The Rise of Electronic Literature

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Artists and authors have experimented with creative computation since the computer's genesis, with early works such as Christopher Strachey's Love Letter Generator for the Manchester Mark II in 1954. (Wardrip-Fruin 2008, p.134) Since then electronic literature has gained traction as a serious artistic endeavour. Electronic literature broadly encompasses literary works which exploit the processing power of the computer to enhance the text's poetics beyond using the computer as a networked distribution medium. Critics and practitioners of these new forms assembled around the term electronic literature through the establishment of the Electronic Literature Organization in 1999: a non-profit organisation designed to promote creative and scholarly work around new digital textual genres. (Rettberg 2012) The term covers a range of genres and material forms including Camille Utterback & Romy Achituv's *TEXT RAIN* (1999), where readers interact with projections of falling words, altering the trajectory of individual characters' descents; Joseph Weizenbaum's *ELIZA* (1966), a linguistic automaton that engages in conversation with users through pretending to be a Rogerian psychoanalyst; and Josh Tanenbaum et al's *The Reading Glove* (2010)*, an installation that encourages the user to explore the history of several objects through picking them up with an RFID-enabled glove to listen to an emerging narrative.

The electronic literature community positions their work against print culture, which allows the form to be seen as dynamic, innovative and multimodal: an evolution from print. In this article, I argue that historicizing contemporary practice within the tradition of avant-garde literature that pre-empts the field's development is more useful than arguing for a clean break.[1] For example, Sherman's (2008) inquiry into the Renaissance's remix culture provides rich evidence for the long gestation period of genres associated with digital media. In this article, I trace the common juxtaposition of electronic literature with print culture and how this ignores the full range of physical literature, the complementary form to electronic literature.

The term 'electronic literature' presents an obstacle in understanding the continuity between digital and physical media as commonly understood. 'Electronic' alludes to the interface between the material basis of computing – integrated circuits, gate arrays, microprocessors, and so forth – and the layers of abstraction and numbers that are denoted by the term 'digital.' The phrase 'electronic literature' therefore implicitly acknowledges the materiality of computational culture. I will use the term 'digital literature' in place of 'electronic literature' as an attempt to construct an idealized separation between works consumed on a computer compared to physical manifestations that will be tested through counterexamples. Through considering the continuity between digital and physical literature, this article analyses William Gibson's *Agrippa: a book of the dead* (1992), and Christian Bök's *The Xenotext* (2015) to demonstrate the liminality of the designations of physical and digital literature, and how such literary works can inform our historical understanding of contemporary fiction.

As an emerging field, digital literature has shifting and permeable borders. Hayles (2008, p.3) argues for a distinction between digital literature and digitized print literature under the rubric of born-digital works, 'a first-generation digital object created on a computer and (usually) meant to be read on a computer.' This definition places digital literature in opposition to print rather than noting the affordances of the platform itself. The rise of self-published ebook exclusives challenge this definition, as formats such as EPUB are optimized for reading on the screen yet would not be considered sufficiently innovative to be classified as digital literature. The prejudice emerges from an understanding that ebooks are not sufficiently distinct from their print counterparts, but this is excluded from Hayles' pithy definition. Bell *et al* (2010) correct this by defining electronic literature as 'fiction written for and read on a computer screen that pursues its verbal, discursive and/or conceptual complexity through the digital medium, and would lose something of its aesthetic and semiotic function if it were removed from that medium.' Analysis of digital literature requires media specificity that situates it within its material context as distinct from, but not necessarily an improvement over, the book.

Wardrip-Fruin (2010, p.29) further argues that there are important boundaries between digital art and literature. Art and literature exist on a continuum defined by a medium's primary semiotic function, drawing upon Bell *et al*'s terminology. Literature features text as its primary semiotic medium, while art can use a wider range of media to convey meaning. This definition does not exclude multimodal works if text is integral to the work's meaning. There is a second criterion to defining literature: the reader must have the choice to be a non-passive consumer through either physical or mental stimulation. This is apparent in Tomasula's (2012, p.485)

supposition that digital literature is a hybrid of human and machine language: sophisticated new forms of literature can emerge through the interconnection between the creative expression of natural language and the rigid structure of code. Traditional concepts of the literary and high culture are secondary to the establishment of generic conventions and expectations, and to this end, plentiful volumes of pulp fiction can aid this formation. The limits of digital literature, however, are established once non-textual elements become the primary semiotic medium. In terms of print culture, this distinction can be seen in the difference between Charles Dickens's *Bleak House* and Kevin Smith's *Book 91*, which replaces the book's text with an arrangement of strings that produce a sound when the reader turns the page. (Drucker 1995, p.106) *Book 91* contains no words, but uses the materiality and haptics of the book as its primary semiotic medium.

Since print is physical textual media's most recognizable format, it is no surprise that digital literature is juxtaposed with print. These definitions aim to stress innovation, as a step towards establishing digital literature's arrival through national and international funding, while the form's complex materiality demonstrate the weakness of the underlying structure for these definitions.[2] The need for a material approach is evident from the frequent calls to print in previous definitions despite contestation of digital media's superiority. The *smorgasbord* of media covered under the blanket term 'digital literature,' along with its range of themes and genres is a misnomer given the plethora of potential physical interfaces. 'Digital literature*s*' provides a more adequate description of the field. Jessica Pressman (2014) suggests that since even a single work can include several media, digital literature is comparative literature. An all-encompassing definition of digital literature must account for a range of platforms

including mobile phones, projections, and exhibitions that vary in lengths from a single tweet to millions of lines of code. Wardrip-Fruin's suggestion that digital literature comprises literary works that require 'digital computation' acts an important corrective to the hegemony of the screen and a clear delineation between digital and non-digital works without exaggerating the novelty of digital culture. (Wardrip-Fruin 2010, p.29)

Early euphoria about the computer's transcendence from materiality has been replaced by a deeper interrogation of the computer's materiality ushered in by work such as Kirschenbaum's *Mechanisms* (2012) and MIT Press's Platform Studies series. (Montfort & Bogost 2009) As digital media studies continues to mature, it is impossible to ignore the materiality of digital culture. While there are multiple instances of the Gutenberg Bible, many ur-digital texts, including Strachey's Love Letter generator no longer exist in their original form but through nth-generation simulations that mimic the original's mechanics, rather than replicate it exactly. The increased computational power of hardware predicted by Moore's Law requires a constant upgrade cycle that makes maintenance of old code difficult. The half-life of a digital work may be as short as a matter of months in the case of works that depend on Application Programming Interfaces (APIs) such as Twitter, as the proprietors of the API may update the protocols at any time rendering previous connections obsolete. (Bucher 2013) While in some cases, this has led to the complete dissolution of performative Twitterbots, which required a particular facet of the API that was later removed; occasionally this has a subtle effect on the usability of individual works. Erik Loyer's *Strange Rain* (2013) experiments with haptic elements of iOS devices by allowing the reader to make patterns of rain based upon pinching and pressing the

touch screen and movement determined by the device's accelerometer. To add a linguistic element to the work, Loyer created three extra modes: Whispers, Story, and Feed. Whisper and Story add a layer of poetry and narrative, respectively, to the App. The Feed option is now obsolete, but its documentation states that the mode allowed readers to search for a keyword on Twitter and view the real-time feed of the tweets through *Strange Rain*'s interface. The Twitter API's upgrade from version 1 to 1.1 (signifying only a minor version, despite the dramatic changes) rendered the Feed option useless. The app was rendered obsolete by the launch of iOS 11 in September 2017. The infrastructure and costs associated with preserving print pales in comparison to the maintenance of a service such as Twitter – demonstrated by the Library of Congress's on-going conundrum (2013) with providing archival access to Twitter – that might only make up a small part of a work's materiality that is still important to preserve.

Physical Literature

A material approach to defining digital literature reveals the problems behind the traditional print-digital binary, as it compares the single medium of print against a plethora of digital media, while ignoring a wide range of physical literature. Drama, improvisation and performance are forms of physical literature beyond print, and many literate forms of inscription—manuscripts, wax tablets and so forth—cannot be classified as print. Physical literature extends beyond non-print forms of inscription to performance, a term that includes non-reading acts of reception such as altering texts, as well as plays and public readings. Many of the non-inscriptive forms of literary activity including performance remain undocumented, as they do not bear permanent traces. Meaning must be captured through a performance, whether reading or

otherwise, to extrapolate the meaning from the piece: a text with no readers has little meaning.

The hegemony of the screen and page has contributed to the marginalization of other forms of physical literature. Due to the long development of print as the dominant form of literature, the screen represents a natural extension of this dominance. It is no coincidence, as Montfort (2005) has revealed, that early works of digital literature relied on an intersection of the two as the output of the computer was printed on continuous paper. Forms of inscription with greater permanence have often been favoured due to their durability, although by nature the permanence restricts the ability to creatively explore the work's materiality.

Oral and gestural literature extend beyond inscription that favours textual genres that emphasize copying and rapid distribution. The book is more visible due to its durability compared to other forms of media. Many physical forms are fleeting and ephemeral, requiring evidence documented by a more permanent medium. Historically, literature has been defined across the genres that are more attuned to effectively convey information: oral and literate works. Haptics and gesture represent a third category that has increasingly been used in digital forms, but is also evident in braille. While examples of oral and literate works are prolific, there are fewer examples of haptic literature. Works that integrate haptic elements such as *TEXT RAIN* and *Reading Glove*, use touch and movement to supplement another semiotic medium, due to the limited vocabulary of haptics outside of established frameworks such as braille.

The oral performance is the most familiar non-inscriptive form of literature. It is important to note that oral literature does not exist in a vacuum in modern culture but

must be considered shorthand for lecto-orality, or oral transmission in a society with writing. (Goody 2010, p.73) Alvin Lucier's *I Am Sitting in a Room* (1969) presents an alluring case study of oral literature's media specificity. In the piece, Lucier loops the recording of a speech until it deteriorates: Lucier intones a mantra describing his experiment, which then forms the basis for repetition and decay. He examines the principles of deterioration in analogue media through oral poetry. The work depends on specific media (reel-to-reel tapes) and location (a room with favourable acoustics). The playback is reduced to noise after many repetitions. The work exploits the poetics of space through the juxtaposition between speech, the acoustics of the room, and the positioning of the recording device. The materiality of the room and reel-to-reel tape recorder are instrumental in developing Lucier's sound poem as it depends on the acoustics of the particular environment. This ensures that even if the performance is replicated, the locative elements of the work create a unique performance with every replication.

There are many other kinds of performative literature that extend beyond the internalizing form of silent reading. These performances coalesce around what Bogost (2010, p.ix) has called procedural rhetoric, a form of persuasion and argument that emerges from the undertaking of a particular process. Outside of reading, this may take the form of ripping up a book or listening to a radio-play. Both of these proceduralize non-typical forms of engagement with literature. Ripping up a book reveals the materiality of the page and the permeable boundaries of the book which shape our reading experience, while a radio-play dramatizes not only the rereading process as the play must continue in a single direction, but also the remediation process that typifies as shift from a single visual mode to single aural mode.

The vocabulary of physical literature reveals fissures in the print-digital binary. Instead of thinking of the comparison as a binary, it is more productive to see them as two opposing sides of a continuum where complete polarity is rare. Improvised oral performances – unmediated by digital or analogue recording equipment – are physical-only texts. It is impossible to conceptualize a digital-only text outside of a thought-experiment as all digital media requires a material presence. The continuum functions as a figurative bell-curve as most literary works are mediated by both digital and physical processes; while only the minority of texts feature only physical or digital elements. Print sits centre in this continuum as many of the processes of creating books are mediated through digital processes. The continuity does not only benefit fledgling digital genres, but also allows us to consider the dynamism of print outside of 'our tendency to pit print against competing media' such as digital literature. (Punday 2013, p.115)

This line of thought is clear through looking at how the book's materiality has been foregrounded in contemporary publishing. Jessica Pressman (2009) argues that 'bookishness' abounds 'as the codex cedes its dominance as a form of information access to other media formats, book-bound content becomes more associated with the literary.' Jonathan Safran Foer's *Tree of Codes* (2013) exemplifies the aesthetic of bookishness, since its die-cut pages cannot be easily replicated or produced digitally. Safran Foer physically ruptured the pages of Bruno Schulz's *Street of Crocodiles* to create a new work. The finished product offers the reader a three-dimensional view of links within the text as they see through the die cut pages to later words. This overwrites the original book to explore the medium's physical presence. These books excel as physical objects rather than readable texts. The aesthetic of bookishness

makes materiality the primary semiotic medium, relegating the text to secondary importance. These texts, which often take multimodal forms, reveal the intersection between physical and digital literature. Aarseth argues that 'the ideology of information technology makes us […] blind' when it comes to multimodal works, as children's books with sound and interactive features are comparable to digital media. (Simanowski & Aarseth 1999)

Simulation & Amplification

If physical and digital literature exist on a continuum, *simulation* and *amplification* are two core terms to describe the connection. Wardrip-Fruin (2009, p.1) argues that simulation is integral to the computer's ontology:

> A computer is a strange type of machine. While most machines are developed for particular purposes – washing machines, forklifts, movie projectors, typewriters – modern computers are designed specifically to be able to *simulate* the operations of many different types of machines, depending on the computer's current instructions (and its available peripherals).

Wardrip-Fruin draws upon the origins of computation through Alan Turing, who envisioned a 'super-typewriter' with a finite number of symbols that could be used to recreate any other symbol. (Hodges 2012, p.97) This theory of computational culture envisions the computer as a machine that is primarily built to simulate other machines, rather than envisioning new machines. Bogost (2008, p.107) defines simulation as 'the gap between the rule-based representation of a source system and a user's subjectivity.' Bogost distinguishes between simulation resignation (blind

acceptance of limitations) and denial (rejection of limitations), which reveals the subjectivity of such systems, that allows the user to understand their own role, a vital function within the system. (2008, p.107) This may be a three-dimensional environment, its physics, the rules and conditions of print culture, or any number of other complex systems. Simulation depends on our understanding of both metaphor and metonymy, as it refers back to the original but also to its own internal logic in the creation of the world. A simulation cannot replace the original, but it can enhance our understanding of it. The construction and limitations of a particular simulation guide the user through the experience. One recent example of this in physical literature is Eduardo Kac's *Aromapoetry* project (2011), described as an 'artist's book with box and slipcase, twelve custom-made aromas enmeshed in a nanolayer of mesoporous glass, letterpress text and graphics.' While this is not poetry in the typical sense, *Aromapoetry* evokes the emotional connections of smell in a book-like object. The book is only made possible through nanotechnology that allows the aromas to be captured in a way that allows users to simulate scenarios through smell.

Amplification is the second part of the feedback loop. While physical media offers a variety of innovative solutions to amplification, digital media makes it much easier since computational resources can be plentiful. The scarcity of physical resources – either time, space, money, or a combination of all three – restricts a possible physical version of a similar conceit. The widespread distribution of Bibles, Qurans and Torahs demonstrates that the reach of physical literature can match the most viewed websites on the Web with enough resources. For the remainder of projects, the possibilities of simulating variables of both possible and implausible physical situations, however

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abstract, allow the reader to explore a fictional world that might otherwise remain unavailable.

Both simulation and amplification require comparison of more than a single medium, such as the connection between print and digital media. There is a feedback loop extending between the two media amplified by the reaction to print in early digital fiction. Hypertext fiction is parasitic and influenced by the nature of print and requires an understanding of both media to appreciate the aesthetic value of works. (Hayles 2002, p.37) Morrisey and Talley's *The Jew's Daughter* (2002) demonstrates the use of exploring the parasitic connection between print culture and hypertext poetry. Morrisey and Talley describe the work as 'an interactive, non-linear, multi-valent narrative, a storyspace that is unstable but nonetheless remains organically intact, progressively weaving itself together by way of subtle transformations on a single virtual page.' The single virtual page is central to the work's poetics, as this never shifts but presents a simulation of the page. Morrisey and Talley appropriate the aesthetic of hypertext links to mask the true processing power of *The Jew's Daughter*. Each page contains a single chunk of text highlighted in blue, usually denoting a link, but rather than offering agency for the reader, once they place their mouse over the highlighted text, the page is re-configured without clicking on the link. This experiment plays with traditional forms of both print culture and hypertext narrative. Morrissey and Talley's project reflects the liminality of the digital in its incunabular days as it requires the unit of the page for familiarity but wants to break free of this critical paradigm. It is only through new experiments with digital media such as the mouse-over gesture that digital literature can extend beyond the performative elements of the pre-existing page.

Digital literature amplifies and simulates aspects of other media. As a machine designed to simulate other media, the computer excels at replicating and extending principles embedded in other media. The transition is seamless and unnoticeable, to the effect that it appears to be something new, but most computational labour works around a few basic principles connected to our traditional senses in lieu of what it is simulating. For example, Michael Mateas and Andrew Stern's *Façade* (2011) is a one-act immersive digital play which simulates the dissolution of a marriage from the perspective of a family friend. The user can influence the course of the narrative through interacting with the two primary characters, encouraging the reader to play again in order to observe alternative narrative pathways. The amplification comes from the increase in user performance, as well as increased emotional investment, as the reader becomes more involved. Mateas and a range of other collaborators further blurred the distinction between physical and digital media through introducing an Augmented Reality version of *Façade*, where users sat down to a full augmented simulation of the environment to interact with the interlocutors on a physical level. (Dow et al. 2006)

Punchdrunk Production's immersive theatre (2000) is a physical counterpart to the form of amplification and simulation at play in *Façade*.[3] Spectators take an active role in the development of the ambiance and minor events, while having no grand influence over the narrative. Participants are dispersed into a large appropriated urban environment and encouraged to interact with a range of actors. Masks help the spectators to overcome their inhibitions and interact fully. A single spectator will not experience the entirety of the work as they focus on a few interactions and scenes. Punchdrunk is more ephemeral than traditional drama, as the audience's active

participation shapes the nature of the performance on a small-scale. As with *Façade*, the participants are only offered limited agency, but the immersive elements ensure that they feel as though their experience is unique.

Remediation

This complex cycle of remediation also includes text-only artefacts. Newman argues plain text has creative affordances and fixed-space typefaces can transform words into art, but this remains a simulacrum of the typewriter aesthetic. (2008, p.100) Contemporary digital file storage amplifies the word count of the physical storage space, as the standard hard drive is the same size as a 250-page trade paperback, but can fit over 300 million plain text files of a similar length. While digital media offers previously unprecedented affordances, physical media can also exhibit qualities of simulation and amplification.

Mike Ando's *Real Myst Book* (2012) demonstrates the complex feedback loop between digital and physical literature in contemporary culture. Ando created a physical simulation of the digital book from the cult videogame *Myst* (Cyan 1993), complete with an in-built computer with touchscreen to replicate the original's interactivity. The book's remediation extends further as the book in the game is itself modelled on a physical object, which Ando hunted down to create an authentic simulation. The fetishization of a digital object as real is clear from Ando's research and development of an exact replica. The final product reveals a yearning for a connection between the fictional world of *Myst* and the real world which can be bridged through replicating objects. As with the rise of bookishness, there are signs within this cultural shift that even if users are not interested in more avant-garde

forms of digital literature, they remain interested in the convergence between physical and digital media.

Another unavoidable difference between print and digital media is the division of hardware and software for digital media, which is also the case with other magnetic and digital formats. [4] Most audio-visual materials have been separated into consumables that require the assembly of multiple pieces.[5] This is not true with the book. When a reader buys a book, they do not have to purchase any further equipment (except if they require self-augmenting devices such as reading glasses), but can read the book 'out of the box.' Conversely, with electronic literature, the user requires a specific hardware configuration rather than a generic device in order to run the software. Older devices become out-dated and difficult to find in a short period of time. John McDaid's *Uncle Buddy's Phantom Funhouse* (1992) only runs on an emulator or old Mac with a floppy disk drive and HyperCard installed. Other more specialist works such as Cruz-Neira et al's *CAVE* project (1992) at Brown University exist only in a few physical instances due to their prohibitive costs. This is unique to digital media as the open nature of computing means that precise specifications of hardware and software are required to run old software, while other formats such as laserdiscs and vinyl records can be played on generic devices, regardless of age. Although it is possible to emulate the conditions of the original work, it is removed from the technological quirks of the original format. The switch from Cathode Ray Tube (CRT) to Liquid Crystal Display (LCD) screens led to some stark visual contrasts. In one transformation, it became difficult to render Atari 2600 VCS games on LCD screens, as due to the Atari's limited memory, designers exploited quirks in CRT screens to enhance visual performance. (Montfort & Bogost 2009, p.140) Since

CRT displays are no longer in production, and the dwindling supplies are snapped up for spare parts, each passing year decreases the probability that a user can experience the work in its original conditions. (Guins 2014, p.253)

The physical-digital continuum strengthens the field of born-digital preservation, as digital archivists may worry about the preservation of the cultural and physical artefact in ways that have been resolved in studies of the history of the book. While video games archivists, for example, strive for the original material conditions of the hardware, software, and format configurations of a particular artefact, this would not be expected of rare book scholarship. When a researcher examines a copy of the Gutenberg Bible, they seek to read the text *in situ* rather than recreating the context of a fifteenth century reader but acknowledge that the object is viewed within the conditions of an archival collection or library. Likewise, digital archivists would not strive to replicate the cultural conditions of a bar's smell or the sticky residue of alcohol on the joypad when preserving an early arcade machine. The Internet Archive's (2014) push towards simulation of classic games and software packages from within the browser in recent years demonstrates a move away from the more formalist approach to digital preservation to the sociology of the digital text, although emulators provide a new set of problems.

Emulators require frequent maintenance for new platforms due to increasing processing complexity. The constant cycle of upgrades and planned obsolescence hinders the development of digital literature as designers must constantly tangle with questions of legacy software and preservation. Plain text is the most stable format since it functions at a level required for hardware to process software, thus being interoperable on any platform. As a consequence, any work written in plain text – a

format marginal to digital literature – has a longer half-life than any other digital text including ebooks and PDFs. Technical innovation in digital literature may prove to be unsustainable due to the constant demands of upgrades and requires preservation efforts often exceeding the care for rare books.

The intersecting codes of computation and biology

It is necessary to explore liminal texts that cross the boundary between physical and digital literature to understand the continuum between the two forms. Innovations in biotechnology such as DNA and genome sequencing represent the most sophisticated interface between the physical and digital. It is perhaps no coincidence that the development of binary computational culture post-World War II correlates with Franklin, Crick and Watson's discovery of the quaternary code of DNA in the 1950s. In the intervening years, artists and authors have been keen to explore the interplay between biology and digital literature. Such experimentation offers an insight into the convergence of digital and physical media. Two examples – William Gibson et al's *Agrippa (a book of the dead)* and Christian Bök's *Xenotext* – explore the interplay between DNA and digital culture in innovative ways and offer future directions for understanding the intersection of media.

Agrippa

William Gibson, Dennis Ashbaugh and Kevin Begos Jr. explore the tensions of the 'late age of print' and the impermanence of digital media in *Agrippa (a book of the dead)*. Many aspects of the work's composition remain a mystery, despite the copious documentation of the *Agrippa Files*.[6] This was intentional, as the book's prospectus states 'this book-as-object raises unique questions about […] the Politics of Information Control. It will be the first Digital Myth.' (Milroy 2015, p.15) The object

has a unique aura due to its patent unavailability and imposing size.[7] At the book's launch party in December 1992, Begos suggested that the project was primarily concerned with the transferal of memory from the computer, 'which is just accrued human memory, to everybody's memory who hears it here and sees it any form. It's not really destroyed, it's just playing on a different kind of memory.' (Begos quoted in Milroy 2015, p.7) This reflection on the work highlights the discourse of incorporeality that has beset both discussion of digital literature, and *Agrippa* more specifically, when the text's material presence is of greater interest.

A heavy case 'designed to look like a buried relic' (Liu et al. 2005) stands between the reader and the book, as they must actively perform an exhumation to read the book. This initial performance by the user evokes a eulogy for the book. Once the reader lifts off the casing, the book's large size is not reflected by volumes of writing, as the text is only 100 pages long with the final 20 sheets glued together to contain a floppy disk with a poem also entitled 'Agrippa.' [8] Where text remains, it is a transcription of a DNA sequence and is therefore difficult to read in a traditional manner, but instead the reader is forced to ponder on the life cycle and demise of three objects: print culture, biology, and digital culture. *Agrippa* reflects on print culture through visually alluding to the Gutenberg Bible by rendering the DNA sequence in two forty-two line columns and the book's encasement in a sarcophagus. Biology remains a clear theme through textual references to the *bicoid* maternal morphogen – itself a statement on the literal digitization of life through the emergent discipline of genomics and a recent breakthrough from the late 1980s – as well as the book's subtitle: *a book of the dead.* The life and death of digital culture is considered through the inclusion of a floppy disk which self-erases after a single execution. The

self-erasure of floppy disk, and digital poem, have received more scholarly attention than the book-object, which belies the book's complex physical-digital relationship.

Agrippa features overprints of antique advertisements that have been pressed onto several pages with uncured toner, thus ensuring their instability.[9] These are the work's most fragile elements, as if the reader turns the page too quickly, the images are disturbed and the toner is displaced on the adjacent page. The images present a media archaeology of forgotten technologies such as 'Cooper's Universal Enlarging Lantern' and a 'photogenic pistol [….] For Instantaneous Photography at Night.' (1992, p.21; 41) The need to carefully turn each page is emblematic of the wider themes of reader performativity presented by the work's large size, heavy-set cover and self-erasing floppy disk. Users must make choices of how to experience the work at all times. *Agrippa*'s strength as an object resides in its ability to make the reader question how they engage with the book-as-object rather than just admiring the traditional linguistic content. *Agrippa*'s designation as art or literature is complicated by the interplay between the book, which primarily conveys meaning through materiality, and the floppy disk, which is more textual. The interplay can classify the book as literature, despite its separate categorization as an artists' book.

The book's bespoke publishing cycle is at odds with mass produced texts, but reflects on the digital through its artisan nature.[10] For example, there is an element of randomness in the distribution of the overprints of the antique advertisements. The National Art Library (UK) copy features an advertisement for Anthony's Timing Plummet on page 12, while the equivalent advertisement is on page 11 in the NYPL copy, and is for Cooper's Universal Enlarging Lantern instead, which appears on page 41 for the National Art Library copy. Further to this, there is variation in the depiction

of the *bicoid* maternal morphogen. While Begos (quoted in Liu et al. 2005) argued that he had not intended to offer an exact replica of the DNA, but rather 'a genetic creation of our own, not a reproduction,' there is an irregularity in the sequencing in both the deluxe and standard editions in the Bodleian Library that reflects a wider trend in the page-by-page content of the DNA sequence. The pattern suggest pages were printed in batches and then compiled with more regard for the aesthetic than maintaining the integrity of the DNA sample. In a later interview, Begos (quoted in Milroy 2015, p.16) states that the code was 'jumbled up during the printing process.' There is no definitive origin point for the DNA, and given Begos's comments, and variation between editions, it is likely to be an extension of the self-destruction mechanism of the floppy disk, coined 'MAKE-SOME-SHIT.' (DuPont 2013) The routine erased sections of the floppy disk through generated cruft that aped genetic sequencing through use of 'C', 'G', 'A' and 'T.' The irregularities in the composition of the book may therefore emerge from digitally generated fake DNA rather than authentic fruit fly data. The 'first digital myth' continues to provoke new questions, but it is undoubtable that it encouraged its audience to consider the developing links between digital and physical media.

Xenotext

In contrast, Christian Bök's *The Xenotext Project* makes more explicit links with developments in genetics in the decades since *Agrippa*'s publication. *Xenotext* is notable for attempting to merge the physical and digital in a form that has grown around biopoetry and transgenic poetry, that is, poetry that inscribes text in DNA. Transgenic poetry should 'synthesize DNA according to invented codes to write words and sentences using combinations of nucleotides. […] Through mutation,

natural loss and exchange of DNA material new words and sentences will emerge. Read the transpoem back via DNA sequencing.' (Kac 2007, p.191) *Xenotext* extends the genre through supplementing the storage element with an inscriptive second poem. Bök's project is one of the most ambitious works of poetry in the early twenty-first century. Bök's mission statement is to synthesize 'a beautiful anomalous poem, whose "alien words" might subsist, like a harmless parasite, inside the cell of another life-form.' (Voyce & Bök 2007, para.58) While scientists have successfully stored text encoded in DNA, Bök wishes to modify the organism to secrete a new poem. (Wershler 2012, p.49) *Xenotext* represents the greatest convergence and divergence between physical and digital media as an arresting intervention between nature and science. Biotechnology combines some of the most advanced computational methods and the underlying structures of nature, thus representing the convergence of the digital and physical in the construction of a new physical entity through cutting-edge computation, while the output is purely physical.

The poem encoded in the genome – which begins 'any style of life/ is prim…' – generates a response in the form of a second poem ('the faery is rosy / of glow…'). (Bök 2011) Both of these poems are constrained by the affordances of writing using the genetic sequence of Protein-13. Coach House Press published *The Xenotext* Book 1 in 2015 to document Bök's progress. While it did not include a copy of the two poems, or the finer details of technical side of the project, it introduced the concepts underpinning the work through a range of poems. In a summary of the project so far, Bök (2015, p.151) states that 'the work offers a primer on genetics while retelling fables about the futile desire of poets to rescue love and life from the ravages of Hell.' The book also features other mediations on the intersection between evolution and

poetry, including several QR code poems, where Bök has taken an example of the two-dimensional barcode schema and applied Conway's Game of Life algorithm to manipulate the content into new patterns.[11]

The project is on-going, but Bök envisions including 'a slide with a sample of the germ for scientific inspection by the public' in the final volume's endpapers. (Voyce & Bök 2007, para.64) The resulting interface is physical rather than digital, but bears the traces of its exceptional composition. At its most extreme, the digital and physical converge through *Xenotext*, a text, which, like *Agrippa*, is concerned with life and death through media. The work's procedural rhetoric stresses the ephemerality of most contemporary literature, which is likely to be destroyed in the event of the apocalypse. It is also apparent that Bök's processes are more important than the final product, particularly with the publication of his struggles, as the final result is near impossible to read without this ancillary evidence.

Conclusion

Experiments that blur the lines between physical and digital literature are gaining popularity. Amaranth Borsuk and Brad Bouse's *Between Page and Screen* (2012), the emergent genre of ambient literature exemplified by Duncan Speakman's *It Must Have Been Dark by Then* (2017), and other augmented reality works reveal how this innovative work is happening in a reproducible manner. The merger between the International Digital Publishing Forum (IDPF) and World Wide Web Consortium (W3C) in January 2017, and the Publishing @ W3C's current work to create the Web Publications standard to enable book-like publications to 'become first-class entities on the Web' (W3C 2017) will further erode the distinction between book facsimiles and more interactive formats. The proposed Web Publications standard will encourage

convergence between websites and ebooks, and will require reconsideration of the distinction between ebooks, digital literature, book apps, and web sites. This new paradigm offers fertile grounds for experimentation that can draw upon the rich historical tradition of avant garde physical literature.

Notes

[1] That is not to say that such a trajectory has not been noted with individual case studies such as concrete and kinetic poetry. (See Schaffner 2010, p.179) This practice, however, has been restricted to the micro-level and not systematically mapped against the field of digital literature as a whole.

[2] Major digital literature projects have gained prominence through big humanities grants including the NEH's Office for Digital Humanities support for the E-Lit Pathfinders project, the AHRC's funding of Reading Digital Fiction, and the monolithic Electronic Literature as a Model of Creativity and Innovation in Practice funded by the European Union's Humanities in the European Research Area pockets. The results of this institutionalization is clear as more pioneers of digital literature including Judy Malloy, Michael Joyce, Mez Breeze, Bill Bly and Deena Larsen have donated their archives to major special collections over the last decade.

[3] Zaiontz (2014) offers an overview of Punch Drunk Productions' strategies for immersion.

[4] Hilderbrand (2009, p.35) argues that this separation with videotapes has led to the idea of VHSs being a medium being contended.

[5] Gitelman (2004, p.204) traces the history of software back to the piano rolls and sheet music of the early Twentieth century.

[6] A comprehensive website documenting the composition and reception history of the project.

[7] There are only five copies available in research libraries across the United States and Great Britain, and the actual print run is indeterminate. Milroy (2015, p.8) notes that even Gibson's archives at the University of British Columbia does not have a copy.

[8] The National Art Library's copy's glue is becoming undone and the sheets are becoming separated.

[9] The vagueness around the number of overprint stems from variation between copies.

[10] Data about *Agrippa* are collated from the author's observations from the National Art Library and Bodleian Library's copies of the book, and supplemented by Rollin Milroy's (2015) bibliographic analysis of various copies of *Agrippa*.

[11] Conway's Game of Life is an algorithm for mapping evolution across generations through applying a simple set of rules to a line or grid. Each cell's survival depends on the conditions of the cells bordering them. Gardner (1970) provides a full overview of the algorithm.

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