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## Hostages of the Ephemeral: A Preservationist View of Electronic Literature

### **Abstract**

Throughout history, stewards of cultural heritage collections have advocated for technologies of external memory based on their proven ability to endure into the future. Despite studies that demonstrate how zeros and ones inscribed on digital media often stand up well to the ravages of time, the long-term preservation of the content they encode—particularly in the field of electronic literature—has proven to be a challenge. This is because the accessibility of electronic literature depends as much on the preservation of bit-streams as on the long-term viability of specialized computing environments and their constituent hardware and software components, thereby placing works of electronic literature at considerably greater risk of disappearance than their analog predecessors. Although authors of electronic literature have cultivated a growing awareness of best practices in digital preservation, they still lack tools designed with the posterity of their creations in mind. This paper explores these issues, as well as the question of ephemerality for electronic literature, by assessing contemporary digital formats within the broader history of preservation technologies.

### **Article Text**

No written work is indestructible, but some last longer than others. Texts inscribed on papyrus scrolls have been discovered in pots buried beside Egyptian mummies, and certain

libraries of Assyrian baked clay tablets are still as legible today as they were 4,000 years ago (Johnson 28-31). Broadly speaking, such artifacts are examples of *external memory*, which scholar Kurt Danziger describes in his monograph *Marking the Mind: A History of Memory* as information represented through the “purposeful modification of a physical medium by means of specifically designed tools and skills” (3). In writing a letter by hand, for example, one inscribes a message in legible script onto paper, thereby memorializing it with some degree of permanence. The longevity of the letter, however, will be determined primarily by physical factors. How acidic is its paper? Were any adhesives applied to it? What is the composition of the ink in which it was written? Are there dramatic shifts throughout the year in the levels of temperature and relative humidity where the letter is stored?

Such questions represent common concerns in memory institutions like libraries and archives, where the professional specialization of preservation management indeed entails conducting physical condition assessments of damaged items, monitoring temperature and humidity levels in storage locations, as well as tracking and mitigating the presence of destructive agents such as insects and mold. Much to their frustration, however, preservation specialists have found that they cannot always rely on training in the physical sciences to estimate and extend the longevity, in an accessible form, of digital works. This is because of the way that information is written to digital media, which differs fundamentally from traditional analog formats.

When one types and saves a document on a computer, what is inscribed onto disk is not, strictly speaking, a human-readable text. Rather, it is a series of zeros and ones written to the computer’s storage layer, which, depending on the author’s computing environment could take any number of physical forms. Currently, the most common of these is the spinning disk hard

drive. What appears on screen as text, image, or prompt to action, however, only does so after passing through a process of decoding this and its related bit-streams and interpreting them in the context of a successful interaction between hardware, software, and a human operator.

These bit-streams are often, in and of themselves, rather durable. In his 2008 monograph *Mechanisms: new media and the forensic imagination*, an invaluable investigation into the physical structure of disk drives and its relevance to electronic literary theory, Matthew Kirschenbaum describes how difficult it often is to dispose of data written to the hard drives in most modern personal computers. Staff in the United States Department of Defense, for example, have even gone so far as to list destruction by incineration or smelting as viable options for the secure wiping of decommissioned computing equipment in their own operating manuals (24-27).

With such concern over the persistence of computer data shown by those with a vested interest in destroying it, one would think that digital media would have garnered higher praise as a preservation medium by now. Indeed, several decades of competitive manufacturing in the electromagnetic storage industry, both in spinning disk hard drives and magnetic tape, has furnished what many information technologists see as a fairly solid foundation for dependable data storage frameworks. In addition, those charged with responsibility for digital preservation in libraries and archives have developed best practices around *bit-level preservation*, that is, the accurate retention of data-streams in their original form. This generally involves maintaining multiple copies of data in geographically distant locations, and regularly verifying the authenticity of stored files by algorithmically scanning their sequences of bits to ensure that the zeros and ones have not changed state.

This is all to say that reliable techniques exist for maintaining digital bit-streams unchanged over time. Yet when we talk about the ephemerality of digital content, we are not so

much concerned with the bit-streams themselves as with the web of contingencies required to bring them to life. There is an immense organism, a kind of intermediary body consisting of any number of thousands of combinations of hardware and software components that must stand between a human and a bit-stream in order to produce something readable for said human's edification. This interpreting organism is subject to constraints often taken for granted in the daily use of computing technology, but which come to the fore when one tries to force a digital expression over the border between communication signal and historical artifact.

Keeping in mind Katherine Hayles' caution that, "To see electronic literature only through the lens of print is, in a significant sense, not to see it at all," it is nevertheless instructive in our case to consider the humble codex, or book. All that one requires in order to validate the preservation practices that have thus far maintained a book, broadly speaking, is the physical item itself and a person with functioning eyesight and knowledge of language. This is a gross simplification, of course, but as long as a book's pages turn without crumbling to pieces, it is readable. By contrast, when reading a digital text one needs, in addition to the aforementioned person, a digitally encoded text, an electrical power source, the correct computer hardware and software to interpret the encoded bit-stream, the legal right or appropriate license required to use said hardware and software, and if the resource itself is online, a functioning network connection. In other words, the armature of an entire information society is required to facilitate the simple act of reading.

The fact that hardware and software must retrieve and decode data streams of zeros and ones in order to present them in a human-readable format does not render the physical foundation of traditional preservation completely useless for assessing the long-term viability of digital works, but it does significantly diminish its importance. We still want to know how well

to trust the media on which we save our data-streams. Yet despite the fanfare made by popular science media outlets every time another research lab publicizes a breakthrough in “permanent” digital bit-stream storage (the freshest examples being crystal [Hornyak] and DNA [Service]), our most serious digital preservation problems do not in fact exist on the inscription layer. Even if a materials physicist were to, on examination of a specimen of digital media—the disk in a hard drive, for example—determine how long one may expect the zeros and ones encoded thereon to retain their magnetic orientation as such, this only partially determines the encoded content’s legibility. It is much more difficult to forecast the long-term viability of all the contingencies related to a specific instance of human-computer interaction required to bring a bit-stream to life.

This is especially challenging for electronic literature, which is a fundamentally experimental creative enterprise. The Electronic Literature Organization defines the term in relation to “works with important literary aspects that take advantage of the capabilities provided by the stand-alone or networked computer,” and goes on to cite the many forms this has already taken—hypertext fiction, interactively generated poetry, installation and performance art, and sound art, to name a few (Electronic Literature Organization, “About the ELO”). The capabilities of personal computing devices are in constant flux, and, as the two volumes assembled to date of the *Electronic Literature Collection* show, authors are wont to take what communication tools are available to them at any given time and marshal them to new artistic purposes. Frequently, these computing environments, or certain of their essential components, fall into disuse, are no longer maintained by their creators, or cease to be readily available for purchase.

Take the example of scholar Leonardo Flores and his attempts to compile a critical edition of Jim Andrews’ electronic poem *Arteroids*. Created in 2001 using the animation

software *Director* (produced and sold by Macromedia before it was subsumed by Adobe) and served to readers on the web as an interactive pastiche on the video game *Asteroids*, Andrews subsequently rewrote the code underlying *Arteroids* over the years to accommodate web browsers' changing standards and methods for content rendering. During Flores's enquiry into the history of those changes, however, the problem of software obsolescence reared its head. In an interview with the Library of Congress's digital preservation blog *The Signal*, he explained:

The biggest problem is that, despite a recent update to a version 12, Director seems to be a mostly abandoned project by Adobe. How much longer will Director files and the Shockwave format be supported? Shockwave files are not viewable in Linux machines, iOS or Android devices, and there seems to be no interest in developing that functionality. Instead, the latest version of Adobe Director offers the ability to publish works as iOS apps—a development that doesn't help *Arteroids* (Owens).

In cases such as this, electronic literature begins to take on more of the ephemeral qualities of performance art than the stable affordances traditionally associated with writing. Johannes Auer has even gone so far as to state that, “bei computerbasierter Kunst nicht mehr zwischen Content und darstellender Hardware und Software unterschieden werden kann,” that is, “in computer-based art, one can no longer make a distinction between content and rendering hardware and software” (this and subsequent German translations by the author), and that this, especially when dealing with proprietary software, has decidedly limiting consequences for archival viability:

Ein solches Werk ist zeitabhängig und tritt mit der proprietären Software auf die Bühne, bleibt dort so lange auf dem Spielplan, wie diese Software gepflegt wird und im breiten Einsatz ist und vergeht dann langsam mit Verschwinden seiner Aufführungsbasis.

Such a work has a time limit; it steps onto the stage with proprietary software, remains on the program as long as its software is maintained and broadly used, and then slowly passes away with the disappearance of the conditions necessary for its performance.

Nowhere is this more apparent than on the world wide web, where works of electronic literature travel across information networks to any number of destination nodes—often with differing results. As early as 1998, Robert Kendall commented on several of the impediments to the longevity of electronic literature already described above. For works published online, he wrote, the question of preservation is clouded by the lack of an authoritative manifestation to hold up above all others:

When an author writes for the Web, there's really no single urtext but rather numerous different versions presented by different browsers. Fonts and graphics are displayed differently on the Mac and Windows, and there are other formatting and interface differences from one browser to another.

Jürgen Schäfer, writing on the same topic, makes the historical insight that, “Writing and the printing press located or locked down within constant strings of fixed symbols what in fact were originally performative processes, thereby securing a high degree of textual stability” (33), and goes on to describe how this progress has, in effect, been reversed by our transition to computer media. Apart from the wide-ranging consequences this could have on our culture as a whole as we continue to prefer digital to analog media, it also has a simple, practical consequence for the artist and curator of electronic literature. Namely, works of electronic literature must receive constant attention if they are to survive in new technical ecosystems as these evolve. This often involves translation, or migration, from one obsolete environment or

format into another, placing a considerable burden on those interested in maintaining cherished works in a persistent accessible form.

This isn't unanimously viewed in a negative light. Joseph Tabbi, for example, while advocating strongly for effective preservation models for electronic literature, has also suggested that the inherent mutability of networked computing technology affords us an opportunity to leave traditional attitudes toward the canonization of stable, immutable works of art behind, and to move instead to a new model where creative communities remain engaged in ongoing acts of translation from the old formats to the new. Rather than trying to force networked computing technology into the role once played by analog preservation formats, Tabbi asks whether, "we might suggest that the model of an individual genius working in isolation, toward the creation of an object that (against all odds) lasts, is a mentality that authors working in networks can no longer afford."

Clearly, this issue has vexed the field of electronic literature for over a decade now. In 2002, the Electronic Literature Organization established its own *Preservation, Archiving, and Dissemination* (PAD) initiative to seek "a means to retrieve and preserve works of electronic literature from the ravages of technological 'progress' that leave the works inoperable in new technical environments, and thus inaccessible" (Electronic Literature Organization and the Digital Cultures Project). Under the aegis of PAD, the ELO has published two essential documents for practitioners, 2004's *Acid-Free Bits: Recommendations for Long-Lasting Electronic Literature*, and 2005's *Born-Again Bits: A Framework for Migrating Electronic Literature*, both of which provide authors of electronic literature with an invaluable basis for assessing preservation risk in their works.

Meanwhile, professionals from memory institutions have begun to actively publish on their experiences providing preservation services for works of new media and electronic art. Notable among these is the New Museum in New York, whose Rhizome ArtBase “encompasses a vast range of projects by artists all over the world that employ materials such as software, code, websites, moving images, games and browsers to aesthetic and critical ends,” and aims to “preserve these works in a sustainable archival format.” The Museum’s Digital Conservator Ben Fino-Radin has published a *Digital Preservation Practices and the Rhizome Artbase* report that not only confirms many of the challenges involved in stewarding collections of electronic art, but also describes specific steps taken at ArtBase during the accession of new materials to identify future preservation needs. Artist depositors are required, for example, to fill out a questionnaire specifying their preferred approach to the preservation of their work (14). Fino-Radin describes the resultant dialogue between conservator and artist as essential to both parties in developing effective plans for the long-term viability of new media works as they are cut off from the original context of their creation to become museum pieces.

The importance of context has also been underscored by Jerome McDonough, Principal Investigator of the *Preserving Virtual Worlds* project at the University of Illinois at Urbana-Champaign and Stanford University, which has sought to define the structure and necessary constituent parts of an “Archival Information Package,” or AIP, for electronic games and works of interactive fiction. This concept, drawn from the reference model for an Open Archival Information System, an international standard for establishing effective digital preservation systems and services, refers to the bundle of files that, taken together, constitute a preservation object as it will be stored for the long-term (Consultative Committee for Space Data Systems). Notably, McDonough has concluded that any realistic attempt to represent the original context

implied by a given work of interactive fiction necessitates storing a considerable amount of related materials in the AIP. This not only bolsters Fino-Radin's recommendation to begin the archival process by gathering contextual information, but also mirrors the motivations behind the Electronic Literature Organization's *Electronic Literature Directory*, as articulated by Tabbi in 2007 in envisioning a resource that will do more for its user community than simply provide the traditional markers of bibliographic metadata:

...bibliographic housekeeping, while fundamental, cannot by itself orient the Directory toward a potential literary development and make that development known within a developing network of readers. The means of accessing a Directory of objects under development needs itself to develop and change over time. The interface that allows access to an E-Lit Directory should, in other words, demonstrate in itself the history of the objects it represents.

A directory of records which testify to the creative contexts of works of electronic literature and their changes over time is an invaluable and necessary resource, but the complementary activity of stewarding said resources in an accessible format, as McDonough points out, is no negligible task. Witness, for example, the list of data streams the *Preserving Virtual Worlds* project recommends for the AIP of the relatively simple, comparatively speaking, 1977 computer game *Adventure*:

*Data Object*: the Adventure Fortran IV file and data file (three versions)

*Context Information*: a scholarly electronic article on Adventure's origins (in HTML format), a web site documenting derivative versions of Adventure, and a later derivative version of Adventure in the C programming language.

*Representation Information*: a PDP-10 emulator (with documentation), the System Reference Manuals for the PDP-10 (including the Fortran IV Manual), the PDP-10 Processor Manual, the TOPS-10 Operating System Reference Manuals, the C Language Specification, and additional specifications for the data formats for all of the preceding materials, including the Unicode, ECMAscript, JPEG/JFIF, GIF, PDF, Shockwave, CSS, GZIP and Unix TAR specifications (1628).

Such developments all point to the increasing sophistication of thought and practice in the preservation community among researchers and professionals interested in the long-term accessibility of works of electronic literature. It bears emphasis, however, that the state of the art is still exploratory at best, and that none of the examples cited above furnishes anything close to a comprehensive, reliable solution to the problems underscored by this paper. Simply put, what progress has been made to date has not managed to convert many preservation specialists into champions of digital technology for the preservation function. While some are more reluctant supporters of digital formats than others, the truth remains that anyone convinced that digital formats are as reliable for the long-term retention of information as, say, microfilm, would raise eyebrows in a room full of preservation professionals. Conversely, mention of the virtues of microfilm in a room of just about any other type of person in the world would likely provoke derisive eyebrow-raising if not outright laughter—and this despite the fact that one roll of microfilm, when manufactured using polyester-based film and stored at room temperature, will easily endure for a *minimum* of half a century (Gwinn 30). Alas, the world has left such unwieldy, un-networked technologies behind.

The answer to the question, “Is electronic literature ephemeral?” does not have a simple response. No one can accurately predict the technologies of the future. While we may hope that

simplified solutions to our problems will materialize under pressure of necessity, our reliance on digital formats for the retention of documents, works of art, and records of importance in our lives certainly constitutes a leap of faith. The most daunting aspect of the challenge is the endless variety of contextual variables related to the decoding and display of bit-streams for electronic delivery. But the missing stability we seek for works of electronic literature is not so much that which is provided, in the brick and mortar library, by paper, as by language. One recalls Roland Barthes' thoughts on "language" (*langue*) as a common foundation of grammar, vocabulary, syntax, and style versus modes of "writing" (*écriture*) as disciplines made possible in his country and others by the formalization of language:

Pour reprendre la distinction entre "langue" et "écriture", on peut dire que jusque vers 1650, la Littérature française n'avait pas encore dépassé une problématique de la langue, et que par là même elle ignorait encore l'écriture. En effet, tant que la langue hésite sur sa structure même, une morale du langage est impossible; l'écriture n'apparaît qu'au moment où la langue, constituée nationalement, devient une sorte de négativité, un horizon qui sépare ce qui est défendu et ce qui est permis, sans plus s'interroger sur les origines ou sur les justifications de ce tabou (Barthes 41-42).

To take up again the distinction between a language and a mode of writing, we can say that until around 1650, French literature had not yet gone further than the problematics of the language, and that by this very fact, it was as yet unaware of modes of writing. For as long as a tongue is still uncertain about its very structure, an ethics of language is impossible; modes of writing appear only when the language, being established on a national scale, becomes a kind of negativity, a line which separates what is forbidden

from what is allowed, without asking itself any more questions about its origins or the justifications for such a taboo (Barthes, *Writing Degree Zero* 62).

It is precisely in an effort to establish common “languages,” if you will, for electronic literature that *Acid Free Bits* recommends that authors give preference to plain-text file formats over binary formats while retaining source files for compiled works, and *Born Again Bits* advocates for the development of a standard Extensible Markup Language-based file format around which to build tools for the preservation and dissemination of electronic literature. These as well as related efforts to build emulators or interpreters for obsolete authoring environments demonstrate a community and its striving towards a common grammar for a language of electronic literature that future generations of computers will be able to speak. Or, to use a painting metaphor, we are still at the stage of digital literature, and of digital arts in general, in which artists mix their own pigments, often with varying results. Just as many canvases and frescoes of the sixteenth century have peeled and faded away due to their creators' use of failed experimental admixtures of color, so will many of today's works of electronic literature crumble, so to speak, into unintelligible sequences of zeros and ones. In time, the concentrated efforts of the electronic literature community's informed experiments with file formats and software platforms may yield trusted methods for composing durable electronic literature. It is safe to say, however, that we are not there yet.

For now, authors of electronic literature are advised to temper their expectations for the longevity of their creations. This is not to discourage innovation in the field. After all, no actor treads the boards of a theater expecting the ensuing performance to endure forever. Perhaps it will remain with certain members of the audience, returning to them in memory now and then throughout their lives, and then it will be forgotten. While literary authors may not be

accustomed to considering their works the fleeting performances of machines, the hardware and software environments of computers as we know them today change too frequently and dramatically to be considered a stable foundation for preservation. Many works of electronic literature have already disappeared alongside the computing environments of their original creation and distribution; others will certainly follow. Until a reliable model for the publication and retention of such works in a durable electronic format is perfected, electronic literature will continue to be held in its present state as a hostage of the ephemeral.

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