapable of understanding internet art. At the time of the purchase of the artwork, the artist had delivered an object—a CD-ROM and a ZIP disk—at FRAC’s request, but those files did not include the database, which was fed by the contributions of web users. Thus the original artwork has irrevocably died. However, the website was replicated or, to be more precise, encapsulated, on a server in Lyon in 2001, so that while this version of the artwork is no longer functional, it has been frozen at a particular point in time which gives at least some insight into the artwork. And to complement this, the 2015 exhibition by PAMAL was conceived to document the demise and disappearance of Les Secrets.

This case raises many questions: how should network-based artwork be best preserved? Does the loss of internet-gathered data lead to the artwork’s immediate destruction or to a temporary break in its visibility? For whom is the proper preservation of the last data-version important? Could we even say that the extant documentation of Les Secrets, made as exhaustive as possible, now constitutes the artwork?

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1 The PAMAL (Preservation & Art—Media Archaeology Lab) is a research unit, founded in 2013 and based at the Ecole Supérieure d’Art d’Avignon (France), http://pamal.org (accessed 15 January 2017).


This paper focusses on the concept of the ‘second original’. A second original is a duplication, for archival purposes, of a lost or non-functional digital art piece, produced as the closest approximation possible of the initial material production conditions, including hardware, software and user experience.

As we shall see, the concept of the second original challenges the theoretical context where the preservation of digital art is centred on a model of performance, which is, in effect, an immaterial conception of art.

Network-based art as ephemeral art

In the account that follows the aim is to understand how contemporary art's key stakeholders, including artists, curators and conservators, discuss network-based art preservation. One useful resource is the frequent exchanges made on the JISCMail New-Media-Curating mailing list, an international forum for those involved in curating, exhibiting, archiving or interpreting new media art and, as such, this will constitute our main corpus. The caveat here is that this article is not designed to provide a thorough review of the questions related to the conservation of media-technical art, of which network-based art is part, nor does the paper purport to give an overview of the field's theoretical history. Rather, the use of a mailing list here presents a platform that makes visible the various fluid and spontaneous responses on areas of the subject where protagonists not only cover various positions, but reveal the presuppositions behind their thinking. Its use here is thus conceived as revealing something not only of the way the various stakeholders understand the nature of digital art and media but to emphasise how any concept of digital art preservation is based on a certain number of assumptions that need to be addressed.

Between 14 November 2016 and 31 January 2017, a discussion took place on the list themed as ‘Methods for studying the (after)lives of Internet art’.

Respondents included several actors in the field of network art conservation in the Anglo-Saxon world and the discussion was initiated by Karin de Wild, a curator and art historian with a special interest in the influence of digital technology on art. As highlighted by de Wild in her introduction, not only is internet art—and the art of the network in general—conceived of as a poor relation in art history, but it is also often forgotten in digital media art studies. At a time when Rhizome, one of the most well-known institutions for the dissemination of internet art, published an online Net Art Anthology, de Wild asked the unequivocal question that ‘despite a work of net art's many manifestations, is it possible to formulate a list of key elements, which need to be studied in detail, to get a better understanding of (the lives and afterlives of) pioneering online artworks?’ Lives and afterlives! Such a phrase was a revelation to the authors here. Network artworks are ephemeral. Yet the issue raised demands thinking about their forthcoming lives rather than preserving any works as they are.

In the ensuing discussion the artist Simon Biggs reviewed the very relevance of preserving these works. He reminded us that internet art—at least in the 1990s—was particular in that its vocation was to escape any idea of preservation as

‘many artists who chose to work with the internet and related media in the late 80s and early 90s did so as they wished to make work and operate in a context that was not canonised and they considered resistant to such a process.’

According to Biggs, since internet artworks are founded on a time-based medium, they are necessarily ephemeral. The reason preservation has become a question today is because institutions have recently taken an interest in canonising such artwork. Biggs contests that the work itself cannot be conserved: ‘the outcome is the museum conserving a shadow of
the work, not the work itself. This is what museums have always done—conserve cultural ghosts, the life sucked out of them by the process of canonisation’.8

What Biggs raises here is that the question of network-based art preservation is a new one. Most of the ‘pioneers’ of internet art did not create their artworks in order to become canonised as art, but rather to resist canonisation. Some public form of the internet has existed since the early 1980s, including the Minitel network in France and Brazil (see Fig. 1) and later Tim Berners Lee’s World Wide Web (WWW), which was put into the public domain in 1993. From 1994, internet artists have claimed that the network is both a medium and a place for the public diffusion of art and, contrary to conventional wisdom, the internet involves ‘cybertime’, that is, the time taken to operate across three timescales: human to machine time; machine(s) to machine(s) time, which is the time taken in inter-machine communication and data processing; and machinic-obsolescence, the gradual redundancy inherent in infrastructures, hardware and software. So network-based art is resolutely time-based art.

Media theorist Dieter Daniels was surprised by the idea of internet art preservation, especially as such art is now being variously described as ‘post internet art’.9 Daniels suggested because of how the pervasiveness of digital technologies and networks have become driving forces in all aspects of our lives that ‘for “digital natives” the idea of preservation seems not to be relevant: online content is in “the Cloud” … outsourced to major companies such as Google (including Youtube), Facebook, Apple etc. …’. At the inception of internet art the notion of preservation was never considered as such art was thought of as process-based and standing in opposition to any form of commodification, and so any form of preservation: ‘the single artwork loses its contextualization, sometimes even its sense, and the look-and-feel of its time’.10

However the discourse has changed. It might be that now any artwork, however ephemeral, can be preserved. The multi-media artist Shu-Lea

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9 Karin De Wild, email to JISCmail New-Media-Curating mailing list (CRUMB), 14 November 2016.
Cheang noted that, while many of her artworks from those ‘pioneering’ years of the 1990s had disappeared, the pieces still available were actually re-created and adapted to the current WWW.11 And in answer to Biggs, the curator Annet Dekker12 highlighted that beyond any institutional mission to preserve collections it was important to transmit both history and narratives around internet art and that preservation was thus important in doing this.13 So questions of preservation now feature heavily in the minds of the various stakeholders involved in internet art, especially at a time when several pioneers have passed away, taking with them their knowledge and secrets. It now seems imperative to think about the preservation of and access to this remarkable artistic and network cultural output from the 1980s to the 2000s and, although these works of art no longer exist, their ‘memory’ is essential to today’s world of creation, underwritten as it is by the culture of digital media technologies.

Preserving network-based arts in the same way as performance art?

Richard Rinehart, a new media art curator, thought that the issue could include new media art in general. For Rinehart, as with Biggs and Daniels, the question of context is crucial, but he sees in it a form of positivity. While digital art (and its meaning) is based on the triple articulation of economy, techno-industry and culture to form the context of the artwork, this articulation can also be used to justify the argument that preserving these works is necessarily contingent upon their re-interpretation, given the new context in which we find ourselves.14 Annet Dekker concurred, writing that for all artworks, digital or otherwise,

‘if’s usually only after time has passed and based on any number of reasons (sentimental, economic, political, social, or historical) that some artists (or curators or conservators) try to capture what is left (or what was never said, or what they wanted to have said before).15

Jon Ippolito suggested that the original artwork can be considered as either a recording or as a score in view of the ‘re-interpretation’ that takes place in any re-creation, thus bringing internet art closer to performance art in terms of its preservation. More precisely, in terms of their preservation the concept of artworks as scores encourages emulation and re-interpretation, whereas recordings encourage storage and migration.16 That is why, as with performance art, documentation and archival work are considered as decisive factors for digital art preservation.17

The idea that the preservation of performance art can be used as a preservation model for network-based art (and digital art in general) has been widely discussed since 2000 and was notably developed in an influential 2006 article by Pip Laurenson.18 Addressing the three fundamental concepts of ‘traditional’ conservation-restoration—authenticity, change and loss—Laurenson demonstrated how media-technical art (i.e. video, audio, slides, computer-based arts) is time-based in a similar way to music and that the related models of score and interpretation can be used to ‘determine what, in the identity of such works, is important to preserve’. Fundamentally, as ‘time-based media works of art are installed events and are like allographic works in that they are created in two phases’, their preservation goes beyond the idea of object as the artwork includes, with regard to each installation, the artist’s instructions, the documentation and an informed knowledge of its production context so that such an artwork can be iterated again and again in many different ways with respect to its author.

Laurenson’s paper revealed the now mainstream idea that the preservation of performance art informs digital art preservation. This is due in

13 Annet Dekker, New-Media-Curating list, 8 December 2016.
15 Dekker, New-Media-Curating list, 8 December 2016.
16 Ippolito, New-Media-Curating list, 20 December 2016. For an overview of methods used in the conservation of digital art, including emulation and migration, see, for example https://digitalis.pamal.org (accessed 15 January 2017).
part to the notion of what is called ‘code performativity’.

In 2005, Richard Rinehart, inventor of the Media Art Notation System (MANS), made the explicit comparison between a musical score and code-based art, and, in the same spirit, Peter Weibel considered the 1960s Fluxus art movement as prefiguring algorithm art because of their use of sets of instructions (i.e. algorithms) in determining their performance actions. Jon Ippolito, commenting on the Fluxus protocols, considered the comparison fruitful as ‘thinking about net art as performance can legitimize re-interpretation as a means for keeping it alive’. This echoes the work of Perla Innocenti and her idea to ‘keep the bits alive’ through the performative element of the artwork by execution of its code. In other words, the true performer is the machine itself, and as Matthew Kirschenbaum suggests elsewhere, this is a justifiable approach to preservation because of the nature of the computer itself: just as we can never step into the same part of a river, we can never access in exactly the same way a digital file, since their ‘activation’ (metaphorically speaking) is made within a computer’s Random Access Memory (RAM) which is always distinct to where the data are located in the Read-only Memory (ROM). Kirschenbaum thus argues that ‘the preservation of digital objects is logically inseparable from the act of their creation’, and consequently ‘preservation is creation—and re-creation’.24

One critique of this line of thought is from the artist Martine Neddam (a.k.a. Mouchette), whose mouchette.org, an emblematic work of 1990s internet art, is a complex piece comprised of a large number of variants, sites, subsites, contributions and, therefore, an extremely rich database. Neddam has variously argued that preserving her work consists in conserving its constantly growing database which thereby constitutes an argument against the re-interpretation thesis. She argues that re-interpretation presupposes the need for an original that would act as a trace (recordings, scores or other traces), which could then be used as the basis for such re-interpretation. However for all internet artworks based on databases there can be no original since the artwork is perpetually changing and being continuously re-interpreted. In other words, such an artwork is itself an endless performance.

Dekker recounted how the Stedelijk Museum in Amsterdam and the Museum of the Image (MOTI) Breda, Netherlands jointly acquired mouchette.org but, given its complexity and its generative dimension, how they could not acquire the entirety of the artwork. Consequently, Neddam offered to sell a fixed encapsulated version of the work along with documentation containing screenshots and a video explaining the working of the site which meant understanding the administration of the database. Briefly, a version of a ‘mechanical Turk’ is needed for some database functions and so anything about its preservation, necessarily involves, according to the artist, the oral transmission of such know-how to a third party in a form of what she calls its ‘generative preservation’. 26

Faced with the question of how to preserve mouchette.org?, Ippolito formulated the hypothesis that the artwork is neither score nor the recording, but rather a ‘matrix … a structured environment containing the building blocks of future life …’. This matrix contains instructions that can be read both by humans and a machine and, in addition, the necessary screen recordings and interpretative documents giving the context to know how these ‘instructions are meant to be performed’. 27

Preserving network arts in the same way as ethnographic arts?

The re-interpretation strategy, based on an analogy between performance and digital art, gains support from the conservation-restoration of ethnographic artefacts. In 1996, Steve Woolgar emphasised that technologies...
could be considered as cultural artefacts. In the mailing list discussion Liza Swaving, a curator of ethnographic objects, picked up on this comparison to wonder ‘what forms of ephemeral exist in ethnographic collections’ and used the preservation of the ‘lamak’ as an example. The lamak is a ritual cremation object, ephemeral by definition, and for which any conservation act is contradictory. Some lamaks are actually made with materials that are deliberately chosen to degrade. Swaving cites the performance theorist and anthropologist Barbara Kirshenblatt-Gimblett, who considers that this kind of phenomena should be seen in terms of ethnographic fragments rather than ethnographic objects.

Arguably what remains of internet art from the 1990s are similarly fragments. Swaving re-uses the distinctions between artworks as either being scores, recordings or a matrices to consider if what remains of those works is a series of fragments that retain the sufficient ‘knowledge and ideas [of the work] that can be activated and reinterpreted in new social and cultural contexts’, thereby allowing them to stay ‘alive’ in some sense.

Where net artists such as Cheang or Neddam now appear committed to preserving their works, Johannes Birringer has argued that any re-interpretation, in whatever form including ‘proliferative re-creations’, ‘re-enactment’ or ‘delegated performances’, almost always results in failure. Citing the cases of Cut Piece by Yoko Ono and Marina Abramovic’s retrospective at New York’s Museum of Modern Art (MoMA) The Artist is Present, 2010, Birringer highlighted that the re-interpretation of these performances only served to show how they had lost their meaning by being cut off from their artistic and cultural context, since performance art can be seen in terms of ‘ethnographic fragments’ and, as with all relational and social artworks including internet-based or telematic works of art, it seems impossible to conserve them, like the lamak, without losing what makes them alive in regard to their ‘artistic immaterialities and their complex physical–infrastructural–technical apparatuses’ that form their context.

The example of the lamak—which the Balinese people believe can be recreated if needed to be ‘activated in new social contexts’—is useful in arguing for a certain form of re-interpretation as preservation. On the other hand Ippolito suggests that Malanggan sculpture is no less interesting to think about as another form of preservation, which he calls ‘proliferative preservation’. Citing the work of the anthropologist Marilyn Strathem, Ippolito writes of how, during a public event, indigenous people from Papua New Guinea destroyed a sculpture so that it could be re-created from memory. Of course ‘a Malanggan figure carved from wood and shells is not nearly as ephemeral as a lamak made of palm leaves—or indeed a website made of HTML and Perl’, but each generation can and must re-create such a figure in the sense that its ‘proliferative preservation’ acts as a mechanism for ‘forging bonds among people across clans and generations. The analogy between ethnographic fragments, performance art and internet art can be productive when theorising on the preservation of artefacts through their re-creation. Such re-creation can take on many different forms including re-interpretation or re-creation as proliferative preservation. The latter is unambiguously inspired by the generation and dissemination of seeds, cells, DNA, code, and suggests that allowing any artist to appropriate a digital artwork effects a form of preservation through its proliferation as justified by the artwork’s very nature of being code-based (albeit with certain issues related to copyright which are beyond the scope of this article). Such an idea presents the advantage, with regard to internet artworks, that the artwork doesn’t depend on any one unique storage place (necessarily fragile and obsolete) nor on the attention of any one custodian.

30 Swaving, New-Media-Curating list, 29 December 2016.


33 Johannes Birringer, New-Media-Curating list, 31 December 2016.


36 Cf. Rinehart and Ippolito, Re-collection, in which the idea of data preservation within DNA is developed.
Accepting and knowing how to welcome the end of an artwork

All the variable media strategies, including re-interpretation and emulation, or considering artworks as scores or recordings, are arguably based on an immaterialist conception of art\(^{37}\) where the ambition is to preserve the ‘soul’ of the artwork, not the material ‘body’. Even when the material conditions of the work are considered important or decisive, the hardware is often sacrificed. For example, in ‘The Myth of Immateriality—Presenting & Preserving New Media’, Christiane Paul writes of how digital art is eminently material and how machines have both an effect on the artists and their artworks but that these machines should be ‘forgotten’ in order to properly preserve the artworks, adding that ‘the most inelegant and impractical strategy for addressing this situation is to collect software and hardware, which would turn any art institution or organization into a “computer museum”’.\(^{38}\)

Paul favours emulation such that works are reverse-engineered to allow the reading of old software on a current computer so as to re-create versions of the original upgraded to a newer medium or platform. In a subsequent article from 2010, Paul addresses the time-based nature of network art, observing that ‘any time-based art piece, such as performance is essentially ephemeral and often continues to exist only in its documentation’.\(^{39}\)

Since any work of digital art can be reduced to binary code, which itself consists of a series of zeros and ones and which ultimately indicate differences in the electric potential inside the processor, no artwork is ever completely obsolete. It can, after a few interventions, be read on any later computer. But as the era of machine code programming passes, any newly programmed artwork, and even more so for any networked artwork, consists of a stack of programmes and languages. Inside the computer, the means of production of the interaction between human language and the machine language, the ‘writing machine’ as it were, there exists a series of layers, and thus a series of conditions of ‘writing’ possibilities. The most elevated layers, which we call the interface, the image, the sound and so on, are purely superficial. They correspond to the screen and loudspeakers, to what we can hear, see or touch. Reducing any of the artworks under discussion to such a perceptive effect is a mistake. Strictly speaking, the digital image, just like software, doesn’t exist.\(^{40}\)

That the making or ‘writing’ of the artwork has never been immaterial, and is never independent from the material devices that produce it, has been a long held view in media theory. Theorists from Marshall McLuhan in the 1960s\(^ {41}\) to the late Friedrich Kittler,\(^ {42}\) have shown how the materialities of the book, the gramophone, film, typewriter and the computer have acted upon or conditioned the ways of writing, reading, listening and seeing. In the case of internet art, although it is produced in a specific context, both historical and cultural, like any piece of art, it is, however, equally dependent on the software, the stacking of software and their compatibility as well as—and this is what we wish to insist upon—the protocols, network infrastructure and, including hardware, all facets that are industrial, economic and ideological. For the proponents of re-interpretation as a preservation strategy, this is precisely what could be forgotten. From our perspective, this context is a part of the artwork itself, and forms part of its very meaning.

Mark Hellar has written that ‘saving’ Agent Ruby, an internet artwork by the artist Lynn Hershman Leeson, consisted mainly in saving the artwork’s programming languages ‘behind the interface’.\(^ {43}\) But saving the languages isn’t enough as, at the time of writing, the domain name ‘Agent Ruby’ is now for sale.\(^ {44}\) Not only is a digital network artwork made up of layers of writing and technical components but it is also made up of industrial conditions. Where before works of art could be related to political or religious events they now more likely depend on industrial, economic, judicial and


\(^{43}\) Mark Hellar, ‘Engaging Computer-Based Artworks: What is Found There?’ (paper presented at the colloquium *Contemporary Digital Art, Conservation, Dissemination and Market Access*, Canadian Center for Architecture, Montreal, Canada, 23 November 2016),
Vidéotex Télétel was a French invention of a passive computer terminal, consisting of a keyboard and a 9-inch screen, devoid of any processing capacity or storage. It was connected to a 9-bit/s network (the Brazilian Minitel tel- network). The animations, composed from the choreography of geometric shapes that constituted letters and words in eight default colours, appeared in a left to right scan typical of the Minitel grid display. Through his videotext poems Kac sought to explore forms of communication using themes such as reciprocity, multi-directionality, and the interrelation of writing and reading activities.

'Eduardo Kac’s first works on the electronic network were videotexts. Reabraca-

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The concept was also commercialised in other countries—including geopolitical strategies such that examples of internet artworks are now either directly linked to Facebook, Google, Instagram, Twitter and so on, or otherwise linked through an industry-standard application programming interface (API). Thus preserving the code and conserving its perceptive effects or its conceptual aspects (which corresponds to the works aesthetic) aren’t enough in themselves, in the sense that the ‘writing’ of the work depends upon other forces that go to make up its meaning and that, in their obsolescence or breakage, cause it to halt or end in some way. This is why instead of talking about context, we prefer to think about works being situated in a media-technical ecosystem which characterises a system of material interactions at multiple levels that collectively gives meaning to the artwork.

At PAMAL we thus recognise the need to preserve internet art by preserving the widest sense of the means of its production (‘writing’) including the means of its execution and decoding/reading. This approach is in line with that taken by others, including ZKM | Center for Art and Media Karlsruhe in Germany, and suggests that we need to not only preserve the writing devices with which the artwork was made, but those on which it needs to be read. Such a method is known as being ‘media-archaeological’ since it implies preserving, as much as possible, the lowest conditions, in the stacking of writing conditions and code reading, all the way to the heart of the hardware, to the infrastructure itself. When these material layers (its material structure, the infrastructure’s surface software) can no longer be conserved, it then becomes necessary to think about this being the end of the artwork. This doesn’t mean that the work should be forgotten, but rather to imagine a way of exhibiting it to recount the story of such an end.

Materialities at work: the restoration of the Videotext Poems by Eduardo Kac

From 1985 to 1986, the Brazilian artist Eduardo Kac created a series of tele-

From 1985 to 1986, the Brazilian artist Eduardo Kac created a series of tele-


45 An API is a set of protocols effectuated between various software components.


47 Cf. Emmanuel Guez, ‘Digital Art Objects: Why Mourning is Inevitable (and Why Hope is Still Possible)’ (paper presented at the colloquium Contemporary Digital Art, Conservation, Dissemination and Market Access, Canadian Center for Architecture, Montreal, Canada, 23 November 2016).

48 Minitel, ‘Médium Interactif par Numérisation d’Information Téléphonique’ [‘Interactive Medium by Digitalizing Telephone Information’]. was a French invention of a passive computer terminal, consisting of a keyboard and a 9-inch screen, devoid of any processing capacity or storage. It was connected to the French service Vidéotex Télétel, and in use from 1980 to 2012. Services could be accessed from a phone line thanks to a built-in modem with a download speed of 1200bit/s and upload speed of 75bit/s. Minitel was equipped with T plugs to connect to the France Télécom telephone network and its screen was a text matrix of 25 lines and 40 columns in the Vidéotex mode (eight shades of grey for the black-and-white screen). A set of graphic characters, each composed of six bytes, made it possible to display images in a tile style, similar to ASCII art. Users simply had to call the short four-digit number that corresponded to their chosen service and wait for the connecting dial-tone before pressing the ‘Connexion/fin’ button to access the page. The concept was also commercialised in other countries—including
The Videotexto system emerged in Sao Paulo in 1982 and functioned until the mid-1990s. Its terminals seem to have used the same technology as the French Minitel but, unlike their French cousin, they did not have a screen and were instead placed under television sets and services could be accessed with a remote control. The terminal was a direct copy of the first experiments of the Vidéotex Télétext in France from 1980 which, later, led to the ‘all-in-one’ black and white terminals, distributed to French households for free. In Brazil, since the screen was the television screen, services were in colour.

Given Brazil’s then economic situation, public ‘all-in-one’ terminals, which were already connected to the network, were available for viewing in post offices, libraries and airports where a user probably had to enter a code to find the desired content. Since the terminal was already connected, the service didn’t need to be reached by phone, instead the ‘public switched telephone network’ (PSTN) was used to establish communication. The server then sent a videotext frame and the content appeared on the terminal’s screen. Unlike the French system, the Videotexto service didn’t really enter the collective memory and it remains to this day one of the forgotten members of the Minitel family.

Restoring the experience

The public Videotexto terminals have disappeared from Brazil and PAMAL could not restore Kac’s poems on a Brazilian model. In order to re-create an experience as close to the original ecosystem as possible, we decided, in conjunction with the artist, to restore the artwork on a French Minitel terminal dating from the same period. Minitel became a dead medium in France on 30 June 2012, when the services irrevocably closed and the servers stopped such that all of the art production dependent on it disappeared. Although the machines, especially the black and white ones, are still available on the second-hand market, they are inert in the absence of any data sent from servers in videotext format.

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50 Also colloquially known as POTS (Plain Old Telephone System).

The only extant remains of Kac’s poems are slides that were made during the Brazil High-Tech exhibition in 1986 and a ‘Quicktime’ animation produced by Eduardo Kac for the purposes of exhibiting and archiving. This Quicktime animation provided a good starting point even though it contains a few inconsistencies such as a top to bottom scan (and not from left to right), colours that didn’t exist on the Minitel, and impossible character angles. Although it is a less than convincing re-interpretation it was essential to get an idea of what the animations were and the artist’s narration was also very helpful in interpreting the work.

The disappearance of the media ecosystem due to the Minitel servers shutting down raises the question of how losses affect any reconstruction attempt for a network-based artwork. PAMAL’s objective was to restore the experience of viewing these animations on a Minitel terminal, with all the characteristics and aesthetic constraints that this implies (see Fig. 3). We approached the work as a media-archaeological reconstruction according to its layers of materiality: from the first layers (the terminal’s image and physical interface) to the last layers composed of low-level programming languages and sound, the vector of communication between the Minitel and its servers.52 By progressing layer after layer and studying the overall system, we were able to reconstruct the Poems.

All Minitel devices are equipped with a serial port DIN. By studying the system in its entirety, we realised that this five-pin DIN port made it possible to communicate directly with the Minitel through a serial connection without needing any modulation. Thanks to the STUM manual [Spécifications Techniques d’Utilisation du Minitel (‘Technical specifications of Minitel Use’)], the standard reference manual for Minitel systems, we were able to understand how the Minitel processed data. In doing so we also realised the importance of conserving the manuals along with the machines themselves. We then created an interface between the machine and our contemporary systems to provide data for the Minitel to process. We were able to use the Minitel technology directly without compromising the Minitel’s initial treatment of data by building an interface with an ‘Arduino’ electronic prototyping board using a ‘Processing’ software environment and creating a bespoke connecting cable.53 Communication then occurred through a serial connection with technical characteristics imposed by the Minitel itself: 1200 bauds, seven data bits, one even parity bit and one stop bit.

In order to implement the artwork in this system (Fig. 4), we started by acquiring the terminal, a colour Minitel. Despite detailed norms, Minitel models had slight differences depending on manufacturers. In France the original Minitel models were not capable of displaying colour content. Although the programming was done in colour, the default display for standard Minitel users was eight shades of grey (including black and white) as the 9-inch ‘all-in-one’ screen could only display black-and-white content.
However in the colour Minitel 1 produced by ‘La Radiotechnique’, the eight shades of grey were displayed in the same way as the programming interface, on a colour screen, and in eight colours: black, red, green, yellow, blue, magenta, cyan and white. The keyboard on this model was separate from the screen. It is important to note that this type of machine was very rare with models only available to a limited number of professionals.

Since the software and the frame creation method originally used by Kac were still unknown—the artist said he didn’t remember—we had to place ourselves at the bit level, the lowest level in the materiality of digital programming. We therefore edited the videotext frames with a hexadecimal editor. This meant translating the animations into hexadecimal code in order to transmit them to the Minitel with grids and encoding tables and re-creating what was supposed to be the original frame character by character, byte by byte, according to a manual transcription of the images on a frame (Fig. 5).

To do this certain international standardised character sets or encoding tables exist including the essentially alphanumeric G0 set and the G1 set, known to be semi-graphic. Switching from one set to another was done thanks to codes specific to the Minitel. With these sets, character type and colour could be defined, and other codes could control erasing the screen or placing the cursor. Since the possibilities linked to creating a videotext image were relatively limited and constraints were high, it seemed probable that our re-created frame was similar to the original. Since a byte could only contain one character, we were able to measure how ‘machinic’ constraints became aesthetic constraints, since those material constraints directly influenced the form of the image (Fig. 6).

Once the frames were edited, the Arduino programme displayed all of the animations that compose the Videotext Poems: Reabracadabra, Tesão, Recaos and Dieus. In order to match the Brazilian experience as closely as possible, we chose not to have the animations scrolling continuously, but created a homepage so that users could choose the animations they wanted to look at by interacting through the Minitel keyboard, thereby perhaps re-creating something of the sensations felt by the original users (Fig. 7).
Alternative histories and Minitel piracy

At this stage, restoration was still incomplete. As we descended further into the layers of its materiality, we got hold of enough key information to recreate a Minitel server, the crucial missing link for this network-based artwork. We discovered that the Minitel was able to ‘hear’!

Data sent to the Minitel by the server is sound, or, to be more precise, frequencies: one frequency for 0 and one frequency for 1. The Minitel ‘hears’ the sound, decodes it in videotext and displays the image. The server can therefore be conceived as a sound–image convertor and the telephone line as a vector for the sound. PAMAL therefore launched the second phase of its project by creating a local single-channel Minitel server which used the telephone line, as was the case for Kac’s original animations. In terms of methodology, we therefore left the realm of reverse engineering, the principle of analysis and deduction used to reproduce something, and adopted a practice that is assimilated in the theory of alternative media histories.54

When the end of Minitel was announced in 2012 it failed to take account of the existence of single-channel micro-servers and the activities of Minitel hackers. One of the solutions to the problem of the missing servers was found in the overlooked and unexplored history of the French telematics world: Minitel piracy. From the very beginnings of Minitel, hackers were able to divert the France Télécom systems to create their own single-channel servers.55 These ‘micro-servers’ could be accessed with eight-digit phone numbers found in various computer journals and newspapers or in flyers—the same method used by Eduardo Kac to share his poems—and they appeared as early as 1984 as a reaction against pay-for services. The hackers used the PSTN, which is still in place in 2017 as it is used by the main technology for Internet Service Providers (ISPs), Asymmetric Digital Subscriber Line (ADSL).

So technically it is still possible to set-up such micro-servers today. In 2012 Minitel was moribund as users had long switched to the internet. During the

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54 When reconstructing a system through reverse engineering, alternative and forgotten paths can be found. It would be unfortunate to neglect these, even if it may imply a highly conjectural and incomplete result. Reconstruction then becomes a way of telling the history that is already known, but also indicating one that’s unknown or an alternative one by and for the machines. This idea, taken from the theoretical realm of media archaeology, has been particularly pursued by Professor Jussi Parikka. See, for example, Jussi Parikka, *What is Media Archaeology?* (Cambridge: Polity Press, 2012).

Fig. 6 The bytes already containing a character are in grey. To close a shape, it is necessary to make a graphic adjustment which leads to a discontinuity in the line. Since it was materially impossible to avoid such a discontinuity, the artist preferred to remove it all together. © PAMAL.

Fig. 7 Example of the homepage. © PAMAL.
golden age of Minitel in France (1985–1995), the architecture of the micro-
servers was based on a modem that respected the V.23 standard in linking
to a computer. Since Minitel worked with a simple telephone line, it only
‘interpreted’ sounds at the input and output levels, somewhat like a sound–
image convertor. Any implemented server therefore had to be able to generate
sound and capture sound, which sound cards currently do in all computers,
tables and smartphones. We therefore chose to create a micro-server using a
sound card in order to simulate the Minitel servers of the 1980s.

The first advantage was that sound cards can easily be programmed and
be substituted for a V.23 modem. The second advantage lies in the ease of
digital recording. The computer is as much the product of the gramophone
as it is of the typewriter and the animations created by Kac could therefore
be stored as audio files, thus ensuring a certain sustainability. At the end of
the 1970s, this type of storage was actually used.56 In our reconstruction
sound entered the Minitel and its server firstly from the server to the
Minitel, where a ‘1’ bit corresponded to a 1300Hz frequency and a ‘0’ bit
with a 450Hz frequency. A phone interface was needed to manage the tele-
phone calls and, as such, automatic dial and hanging up were possible. The
interface was controlled by a dedicated Arduino board, and this interface
also had a duplexer that could, within the sound card, separate uploaded
data from downloaded data on the telephone line (from the server to the
Minitel and from the Minitel to the server).

The most common Minitel could therefore be coupled to a telephone from
the 1980s. To connect to the server the user needs to compose a number, wait
for the high tone specific to a Minitel server, then press the button ‘Connex-
ion/Fin’. This procedure, obvious to any Minitel user, is lost to the younger
generation of ‘digital natives’ yet experimental media archaeology allows
a new audience to re-appropriate such knowledge and in this sense,
although the Minitel is a dead medium, creating the ‘second original’ has
made it into a sort of ‘zombie’ medium, giving an archival life, or afterlife,
to Kac’s Poems. Any happy Minitel owner with access to a landline can
call the number linked to the micro-server and get connected (Fig. 8).

Conclusion: the second original or the work’s afterlife
The different stages of this media-archaeological project were exhibited in
France in 2015 and 201657 where we introduced the term ‘second original’.
Reconstituting second originals, consisting in the duplication, albeit incom-
plete, of works that have disappeared or that do not work, allows us to
define the epistemic contours of a media-technical ecosystem, which we
can now realise extends far beyond its mere technological appearance.

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56 For example, according to Walter Zingerle, an engineer for the US artist Paul
Earls, from 1977 to 1978 the artist
stored his drawings in hexadecimal
code on audio tape. Personal conversa-
tion between Walter Zingerle and
Morgane Stricot, September 2015, MIT,
Cambridge, MA, USA.

57 The Kac Videotext Poems ‘second orig-
inal’ was exhibited at different stages of
its re-creation: stage one (without a
server) was viewed at the exhibition
Une archéologie des média at Seconde

Fig. 8 Eduardo Kac, Rebracadabra. © PAMAL and Eduardo Kac.
As for any work of art, there is always a loss in its restoration. Where Brandian restoration suggests the reinstatement of such a loss by playing on the relationship between form and substance, and when most other institutions concerned with digital and media art preservation have presented the hypothesis that the artwork's meaning gets richer when we point to any loss and exhibit it: the more the restoration is incomplete, the more it highlights how, in the present day, it is so far removed from the ecosystem in which the work was created. As such, this distancing allows us to think about temporal and epistemological ruptures and allows us to understand what vast changes were effected, not only for the artwork and its integrity, but also in terms of its cultural, economic and ideological environment.

That the current theoretical, practical and institutional context of the preservation of digital art is largely based on a model of performance art reinforces the idea that digital art preservation is similarly based on a distinction between the materiality and immateriality of the artwork. This has the regrettable effect of often eliminating the former in order to ‘preserve’ the latter, the ‘spirit’ of the work. This might support strategies of re-interpretation and emulation but is considered here to be an incomplete and improper strategy for the successful conservation of the context and knowledge-culture in which these works were created.

The case study of Kac’s Minitel poems illustrates that the aim of creating a second original is not born out of the necessity to maintain an artwork as in any way authentic, but rather consists in preserving it as a different iteration. Although the media-archaeological reconstruction of the Videotext Poems contains certain simulated elements (the micro-server, for example), these are never hidden and, arguably, the second original leads us to experience the artwork through its archive. It may not be a completely living archive, but, as a ‘second original’ archive, it aims, as far as possible, to uncover the life of that artwork.

Abstract
Due to the obsolescence of software programmes, hardware and network infrastructures, many network-based artworks have disappeared. How can we give them an afterlife? A close look at messages within an international new media curating mailing list reveals that current theories and practices relating to digital art preservation are extensively based on a comparison with performance art and an immaterialist conception of art. This paper aims to challenge these notions and put forward a suggestion as to what we might call the materiality of ‘machinic-writing’. It focuses on the media-archaeological reconstruction of a telematic artwork by Eduardo Kac, his Videotext Poems, to develop the idea of what we call a ‘second original’ artwork. This second original is a sometimes incomplete duplication of a digital work of art which has either disappeared or is non-functional and achieved by reproducing as closely as possible its original conditions in terms of hardware, software and user experience. Its function is aesthetic, educational and epistemological. This paper aims to show that what is at stake is not so much the work of art’s afterlife, since it has ‘died’, but rather its new archival life.

Résumé
« Les vies posthumes des œuvres d’art des réseaux »
En raison de l’obsolescence technologique, de nombreuses œuvres d’art des réseaux ont disparu. De quelle manière peut-on leur donner une « après-vie »? L’article, en s’appuyant sur l’analyse notamment des échanges au sein de la liste de diffusion New-Media-Curating, montre que les théories et les pratiques de la conservation-restauration des arts numériques se fondent actuellement sur une comparaison de ces arts avec la performance autant que sur une conception immatérielle de l’art. Portant un regard critique sur ces dernières conceptions et interrogeant ce qu’est l’écriture numérique, l’article développe l’idée d’un second original à travers un cas d’étude: la reconstruction média-archéologique d’une œuvre télématique d’Eduardo Kac. Le second original consiste en une duplication (parfois lacunaire) produite au plus près des conditions matérielles initiales de l’œuvre (matériels, logiciels, expérience). Sa fonction est aussi bien esthétique, pédagogique qu’épistémologique. L’article montre alors qu’il s’agit moins de donner à l’œuvre, malheureusement condamnée, une après-vie que de lui offrir une autre vie: une vie archivistique.

Resumen
“La vida de ultratumba de las obras de arte basadas en la red”
Muchas obras de arte basadas en la red han desaparecido debido a la obsolescencia de los programas de software, el hardware y las infraestructuras de la red. ¿Cómo podemos darles una vida del más allá? El análisis minucioso de los mensajes entre curadores internacionales de nuevos medios en una lista de correo, nos revela que las actuales teorías y prácticas relacionadas con la preservación del arte digital se basan ante todo en una comparación con el arte de performance y la concepción inmaterial del arte. Este artículo pretende cuestionar estas
neciones, and sugerir lo que podríamos llamar la materialidad de la "escritura mecánica". Centrándose en la reconstrucción mediática-arqueológica de una obra telemática de Eduardo Kac, sus Videotextos Poemas, se desarrollará la idea de lo que llamamos una "segunda obra original". Este segundo original es un duplicado, a veces incompleto, de una obra de arte digital que ha desaparecido o no es funcional. Se logra reproduciendo lo mejor posible las condiciones originales en términos de hardware, software y experiencia del usuario. Su función es estética, educativa y epistemológica. El objetivo de este trabajo es mostrar que lo que está en juego no es tanto la obra de arte en la vida de ultratumba, ya que ésta ha muerto, sino más bien una nueva vida como archivo.


摘要 基于网络的艺术品的来生 由于软件程序、硬件和网络基础设施的过时淘汰，许多基于网络的艺术作品已经消失。我们如何才能使这些作品复活呢？作者通过仔细查阅国际新媒体策展展览列表中的信息，得出与数码艺术保护相关的现行理论与实践是广泛基于对表演艺术与无形艺术观念的比较的结论。本文旨在挑战这些观念，并提出关于我们应如何描述“机械写作”的物质性的建议。作者专注于爱德华多·卡克（Eduardo Kac）的信息通讯艺术品“视频文本诗”(Videotext Poems)的媒体考古重建，以此来研究我们所说的“原始材料”的艺术观念。这个第二原作是个可能不完整的数码艺术作品的副本，因为这些数码艺术工作不是已经消失了就是失去功能了，它们是基于硬件、软件和用户体验的方面，通过尽可能接近原始状态的复制来完成的。它的功能是美学的、教育的和认知的。本文旨在表明，由于艺术品已经“死亡”，所以棘手问题并不是使艺术品复活，而是它的新的存档期。

Biographies Emmanuel Guez is an artist, ‘writing machinist’, media archaeologist and curator. His works explore pseudonymity and heteronymy, media materialities and computational subjectivity, web dramaturgy and google theatre, and the tragedy of the art world (ephemeralism, desire of immortality, preservability). He is co-founder and co-director of PAMAL (Preservation & Art Media Archaeology Lab). Ecole Supérieure d’Art d’Avignon (ESAA), France. He was the co-director of the research project « Les Sondes » (Probes) at La Chartreuse-Centre National des Arts du Spectacle (2009–2012). He teaches new media art at the Avignon School of Art and at Beaux-Arts de Paris.

Morgane Stricot is a conservator-restorer and head of digital conservation ZKM | Center for Art and Media Karlsruhe, Germany. She is a PhD candidate at PAMAL and has studied the preservation of complex digital objects during her MA in Conservation of Media and Digital Art at ESAA, and in her fellowship at the Still Water New Media Art Lab University of Maine, USA. Her PhD research is on the methods and limits of media archaeology as a preservation theory. She presented her research at the International Digital Heritage International Congress, Marseilles 2013 and won the Leonardo award at The Emerging Researchers’ Symposium, Media Art Histories Re-Create, Montréal, 2015.

Lionel Broye is an artist, media archaeologist and graphic designer. He is co-founder and co-director of PAMAL. At ESAA he teaches New Media Art and researches different strategies for the preservation of digital arts. He is currently researching open source solutions to ‘save our digital souls’. http://www.pamal.org, http://www.macrosonges.org.

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