

# Agatha re-Appears

## Restoration Project: Olia Lialina's early net.art piece *Agatha Appears* from the Collection of the C<sup>3</sup> Center for Culture & Communication Foundation

### Acknowledgements

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### Abstract

Net art preservation can be seen as a paradox: how does one conserve art works which, by their very nature, are in constant change, surviving in an ongoing process of becoming. And is there really a need to conserve art works, which, as we may think, were created 'yesterday'?

Net-based art came to the fore a decade ago and quickly assumed particular urgency due to the rapid obsolescence of Web technology and the fragile nature of digital media formats. The goal of the *Agatha re-Appears* project was to investigate solutions for the preservation and restoration of net-based art. The direct inspiration for this project was Olia Lialina's net.art piece *Agatha Appears*, which belongs to the C<sup>3</sup> collection. This renowned object, created during the very first stages of the genre, suffered partial destruction of its files through obsolescence of code and liquidation of some locations of the art piece.

The restoration process was conducted by a team of conservator (the author) and programmer (András Szőnyi), and consisted of reformatting, reprogramming and partly re-creating missing elements.



Fig. 1. Olia Lialina, *Agatha Appears* 1997, <http://www.c3.hu/col-lection/agatha/>

Through interviews with artists and programmers and by analysing restoration projects undertaken so far, I am attempting to find a proper means of combining the long tradition of art conservation with new tools and theories which have accompanied the digital revolution in order to solve the specific problems of net-based art. This paper is written from the perspective of a fine arts conservator for whom dealing with net-based artwork was a tremendous challenge and adventure.

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var scl = "- You know, Agatha,
[_1_____]#[_1_____]#[_2_____]#[_2_____]#[_2_____]#[_2_____] Inter-
net its not computers, aplications, scripts
[_1_____]#[_1_____]#[_2_____]#[_2_____]#[_2_____]#[_2_____] Its
not a technology, but new world, new philosophy [_1_____]#[_1_____]#[_2_____]
#[_2_____]#[_2_____] New way of thinking, to understand the net u must be
inside[_1_____]#[_1_____]#[_2_____]#[_2_____]#[_2_____] U should come
through it, u must be in it... - New world? I want to try!";
function sclsts() {1

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### Art on the net (introduction)

We are all used to looking on the Internet as a quick and convenient source of information. We can clearly see how more and more elements of our lives (including the sphere of art) are moving into virtual space and how the Internet has become an integral part of life in (post)modern societies. These processes are no longer sources of awe and wonder and so we do not remember the widespread optimism and enthusiasm that accompanied its beginnings. In those days proclamations of universal freedom and independence from existing structures were made and unlimited space for art and culture was promised. Almost immediately, the first artistic projects were on-line and soon a vivid community of artists was organised around them. Today, on the one hand we have stopped believing in this widely heralded promises and, on the other, started to be concerned about the risks of this dream coming true and net-based art is not essentially intended for exhibition in public gallery spaces. Just like the Web itself, net art is not subjected to any outside restrictions (besides the limits of a technology). However, after only a few years since the first experiments were made, a new territory of art was established spreading to prestigious art events and capturing public interest, and today we can visit net art exhibitions in physical galleries or visit curated websites. Soon after this establishment, institutional collecting began and as a consequence the issue of preservation has become widely recognised. Today the first projects involving the archiving and restoration of net-based resources are already in progress.<sup>2</sup>

### Net art – looking for the definition

Enclosure of any the disciplines of contemporary art by strict definition will usually not survive the test of time, especially in the case of digital art where the definitions are deconstructed as fast as the development of technology. One basic criterion is, of course, the material from which the object of art is realised. In the case of net art it is a network – the World Wide Web accessible via the Internet<sup>3</sup>. Although we often find art created using other media in the Internet, when we refer to net art we go beyond the simple treatment of the Internet as a cheap space for the exhibition of digitalised images. As aptly put by Steve Dietz: “Internet art projects are art projects for which the Net is both a sufficient and necessary condition of viewing/expressing/participating. Internet art can also happen outside the purely technical structure of the Internet, when artists use specific social or cultural traditions from the Internet in a project outside of it. Internet art is often, but not always, interactive, participatory and based on multimedia in the broadest sense.”<sup>4</sup> We can say that net art is a specific form of digital art applying selected programming languages and technologies created for the network. This is art, which uses code as a means of creation, however the programming aspect is not necessarily noticeable to viewers. Importantly, the Internet not only provides material but also exhibition space for the creations themselves.

Similar to the video-art medium, it becomes a theme itself. Artists inspire its availability, communicativity and non-local nature. A chosen programming language determines the logic of action and aesthetics of the final object. While all technologies and programming languages may be used for artistic creation, not all were created for the purpose of artist activity. As a means of expression net artists use hypertext, browser interface elements and the inherent attributes of Web environment to change or expand the meanings we are used to. For example, in Alexei Shulgin's work *Form Art*, which also belonging to the C<sup>3</sup> collection<sup>5</sup>, the field elements of the forms, buttons and scroll bars become decorative structures, like ornamental designs.

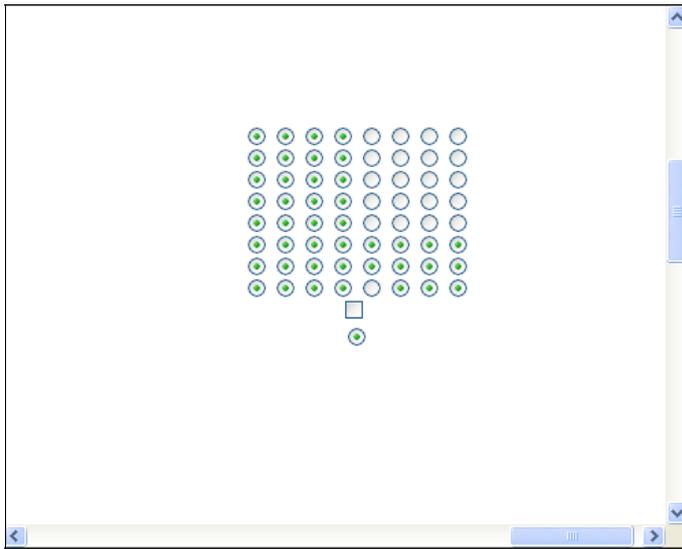


Fig. 2. Alexei Shulgin, *Form* 1997, <http://www.c3.hu/collection/form/>

Although there are no proscriptions when choosing the means of artistic creativity not many popular technologies were specially created for artistic purposes. We can see how artists annex technologies for their needs and how chosen artistic methods are usually connected to the artists' previous experiences. New technologies transform and improve previous genres into extended forms: the earlier mail art<sup>6</sup> transformed into e-mail art, and video installations allowed space and software-based art to become more widely available. Moreover, it allowed for on-line contact between 'interactors.'

New language brings new and sometimes surprising aesthetics together and creates

a working logic for the objects it describes. Artists using the medium of code often cooperate with information technology developers. They join together in specific tandems, sometimes maintaining it difficult to clearly separate creativity from technical assistance.

### The beginnings of the material infrastructure

Despite its common associations with freedom and anarchy, the Internet (just like the computer) has its roots in military activities. The birth of Web technology is widely considered to be the creation of the ARPANET in 1968.<sup>7</sup> The purpose of this network was to maintain communications after a nuclear attack. The original idea is exactly what we use now: a graphical network interface, known today as the World Wide Web, which goes back to CERN, the Swiss Particle Physics Laboratory in 1989<sup>8</sup>. In 1993 the alpha version of Windows 95 became available, and two years later the operating system, which was supported by a GUI (Graphical User Interface) with intuitive operation, entered the market. In the same year Mosaic (the first graphic browser) was written and a year later came Netscape Commerce S. So, in the mid-'90s, each owner of a phone and a personal computer could connect to the Internet. Widespread ownership of computers and their increasing parameters contributed to the need to accelerate the growth of the Internet. As a result, new technical solutions and continued development of hardware and software mirrored the evolution of programming languages. Awareness of the history of the medium

helps understand tools used for creation and changes in code representations of net-based artworks.

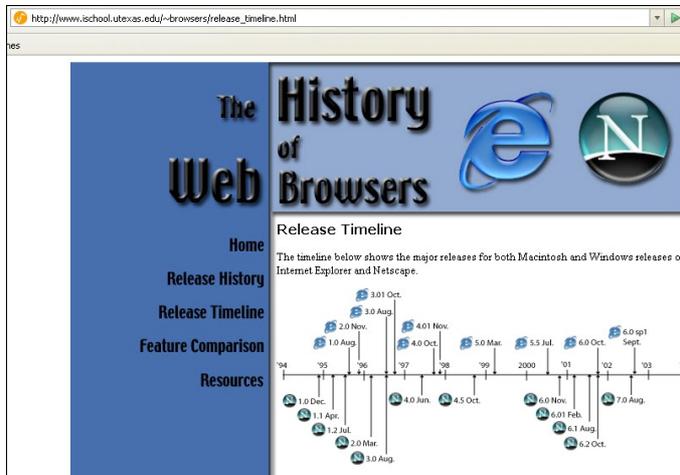


Fig. 3. Web browser history -project, completed by Dr. Don Turnbull and Jennifer Jobst at the University of Texas, <http://www.ischool.utexas.edu/~browsers/index.html>

## HTML

Programming languages have had a decisive influence on the functioning and representation of the Web. The network is built primarily on HTML (HyperText Markup Language), alongside JavaScript, PHP, Perl and the three-dimensional format VRML. The first version of HTML was developed by Tim Berners-Lee in 1989, at that time a software consultant working for CERN. Originally it comprised several markers to display text with references to other texts (hypertext).

This was the zero version of HTML. The first official version of HTML 2 (even before the first graphic browser) was created in 1991, which achieved great success through its compatibility with the two leading browsers (Internet Explorer and Netscape) together with the ease with which one could add and rebuild internal elements. The rapid development of computers and improvements to data bus capacity alongside webmasters' increasing abilities led from the publication of initially text-only Web pages through those containing simple embedded images and later photos and sound files to those of today complete with video. Thus improvements to the HTML language were needed. Producers of Web browsers developed these versions without mutual consultation, which led to a partial incompatibility of HTML. The response to this situation was the W3C - World Wide Web Consortium. This international organization was created to ensure compatibility and agreement among industry members in the adoption of new standards for the World Wide Web. The second edition HTML version, agreed upon by the two leading browsers, was version 3.2 in 1997. Since then, the W3C has given its recommendation to four visions of HTML including the current 4.01. In this new version of HTML the semantic layer is separated from the presentation layer by keeping the code responsible for appearance in a different CSS (cascading style sheets) file. In January this year the W3C published its Working Draft for HTML 5.0 so we can be sure of further changes especially given the growing implementation of XML in all IT sectors.

## Animation Java Script and other languages

Despite the universality and the great potential of HTML, it has some inadequacies in the construction of tables, dynamic changes, colour, and any interaction with the user, leading to the need to find a solution for the better control of objects. The answer was Mocha - an object oriented programming language, later named LiveScript, developed by Netscape. In 1995 this language was renamed JavaScript and implemented to Netscape 2.0 B3, revolutionising the look and interactivity of the Web as we experience it today.<sup>9</sup> For the purpose of serving the growing popularity of 3D simulations, VRML was created in 1994. VRML (Virtual Reality Modelling Lan-

guage) is a standard file format for describing 3D worlds and movement through them. Over the next few years the rapid development of technologies and techniques for creating dynamic Web pages applying server-side scripting like ASP and PHP proved a success.

## Net Art preservation vs. previous conservation practices

From one perspective, new-media art preservation continues the tradition of fine art conservation but at the same time, on many levels (both theoretical and practical), the conventional approach proves inadequate or completely unhelpful for computer-based art. New-media-based art explores both preservation and conservation experiences via unknown territories and courses of action. Preservation no longer means only treatment to save and conserve physical object since problems are based on keeping net functionality in a complicated 'net technology ecosystem'. In the context of the Net preservation will be an umbrella term for the many policies and practices. Preservation is the prevention of further deterioration by archiving all necessary elements and restoring the usability of selected groups of materials, documenting the artwork itself and the changes that occur inside and around it. This definition can be applied to all digital art, however net art needs special consideration and the problems concerning its preservation seem to be the most complex, as we will see through analysing its character.

### Net.art and the concept of the original

What constitutes a net art object? It is a structure of many elements: text, tables, images, music, video, and so on, whose structure and inter-relationships are formed by HTML. This source is not a secret and can be seen by every user (through the simple selection of 'view/page source' in the Web browser). The disclosure of the code is sometimes compared by media theoreticians to the exposure of physical media images and their possible imperfections which, in the case of film, was known as structural cinema – as noted by Polish art researcher Ewa Wójtowicz.<sup>10</sup> In the case of traditional art objects this special experience of artwork materiality was always the privilege and domain of conservators. Conversely, net art objects this materiality remained open to all and so vulnerable. With HTML-based art anyone can copy and transfer a page or images published on the Internet to another net location or to their own computer. One can also develop and utilise code lifted from another source. We clearly see how the conventional notion of the original becomes arbitrary. Some artists (*inter alia* Olia Lialina) consider authenticity to spring from the unique address where object is placed. As Lialina declared in interview with Sven Spiker: "What exists on my server is by that very fact declared to be an original."<sup>11</sup> Also, when describing purchase terms in Teleportacia.org, the first net.art gallery, she says: "Art.Teleportacia provides a special certification proprietary system which ensures that the artwork you have purchased is the original. For example, one simple way to prove that an artwork is an original is the URL in the location bar. It is included as an important part of the performance of the artwork. One can copy HTML code and the images of a simple Net project, but the URL can't be duplicated. This is what we are really after - not the removal of files from their original space, but the control of access to them and the copyright advantages. The original location is an important part of an artwork. It has its historical sense and it is simply more prestigious."<sup>12</sup> This point of

view corresponds to Walter Benjamin's concept of 'aura'. In the essay *Work of Art in the Age of Mechanical Reproduction*<sup>13</sup>, 1936, Benjamin finds the aura of the work of art not exclusively in the object itself but rather in external attributes such as its line of ownership, its restricted exhibition, its publicised authenticity, or its unique cultural value – in the relation between the purveyor of the work of art and the work itself.

The notions of authenticity and intellectual property were popular themes for net artists in the early years. Their activities were close to the *culture jamming* art movement and consisted of appropriation by copying fragments or entire Web pages – for example the actions of Vuc Cosic: Net.art per se/CNN Interactive in 1996, and a copy of the Documenta X website in 1997.<sup>14</sup> Although in those works Cosic avoided repetition, in later, similar actions artists were at risk of serious repercussions as was the case with British artist Rachel Baker who made pastiche of a questionnaire given to Tesco customers,<sup>15</sup> or Heath Bunting who copied the American Express website. Both were forced to cease publication of stolen or pastiched data.

What was an act of appropriation in the nineties has (more recently with agreement with owners) become an official archiving practice embodied by the cloning of valuable net art sites. The platform Rhizome.org, in addition to the presentation of objects, takes measures to protect digital objects, including net-based art through its archiving efforts. Its activities are twofold: cloned objects and linked objects. Cloned objects are located on the organisation's servers.<sup>16</sup> Multiplication (digital clones are identical to the originals but can be found at other locations) increases the chances of survival. If the source object isn't available at the original location (through change of location, link mistake or removal), the original can be recreated from a copy and stored at the Rhizome.org repository. From this results the final deconstruction of the traditional notion of original – the notion that used to be a direct indicator in preservation efforts.

### Net art as performed art

Another feature of the blurring of the concept of the original is the individual experience of hypertextual artwork. The viewing condition is not so ambiguous (admittedly net art encourages interactivity but at the same time it indicates the constraints of technological achievements). The degree of competence of the viewer can vary greatly - from that of an active participant and designer of new contexts to that of the passive observer. "He is lead astray, and his curiosity and creativity are the basic conditions of perception of Internet art."<sup>17</sup> Although all electronic art is ephemeral, this form, based on the net, is subject to the constantly evolving environmental influences of the surrounding Web. This variability frequently defines its sense and the individualisation of the viewer's (interactor's) behaviour completes its importance. In this way the final shape remains an open question. More importantly, through this act of participation the viewer becomes (to some extent) co-author. In this sense, net art is close to performed art. Similar to music or theatre it can change over time and may be played or performed in that changed state. According to Polish media theoretician R. Kluszczyński, through the act of interaction the viewer creates art again and again from the beginning. "A subsequent activation of the hypertext, even performed by the same recipient/interactor, is bound to conjure up a new work. Both the analysis and interpretation of an artwork thus understood must be parallel to the process of its interpretation, of its reception, its (co-)creation; it must be identical with it."<sup>18</sup>

These features of Internet art cause difficulties not only for art historians' analyses. They create complications and dilemmas in the preservation process as well. Just as with interpretation of the artwork, the process of conservation is based on the stability of the object. Although efforts to fit net art objects into a stable entity turn out to be unsuccessful, it does not mean that there is no available method for restoration projects, or that such efforts cannot be verified. For the conservator this means that during the preservation process he/she will be exposed to unexpected results and ought to avoid solutions that freeze the object or place it outside the context of the network. Through the 'hibernation' of such objects we can make a radical departure from the original intentions of the author.

### Net art – the challenge of (im)materiality

The conservation proceeded is, in a way, always *in situ*. In this sense net art preservation has completely broken with the tradition of dealing with the monolithic and individual *oeuvre*, a rule that was undermined previously by film and video.

Firstly (as is always the case in preservation efforts) net art works should be envisioned in their substance. Net art material (files of a certain type of format in a certain file system on a server, that is in the hard disk of a computer) are essential and cannot be ignored despite the aura of immateriality surrounding the Internet. When it came to traditional materials, conservators used to analyse every layer (stratigraphy) of an object describing it with respect to its material (technology layers, e. g. wooden desk- plaster-paint-varnish) and when it was executed (chronology layers). Are we able to distinguish these stratigraphic layers in computer-based artworks? Even Lev Manovich in *Language of New Media* identifies levels in hierarchical order: "interface-content, the operating system - software, Web site – HTML code, a high level programming language - assembler - machine language."<sup>19</sup> As with previous conservation experiences the condition of a certain coat determines the nature of conservation intervention. And this is true in today's computer-based art. We can localise problems at the level of hardware, operating system or specific element of artwork code, and so on. However, in a comparison between stable material objects and variable media objects the difficulties encountered by the conservator become clear. In the case of a digital object the relation and interdependences of elements are as highly sophisticated as the structure of the object itself. But net-based art goes much further. The position of the conservator is extraordinary in that he deals with two aspects of the work of art: the interface, which comes into contact with the user 'client side', and the 'server side' (hence 'physical') location of the object. During preservation the conservator struggles with the problems of both sides and on both sides cares for the condition of the artwork. We have not come across such a bilateral configuration before.

## Exhibition place and relations with the surrounding network

This dislocation as a basic criterion of value in net artwork was also emphasised by Peter Weibel. “Most of the artworks in history are locally bound, which means the spectator and the artwork itself share the same space. Even with media works this is important - in a media installation you share the same space. For the first time with the net, the spectator and the work are dislocated, separate; they don't share the same space. It is important to look for works and the criteria that are appropriate to this condition.”<sup>20</sup>

One of the basic missions of the museum is to provide contact with works in the original context, which entails the presentation of works of art in a way that connects the artwork and the original environment. Since net art objects are the most 'context-dependent', we can question whether institutions can provide such context outside the network. The first net art exhibition presenting objects extracted from the Internet, available via a special kiosk, met with the disapproval of the net art community. “Interfacing New media within the museum or gallery space always entails a certain recontextualization and often reconfiguration. Many new-media art projects are inherently performative and contextual to the ‘outsider’ and feel decontextualized in the ‘white cube’ that was intended to create a ‘sacred’ space and blank slate for the contemplation of objects.”<sup>21</sup> It can, therefore, be inferred that the network does not define net art only in terms of media, but also in terms of how and where exposure occurs.

The placing of an art object on-line is not the whole issue but concerns its unique relationship with the surrounding network. Each net art object ‘lives’ in a certain dependent relationship with other network elements. Depending on the nature of the work, its essence may be contained in interactivity, its relation to the network neighbourhood or the community built around the site. In terms of relations with the surrounding platform, Rhizome.org archived objects divided into:

- static sites which do not change either the structure or the content;
- evolving, but self-contained sites which change over time but do not exceed the limits of their own site;<sup>22</sup>
- uncontained sites which are not really sited anywhere, but migrate from site to site or ‘feed’ on them.<sup>23</sup>

As regards the first two groups’, methods of preservation of digital material can be applied. The third group does not offer a clear solution for archiving.

## The issue of obsolescence

As previously mentioned, among all the disciplines of visual culture, art based on the Internet is the most vulnerable and most sensitive to continuous limitation, and is not resistant to changes in hardware and software, whilst being sensitive to erroneous server management.

Developments in technology have had a great influence on net art objects making them incompatible with surrounding neighbourhoods and modifying their aesthetics and workings so changing the experience of the work and its interpretation. The nature of the medium reveals natural features, but creates the limitations and ageing typical of ageing material. The old question returns: whether the changes and variations of artworks caused by a variable medium should be accepted and adopted or understood as an integral part of the artwork. We used to accept these changes, in the case of older objects, or even see them as a dignifying ‘patina’ feature. However, in the case of art based on the information technology this leads to the destruction of

the work. Works of art affected by these processes (computer hardware failure and development of standards for programming) cannot function or at best work incorrectly. In the case of Internet-based art degradation surfaces as invalid links, incompatibility and differences between browsers resulting in the complete destruction of the piece caused by a growing number of errors in the code. Even positive changes such as evolution and standardisation of languages used, updating of browsers and the eventual correcting of previous errors may have destructive effects on net artworks. An interesting example is a work by Olia Lialina entitled 'Cross the Border'. This artwork was created to be viewed using Netscape 3.0 whose errors allowed the author to use vibrating texts. This version of the browser was updated and the error corrected. As a result it is no longer possible to see vibrating texts. Through this change the artwork no longer represents the artist's intention and lost its value.<sup>24</sup>

To repair malfunctioning script it is usually not enough to add or change a line or two in the source code. There is no 'retouch trick'. Sometimes it is the case that a digital object needs to be built again from scratch. This is why the issue of interpretation and dialogue with the author of the work becomes essential. During this phase of the project it becomes possible to determine which elements of the object should be emphasised, documented and protected.

Institutions collecting net art objects usually have contact with the artists so artists can oversee the decisions made about objects and supervise preservation processes. It is good practice to interview artists whenever an object is commissioned and obtain all necessary instructions about the future of the object along with documentation made during the process of its creation. This will be essential in choosing the conservation strategy. Given all this, the artist's collaboration with the conservator/archivist/developing programmer is necessary.

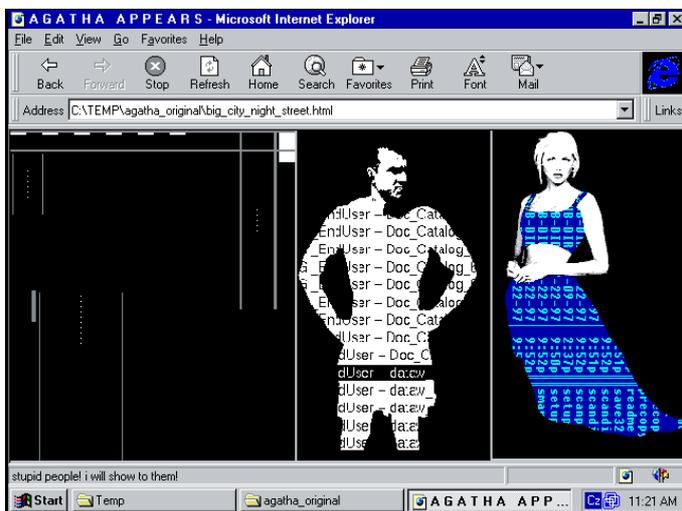


Fig. 4. Olia Lialina, Agatha Appears 1997,  
[http://www.c3.hu/collection/agatha/big\\_city\\_night\\_street.html](http://www.c3.hu/collection/agatha/big_city_night_street.html)

individually as there is no single ideal solution. Those dilemmas become more and more sophisticated and difficult as technology develops and collected (or even dispersed) preserved artworks age. The future of collection of net art, along with its condition and interpretation, will depend on the answers the institution gives today.

The question that must be asked is this: What defines a specific work? Its code, which contains irreplaceable historical value? Perhaps the most important thing is to preserve the original experience, which was conveyed at the time of its creation. Are efforts to preserve the original equipment and the code and format more important than on-line access to the artwork? Is keeping old obsolete hardware or emulation an old browser interface representative of the original filing? Or has this style of techno-nostalgia come into competition with the aesthetic of the artwork and made the message unclear? As in the conservation of traditional art works all decisions should be made

## Agatha Appears case study

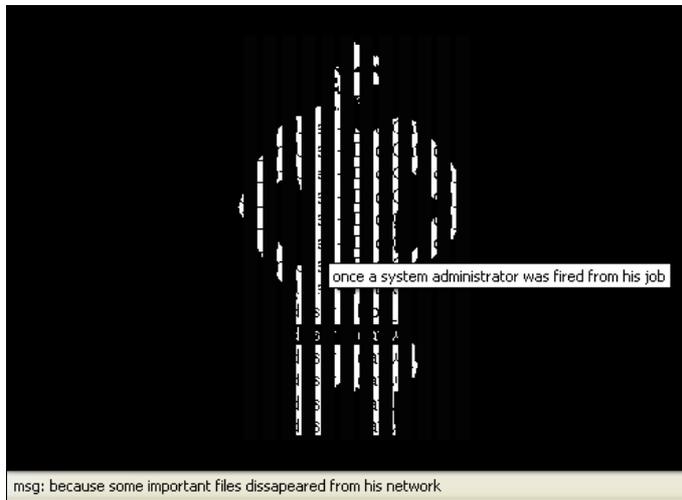


Fig. 5. Olia Lialina, *Agatha Appears* 1997, <http://www.c3.hu/col-lection/agatha/>

### Context and content

*Agatha Appears* was created in 1997 by Olia Lialina during her residence program at C<sup>3</sup>, The Center for Culture and Communication Foundation and belongs to its collection. *Agatha Appears* is available on-line at <http://www.c3.hu/collection/agatha/>. The author of the project, Olia Lialina is a well-known Internet artist and theorist and an experimental film and video critic and curator. She is one of the founders of the pioneering 'net.art' group. As defined by Cornelia Sollfrank: "(net.art) refers to a loose group of people that came together for the first time in 1996. These cultural producers (artists, activists and computer programmers) had met on-line through the mailing list 'nettime' - <http://www.nettime.org> - that is still around - and formed a context for art production. They all came from different backgrounds and had different artistic practices, that's why it is hard to generalise what their art was, except that it mainly happened on the Net. These people, however, used a smart marketing idea, called what they were doing 'net.art' and promoted it all over."<sup>25</sup> *Agatha Appears* was made under the auspices of the 'net.art' group. In her work, through narration constructed by a sequence of hyperlinks leading to various locations, Lialina considers the non-linear nature of the network. The network becomes a place of conscious and accidental choice, and its dynamic nature cannot be completely embraced or predicted. On the other hand, we can see a controlled, considered chain of events reminiscent of the structure of film editing – a throwback to the authors background in film.<sup>26</sup>

Agatha, a lost country girl, meets a system administrator - SysAd - who asks her if she has heard about the Internet<sup>27</sup> and encourages her to travel by 'net vehicle'. Despite some difficulties due to her long legs he successfully teleports the girl from one server to another all over the world. The viewer can see their path both on a browser status bar and in the title bar. This is a hypertextual journey across space and time boundaries and could continue forever but in the end Agatha becomes tired and decides to stop.<sup>28</sup> Her virtual body goes back to the home-server of the C<sup>3</sup> Foundation.<sup>29</sup>

### Preparation of project

Before one can start any restoration work, it is always important to collect all available information about the object, including its original state and current condition. Alongside this, technical considerations, which determine the action and reception of the work and the circumstances of its creation, are important. It is necessary to examine whether we have access to all the constituent elements.

The ideal is to stay in touch with the author and programmer (if such exists). This was true in the case of *Agatha Appears* created with developing programmer Márton Fernezelyi.

## Object perception at the time of creation

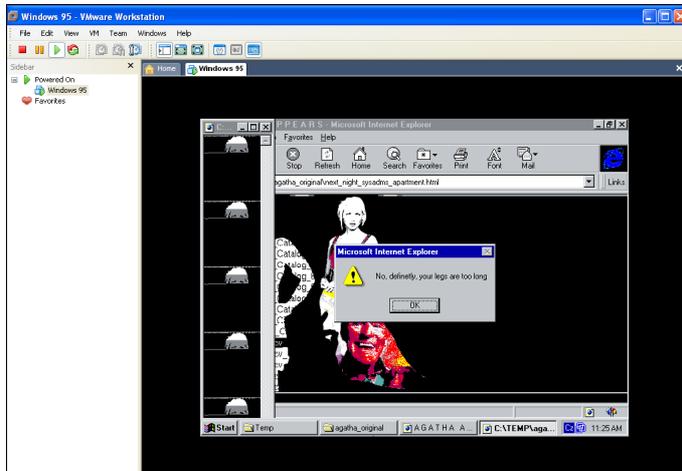


Fig. 6. *Agatha Appears*: Internet Explorer 4.0 web browser running on virtual machine  
[http://www.c3.hu/collection/agatha/next\\_night\\_sysads\\_apartment.html](http://www.c3.hu/collection/agatha/next_night_sysads_apartment.html)

Knowledge of the history of the ‘on-line medium’, which is mentioned here just briefly, is very useful in imagining how the object was experienced at the time it was created. These nuances aid interpretation and choice of preservation methods. In 1997, when the work was created, the Internet was a new phenomenon reserved for institutions and a few private individuals. Users had, almost exclusively, small 15” or 17” monitors with a resolution of 800 x 600 pixels. This meant the viewing experience was significantly different from the one we are now accustomed to. Graphics seemed to be much bigger in proportion to screen size and to see all the items on Agatha’s page, it was necessary to

scroll down, and so a kind of interaction was necessary. Also, the time needed to load a page was different (so you put much more care what appeared in the status bar). Browsers of that time, such as Netscape Navigator 4.0 and Internet Explorer 4.0, looked slightly different and brought with them a lot of their own extensions.<sup>30</sup> In the early days browsers enabled greater freedom of programming for two reasons. Firstly, the Internet had not yet meshed and was not so strongly interconnected, and secondly it was not a source of so many threats and such brazen advertising. Today’s browsers offer us much greater protection.

For the purpose of this project, in order to see how *Agatha* might have looked in 1997, an old computer was used (Win98 with IE 0.6) and a virtual machine running WIN95 with Netscape 4.0/IE 4.0 was installed on a modern device. The speed and capacity of the virtual machine and screen resolution were configured to simulate the operation and interface which the average user experienced at that time. Despite the visual drawbacks involved in using old software it became possible to use the parts of the original source code that were incompatible with modern machines. Today’s fast bus operators, complicated browser interfaces, transformation and standardisation of programming languages, and the policies of browser producers have had a great impact on the appearance and working of *Agatha* in the extended space of the Internet. Each of the following aspects of work has become a separate issue for preservation. At the beginning SysAd says, “because some important files disappeared from his network” and because of this the degradation of the artwork also represents a medium and we can assume that author is conscious of this progression. This is a ‘natural’ process for this medium and is how networked art ages - through the inability to view the next page, missing links or occurring errors, all of which can be considered intentional elements of the work. But this kind of degradation did not stop and the work suffered further disintegration. The next stage of degradation rendered it impossible to read the dialogue and hard to follow the story. In the final stage of degradation some of the files on servers outside C<sup>3</sup> vanished and it was no longer possible to navigate Agatha’s path. As we see, what used to be an

advantage of Lialina's work using Internet elements as a means of expression (hypertextuality, dispersal, navigability) became a major cause of the extremely accelerated obsolescence rate and its fragile nature. These characteristics also brought about complications in the conservation process.

## The elements of the structure and the process of degradation

### Hypertext

Hypertext, hyperlinks – often used by Olia Lialina - are the main engine of the narration in this story. Although the work still has much in common with traditional, linear stories, through the use of modern devices it is turning into a multi-layered hypertextual adventure. As previously mentioned, the files were not only located on the C<sup>3</sup> server but, during the 'travel chapter', were dispersed among a dozen diverse locations. These were servers belonging to famous net.art collectives and individual artists.<sup>31</sup>

**Conservation issues.** Agatha's hyperlink journey was a real trouble spot. It was enough for just one file from an external server to be deleted or not act properly to interrupt the chain of events. And so it happened. One file went missing, another was replaced by a different file in the same location, and still another contained a wrong URL that led nowhere. One could say that such degradation is a natural process of ageing in works of art and the aborted trip represents the dynamic nature of its medium. The problem is that in the case of this kind of art, we do not experience a 'digital patina', rather the complete destruction of the work whether the code is working or not. What the viewer sees is the '404 Document not found' error message meaning that the document has been lost.

### Consultation with the author

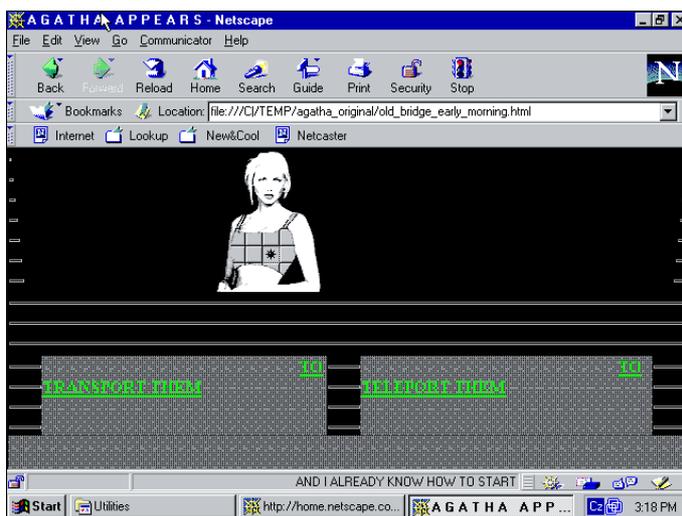


Fig. 7. Olia Lialina, *Agatha Appears*, running on Netscape 4.0  
[http://www.c3.hu/collection/agatha/old\\_bridge\\_early\\_morning.html](http://www.c3.hu/collection/agatha/old_bridge_early_morning.html)

To decide about the future of the object and settle the issue surrounding the general idea of the preservation project, the assistance of the author was requested. She was enthusiastic about the idea of the restoration project and suggested she trace a new path. During the project she selected four new locations for troublesome files. The C<sup>3</sup> decided to leave the remaining six files in the old locations in a restored version.

Due to the need for reprogramming and overwriting files (applying also to files which were to stay in the same locations) it was necessary to contact administrators. Unfortunately, in some cases this

proved impossible. Therefore Lialina decided to establish a new trajectory, which was noticeably different from the original. As we can see, this element of the work – files stored outside the C<sup>3</sup> Institute and belonging to various owners, they are practically out of the control and responsibility of the collector. Given this we can assume that

Agatha's path will be in constant flux and may well change again if a break in the path is found in future.

### HTML code

*Agatha Appears* was written in HTML 3.2 at a time when the process of standardisation of the syntax, components used and their interpretation by browsers were not yet completed. The programming was more unconstrained so many elements that acted correctly at that time today generate errors and some of the tags and their attributes have become defunct. The extent of this problem is increasing.

### Alt and title attributes

For displaying dialogue between Agatha and SysAd the author used the *alt* attribute, which was a common but incorrect way to provide pop-up tooltips when a user's mouse hovered over the image. Originally the *alt* attribute was intended to specify text instead of the element to which it was applied and could not be rendered (*alt* = alternative text) but it also appeared when a user's mouse hovered over the image.<sup>32</sup>

**Conservation issues.** Currently, thanks to the growing standardisation of HTML browsers, these browsers do not support this erroneous method of using *alt* as a tooltip generator. The attribute currently recommended for viewing short text information is *title*. Title attaches subtential explanations to elements and is displayed by tooltip appearing on the screen after mouse events so it looks and works in the same way as previous pop-ups generated by *alt*. As part of the restoration all *alt* attributes have been converted to *title* attributes.

### The status bar



Fig. 8. *Agatha Appears*: the text in status bar must be preceded by the *Message* and a colon.

The status bar is a window attribute and appears in a bar at the bottom of the Web browser. Olia Lialina placed part of dialogue in this bar and the text was subject to interaction with events with defined fields (images or hyperlinks).

**Conservation issues.** Current browsers do not allow for flexibility in the programming of this field and it became redundant so viewers soon dropped the habit of looking at it. Since version 7.0 of Internet Explorer the status bar has been reserved for information about embedded links (on mouse events) or for information about the state of loading of the page. Since this version the viewer has not

been able to see any part of the Lialina's work placed in the status bar. There was no perfect solution to overcome this problem, so because of the compromises involving possible options the final decision was left up to the artist.

Three solutions were proposed:

1. Transfer text from the status bar to the additional tooltip fields.
2. The creation of an additional bar to display and animate text from the previous version. For this purpose the use of Macromedia Flash technology was planned.

3. False link method - putting Lialina's previous text in false URL links. This simple solution allows for the screening of just one text in an active document. The Artist used several comments on one page so it was necessary to reprogram the entire status bar dialogue. To do so JavaScript was implemented to imitate the status bar behaviour of 'Agatha 1.0'.

Lialina chose the third solution, which, for the conservator, too, seemed to be the least invasive. After these amendments short messages appear in the same field as in the original version. The difference is that statements must be preceded by the *Message* and a colon. After consultation with the author this programming requirement was met through the use of the names of the protagonists. Thus *agatha: ....* and *sysadm: ...* instead of *msg:...*

This solution was not without its consequences. First, a small problem was found in naming files. Files with special characters in the name of the program do not treat them as a string - but as other functional elements of language. Therefore the names of files which generated errors have been changed. The second and more complex problem was the inability to animate text in the status bar. In the file [http://www.c3.hu/collection/agatha/late\\_evening\\_railway\\_station\\_heavy\\_rain.html](http://www.c3.hu/collection/agatha/late_evening_railway_station_heavy_rain.html) there is the crawling string of characters:

"Internet its not computers, applications, scripts. It's not a technology, but new world, new philosophy, new way of thinking, to understand the net u must be inside. U should come through it, u must be in it ... -- New world? I want to try!"

Embedded in the code, the JavaScript function was not able to animate the field of the status bar or these false links. Because text animation was used to create the railway station atmosphere, the Artist wanted to keep this movement. Therefore it was decided to move the animated text to the document's *TITLE* field.<sup>33</sup>

## Java script

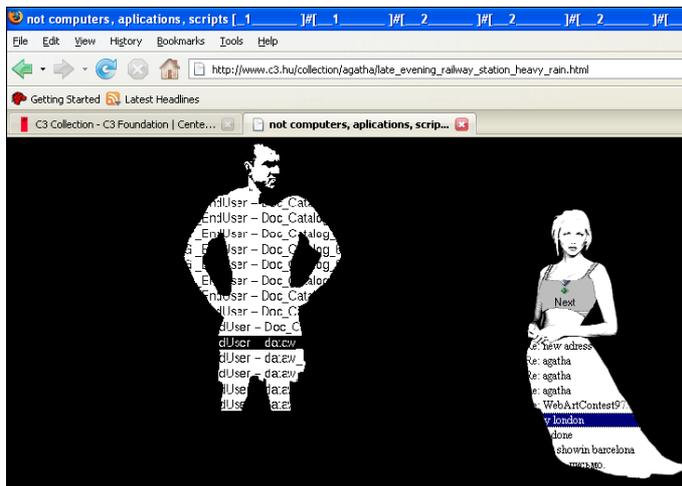


Fig. 9. *Agatha Appears*, the crawling string of characters on: [http://www.c3.hu/collection/agatha/late\\_evening\\_railway\\_station\\_heavy\\_rain.html](http://www.c3.hu/collection/agatha/late_evening_railway_station_heavy_rain.html)

## Music

A music file was embedded in some of the files. The author used the popular RealAudio (.rpm) format which needs a RealAudio plug-in. Currently, this format is rare and is not recognised by modern browsers and as a result users do not hear the music and are not aware that there should be any (because no error is indicated).

Olia Lialina embedded JavaScript elements to animate graphics in the piece. JavaScript was also used to communicate with the user through pop-up windows (*Message Dialog* and *Confirmation Dialog*) at the culmination of the story, just before Agatha's teleportation.<sup>34</sup> Most of today's internauts configure their browser settings to avoid annoying advertisements. The security manager will create JavaScript exceptions to ignore the *window.open()* method. Thereby giving the viewer a restricted version of the artwork unless they configure their browser to allow pop-ups.

During the restoration process the music file was reformatted to the currently popular MP3 file format supported by the Flash player plug-in.

### Image Files

Obviously, graphics files are essential elements of the artwork. Gif images (Graphics Interchange Format) are still very popular hence no changes were required.

### Storage, security and documentation

Despite difficulties which are involved in the maintenance of new-media art, it has one important advantage. The digital object is infinitely duplicable and its clone is equal in every way to original. Before starting restoration the artwork and all additional software elements were copied twice and stored in separate locations.

These kinds of actions may be termed 'static preservation': everything is preserved along with the art project, including the technical 'environment', as if placed in a time capsule - from the pc, the browser version, the plug-ins needed, and the files for the net art project itself.<sup>35</sup> During the work process additional copies were made both for security reasons and to document unrealised ideas about how to restore the work.

One of the fundamental principles of conservation is the rule of the distinction of reconstructed parts from the original and the documentation of the applied treatments is highly recommended. Only when the intervention is clearly defined can the artwork retain its historical value. To obey this rule all operations were registered in an additional document. Also, correspondence with the author was added to the database. In addition to this, documentation of programming changes was also recorded in the form of comments "restoration info" hidden in the source code of every page of the artwork. This information allows the conservator to preserve the exact context, but mostly it allows them to keep the processes of conservation transparent. It is also instructive in a way hidden from the ordinary viewer but can contain valuable information for researchers and instructions for future conservators. There is a long tradition of conservators including hidden information in restored works as a reference point for colleagues in years to come. Just as conservators of the past left short remarks on the back of a canvas, so their modern conservators leave notes in source code.

## Result of the *Agatha Appears* restoration project

The outcome of the preservation project is the re-establishment of the original visual effect intended by the author through the restoration of the proper functioning of *Agatha Appears*. It was decided that a higher priority was to be attached to the maintenance of easy on-line access to the work and its correct functioning on modern browsers rather than preserving the author's programming, through virtualisation of the artwork's environment. A consequence of this decision was the compilation of a handful of strategies needed for this kind of complex net art object. Generally, objects 'migrate' to modern technologies: a part of the files was reformatted to valid formats (reformatting) and malfunctioning lines of code were reprogrammed according to new HTML standards. If a simple change was not possible, a more developed script was used to mimic the behaviour of obsolete code. We may say that this is a kind of reinterpretation of the author's idea using today's

linguistic possibilities. The decision to recreate a path with the new version was a consequence of the preservation strategy undertaken - at this time in the project a method close to that used by the Variable Media Initiative called “re-interpretation” was utilised. Following the author's way of thinking, this part of the object was kept in mind as elements were modified. This means that the work could be recreated in the spirit of the original to maintain the correct interpretation and a seamless perception of the piece.

## Other preservation methods

In the case of *Agatha Appears*, a reformatting and reprogramming strategy was considered the best option. However, Internet art objects can have very diverse forms and needs. Disadvantages and features can potentially make this method unsuitable for some net art works which demand minimal intervention or simply do not tolerate archiving in any stable form. In the following paragraphs I will try to establish which types of net artworks influence the choice of conservation method, and their individual features.

### Documentation

Documentation of art has performed a crucial role since conceptual art, (where theorists place the sources of new-media art) through performance and other ephemeral art forms to contemporary digital art. It fulfils a dual function: it is a testimony to what has occurred and is, in a certain sense, an independent entity, as regards the physical face of ephemeral art, which is linked to the art market. In the case of digital artwork, which cannot be saved in an integral and representative form, documentation at least provides adequate and official information. This occurs with projects based on the communities built around them. Such documentation may, in a relatively short time, be the only source of information concerning the project.

### Re-creation, re-presentation

In the case of new-media art competent technical documentation might have a special role - it can be used for re-creation of objects to bring back the same understanding in next-generation technology. This kind of approach has its beginnings in the understanding of digital objects as performative scores (as mentioned before) and it allows for the re-creation of artworks in the future even if collaboration with the artists concerned is not possible. But only competent and fully reliable information can provide the chance to avoid missing the artists' intentions and observe the conservators' profession rules. Repeating the artists' ideas using new technology was the aim of the preservation-artistic experiment accompanying the *404 Object Not Found International Congress* concerning the production, presentation and preservation of media art.<sup>36</sup> The Center for Culture and Communication used *Cryptogram*<sup>37</sup> - a Web project from 1996 - as a case study. The author of the object Zoltán Szegedy-Maszák and software engineer Tibor Fóris were involved. *Cryptogram* is an on-line encryption system allowing the coding and translation back and forth of textual messages into three-dimensional objects in VRML 1.0. Depending on spatial locations the characters to be substituted in the program create virtual sculptures. Although the language of VRML (Virtual Reality Modelling Language) is still supported by some browsers its life expectancy is short. To overcome future problems, the author Zoltán Szegedy-Maszák decided to reproduce the work using

current Java technology. The experimental nature of the project came from programmer Tibor Fóris never seeing the original work. As the author of *Cryptogram* said: “He has been working using exclusively my (constantly upgraded) documentation, without seeing any other screenshot, description of the piece, including the still-running piece. (...)The ‘remote-reconstruction’ turned to be absolutely successful, the following pages show the documentation which is the sum of our e-mail communication. This information should be enough for any software engineer in the future to reconstruct Cryptogram.” The project resulted in an almost identical (as it appeared to the viewer) stand-alone Java application using the Java3D extensions.

Given all this, the open structure and performance of digital media artworks and their preservation can often be seen as an act of re-creation or re-presentation. This kind of idea was suggested by artist Mark Napier when interviewed by Jon Ippolito at a Conference on Variable Media entitled *Preserving the Immaterial*.<sup>38</sup> His artwork *Net.flag* was commissioned by The Solomon R. Guggenheim Museum for its permanent collection. *Net.flag* is an evolving project allowing visitors to create their own emblem of territorial identity by putting together elements – graphic symbols from the international flags. The author envisions the future of the work as never-ending, evolving in a constant process of creation in the prevailing geo-political and technological context. This means that the author is open to changes updating the artwork to current political situations and subsequent authors’ choices regarding re-creation and 'reinterpretation' as a future preservation strategy for artwork.

## Emulation

The next prospective preservation strategy is emulation. When we deal with a net object whose value is based on programming and so is close to 'software-based art' reformatting and reprogramming potentially entail a loss of authenticity and historical value. Precisely to solve the problem of increasing incompatibility with software and hardware, a strategy entitled ‘emulation’ was established a long time before anyone thought about using it for art preservation. Emulation is the implementation of an environment for other programming entitles. In such an architecture, software-based artwork is executed on an OS or other software installed on a virtual machine installed on a modern computer – a far from trivial task. The emulator needs to be updated and programmed for each generation of software and hardware so the sum total of effort and cost is relatively high. Through this method the code stays unchanged and the minimal intervention is a great advantage of this method. The emulation method overcomes problems of obsolete code but creates the problem of connection with real networks, which cannot be fully virtualised. This determines access to the object, which is then limited to the configured hardware. Therefore, in the case of objects for use on the Internet, this strategy is highly controversial. In practice it will mean that artwork will be presented in museums and galleries using special computer platforms (i.e. via virtual machines installed on modern computers) or via kiosks.

Perhaps this problem can be relieved by on-line applications or by providing user-friendly plug-ins<sup>39</sup> that could be installed by visitors to on-line galleries. But we should remember that if this procedure is complicated or creates the need to install additional applications most users will quickly give up.

## Summary

To date all museums' and art collectors' activities have been 'object-oriented' (to use IT parlance). They construct context, framework and physical infrastructure for storage, preservation and access to their collections. Previous conservation practices, according to academic analysis, proclaim wholeness, integrity, repeatability of the experience and verifiability of interpretation of the work of art in contact with objects in which material is replaced by medium and interface conservation practices awaiting a revolution in thought. New-media art, as distinct from stable art forms, characterises art as "process oriented, time-based, dynamic, and real time; participatory, collaborative, and performative; modular, variable, generative, and customisable."<sup>40</sup> Therefore the main goal will be to preserve also these features and not merely save the 'physical artwork' (files) itself.

The strategy of reformatting and reprogramming applied to *Agatha Appears* was not the only possible way to go. Although *Agatha* is complete again and works properly in present browsers, applied conservation treatments won't protect net art pieces from further Internet development as it is barely possible to predict these transformations. Reformatting and reprogramming strategies are not long-term solutions because they place the artwork in a never-ending process of continuous translation to correlate with valid technology. For this reason, and due to the nature of the medium itself, the result obtained cannot be considered the final state of the work and the end of preservation efforts. Will the author decide to establish a new path for *Agatha's* travel in coming years? Will *Agatha* be upgraded to version 3.0? This is highly possible! How long these changes of source code will be compatible is difficult to predict, but it seems probable that after standardisation of HTML, it should no longer require great changes. At the same time the development of interfaces and the operations of browsers will not be slowed by the extremely rapid development of the communication technology sector. Perhaps in the distant future only emulation will provide the opportunity to present this work.

We can clearly see a dilemma, which soon all contemporary art museums will need to face: how can one save the source material (i.e. encoding files) in a world of constant technological development and how does one preserve on-line art? How can the role of the network environment be estimated for a particular work of art and how can the constant change of artwork context be dealt with? Since the problem will continue to grow we may assume that soon there will be no compromises or half-way solutions, simply choices between leaving the source encoding and file formats as they are so the object is available only via a special hardware configuration (using a VM or emulator), or making the object a cyclical re-creation (re-interpretation) make possible easy access via Internet. In any case a strongly recommended practice is to collect the documentation of net artwork which provides a proper context for viewers and which will give some impression about inactive objects for researchers so as to provide a starting point for future methods of conservation which are as yet unknown. Individual evaluation of a particular net art object, close cooperation with the author and making decisions from the perspective of superior technology can give proper information to generations to come about this non-replaceable part of new-media art history and may even serve to save it from loss. It is important that we start with the best intentions when dealing with the conservation of these special works of art thereby avoiding signing the death warrant of pieces whose very variability constitutes their value.

- <sup>1</sup> From the source of: [http://www.c3.hu/collection/agatha/late\\_evening\\_railway\\_station\\_heavy\\_rain.html](http://www.c3.hu/collection/agatha/late_evening_railway_station_heavy_rain.html)
- <sup>2</sup> The UK Archiving Consortium: available at <http://www.webarchive.org.uk>, The Digital Preservation Coalition (DPC) can be found at <http://www.dpconline.org>
- <sup>3</sup> WWW is not a synonym of the Internet as we use to think. The World Wide Web is rather way of processing and presenting information while the Internet is electronic system of inter-communication. G. Graham, *The Internet. A Philosophical Inquiry*, Routledge, London & New York 1999, p.22 quoted in Wójtowicz E.: *Net Art*, Kraków, 2008, p. 89.
- <sup>4</sup> Definition by Steve Dietz, former curator in new media at the *Walker Art Center* in *Minneapolis* on wikipedia: [http://en.wikipedia.org/wiki/Internet\\_art](http://en.wikipedia.org/wiki/Internet_art)
- <sup>5</sup> Available on: <http://www.c3.hu/collection/form>
- <sup>6</sup> Dieter Daniels noted this in 1994. Daniels D.: *The Art of Communication: From Mail Art to the e-mail Neue Bildende Kunst*, Nr. 5, Berlin, 1994, p. 14 -18. Available on: <http://www.hgb-leipzig.de/index.php?a=person&b=mitarb&c=&d=&p=312&js=2&>
- <sup>7</sup> The Advanced Research Projects Agency, known as ARPA created in 1958.
- <sup>8</sup> On August 6, 1991, CERN, published the new World Wide Web project
- <sup>9</sup> [http://www.programowanieobiektove.com/era\\_internetu.php](http://www.programowanieobiektove.com/era_internetu.php)
- <sup>10</sup> Wójtowicz E.: Op. Cit., p. 57.
- <sup>11</sup> Lialina O. interviewed by Spieker S.: *Dispelling the Myth that Net Art is (not) a Commodity*. 6 Jun 2008. <http://www.artmargins.com/content/evview/third.htm>
- <sup>12</sup> Lialina O.: interviewed by Baumgärtel T.: *Internet Art Haute Couture*, 25.08.1998. Available: <http://www.heise.de/tp/r4/artikel/3/3276/1.htm>
- <sup>13</sup> Benjamin W.: *The Work of Art in the Age of Mechanical Reproduction*; 1936. Transcribed: by Blunden A.1998; proofed and corrected Feb. 2005. Available on: <http://www.marxists.org/reference/subject/philosophy/works/ge/benjamin.htm>
- <sup>14</sup> Available on: <http://www.ljudmila.org/naps/cnn/cnn.htm> and <http://www.ljudmila.org/~vuk/dx/>
- <sup>15</sup> Is still available on <http://www.irational.org/tm/archived/tesco/front2.html> as well as the letter which Baker got from Tesco informing him that the company would take all necessary steps to protect its rights by commencing proceedings such as seeking an injunction, delivery and/or destruction under oath, and monetary compensation. <http://www.irational.org/tm/archived/tesco/>
- <sup>16</sup> According to Mark Tribe, Director and Founder of Rhizome.org. Tribe M.: *Archiving net.art*, New York, November 2000. Available on <http://www.afsnitp.dk/onoff/Texts/tribearchivingne.html>
- <sup>17</sup> Wójtowicz E.: Op. cit., p. 126.
- <sup>18</sup> Kluszczyński R.W.: Op. Cit. p. 224
- <sup>19</sup> Manovich L.: *The Language of New Media*, 2002, p. 361. <http://en.wikipedia.org/wiki/Internet>
- <sup>20</sup> Cook S.: Interview with Peter Weibel: <http://www.crumbweb.org/getInterviewDetail.php?id=9&op=3>
- <sup>21</sup> Paul Ch.: *The Myth of Immateriality*, in *MediaArt Histories*, ed. Grau O. Massachusetts 2007; P. 259
- <sup>22</sup> An example is Ben Benjamin's Superbad.
- <sup>23</sup> An example is Mark Napier's Shredder. Accessible at: <http://www.potatoland.org/shredder/shredder.html>
- <sup>24</sup> Gapevicius M.: *Vanishing net art*. 1999. Available at: [http://www.o-o.lt/agon/v\\_n.a/](http://www.o-o.lt/agon/v_n.a/)
- <sup>25</sup> <http://www.artificial.dk/articles/forreal.htm>
- <sup>26</sup> Internet artists were mostly connected involved with analogue-media-based art (photography, painting or film, and rarely sculpture) and their previous experience noticeably affected the understanding and method of use of media networks.
- <sup>27</sup> [http://www.c3.hu/collection/agatha/big\\_city\\_night\\_street.html](http://www.c3.hu/collection/agatha/big_city_night_street.html)
- <sup>28</sup> [http://www.superbad.com/agatha/lost\\_the\\_interest.html](http://www.superbad.com/agatha/lost_the_interest.html)
- <sup>29</sup> [http://www.c3.hu/collection/agatha/sysadms\\_apartment\\_4am.html](http://www.c3.hu/collection/agatha/sysadms_apartment_4am.html)
- <sup>30</sup> More information available on Turnbull D., Jobst J.: *Web Browsers History Project*, 2003 available at: [http://www.ischool.utexas.edu/~browsers/release\\_history.html](http://www.ischool.utexas.edu/~browsers/release_history.html)
- <sup>31</sup> [http://www.irational.org/agatha/wants\\_to\\_teleport.html](http://www.irational.org/agatha/wants_to_teleport.html) - Heath Bunting, [http://www.vuk.org/agatha/goes\\_on.htm](http://www.vuk.org/agatha/goes_on.htm) Vuc Cosic; [http://www.zuper.com/agatha/wants\\_home.html](http://www.zuper.com/agatha/wants_home.html) Zuper; <http://www.easylife.org> - Alexei Shulgin, Ljubljana digital media lab, Ljudmila, <http://www.altx.com> Mark Amerika
- <sup>32</sup> It was useful at a time when connections were relatively slow and it was a danger that some photos could not be rendered.
- <sup>33</sup> *Title* tag is an element defining the title of the document.
- <sup>34</sup> [http://www.c3.hu/collection/agatha/next\\_night\\_sysadms\\_apartment.html](http://www.c3.hu/collection/agatha/next_night_sysadms_apartment.html)
- <sup>35</sup> Tribe M.: *Archiving net.art*, <http://www.afsnitp.dk/onoff/Texts/tribearchivingne.html>
- <sup>36</sup> International congress concerning the production, presentation and preservation of media art Dortmund: <http://www.hartware-projekte.de/programm/inhalt/eueng.htm>; [http://www.c3.hu/c3/eu\\_projects/hartware/index.html](http://www.c3.hu/c3/eu_projects/hartware/index.html)
- <sup>37</sup> <http://www.c3.hu/cryptogram/>

<sup>38</sup> Session on Interactive and Duplicable Artworks entitled Preserving the Immaterial: A Conference on Variable Media March 31, 2001: <[http://www.variablemedia.net/e/preserving/html/var\\_pre\\_index.html](http://www.variablemedia.net/e/preserving/html/var_pre_index.html)>

<sup>39</sup>As suggested by Richard Rinehart, Digital Media Director of Art Museum (BAM)  
<[http://switch.sjsu.edu/nextswitch/switch\\_engine/front/front.php?artc=233](http://switch.sjsu.edu/nextswitch/switch_engine/front/front.php?artc=233)>

<sup>40</sup>Paul Ch.: Op. Cit., p. 253