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The Digital Architexture of E-readers

How the Internet of Things Adds Layers of Meaning to Text.

When *Seuils*, Gerard Genette's first full-length work on paratextual elements in print books, was published in 1987,[1] digitized text had been online for nearly two decades. Michael Hart's *Project Gutenberg*[2] started on 4 July 1971 with a post of the text of the United States Declaration of Independence to the Advanced Research Projects Agency Network (ARPANET), a precursor to the Internet. His posting is often considered as the starting point for ebooks, that is, books that were both digital and networked.[3] It would take eighteen years for Hart to publish his tenth digital title, the *King James Bible*, in 1989 the same year Tim Berners-Lee released his proposal for merging hypertext with networking protocols. The World Wide Web would emerge out of the work done on that proposal and would become the main avenue to create, share and read digital content. The Web would bring not only new readers to *Project Gutenberg* but new volunteers as well: the archive was releasing 104 books per month by the project's 30th anniversary in 2001.[4]

Project Gutenberg was not the only digital archive started in those pre-Web years. The Oxford Text Archive,[5] a digital academic text resource would start in 1976. It was followed by the University of Chicago's ARTFL project[6] on French

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[1] Genette, Gerard: Seuils. Paris 1987. The English translation of Genette's work would appear a decade later and go by the title *Paratexts* instead of the literal translation of "threshold". Throughout this paper I will refer to the book as *Seuils / Paratexts* to reflect Genette's theory of paratextual elements as thresholds.

[2] Hart, Michael: Project Gutenberg. https://www.gutenberg.org (last access: 28.10.2022).

[3] Hart's concept of an accessible library that existed outside the codex form was not unique. Robert Carlton Brown conceptualized a reading machine connected to a wireless network in 1930. Vannevar Bush proposed the Memex in a 1945 article (As we may think. In: The Atlantic Monthly 176,1, 1945). Roberto Busa, an Italian Jesuit priest began work on the *Index Thomisticus*, machine-readable punch cards used to index the writings of Thomas Aquinas in 1946 (Index Thomisticus: Sancti Thomae Aquinatis operum omnium indices et concordantiae in quibus verborum omnium et singulorum formae et lemmata cum suis frequentiis et contextibus variis modis referuntur. Stuttgart-Bad Cannstatt 1974). Ángela Ruiz Robles, a Spanish teacher and writer, was granted a patent in 1949 for her Mechanical Encyclopaedia, a mechanical precursor to the modern e-reader.

[4] Project Gutenberg: 50 years of eBooks: 1971–2021. https://www.gutenberg.org/about/background/50years.html (last access: 28.10.2022).

[5] University of Oxford: Oxford Text Archive. https://ota.bodleian.ox.ac.uk/repository/xmlui/ (last access: 28.10.2022).

[6] University of Chicago: The ARTFL Project. https://artfl-project.uchicago.edu/ (last access: 28.10.2022).

literature in 1982 and the Perseus Digital library[7] in 1985. These archives pro-
vided readers access to digital text that had been created with proprietary code
that was tied to a specific archive. Standard Generalized Markup Language
(SGML) would become an ISO standard in 1986.[8] Several communities would
use the SGML standard to create specialized versions for their communities. One
example is the Text Encoding Initiative,[9] an organization that created the TEI
markup language for scholarly and academic digital publishers from the original
SGML standard. TEI would eventually revise their markup to conform to the
newer eXtensible Markup Language (XML). XML itself is based on SGML as is
HTML, which was developed specifically for use with the World Web that was
developing on top of the Internet.

As the world shifted to the Web in the first decade of the twenty-first century,
Genette's theories on paratexts would influence academics who would use his
schema to explore everything from print books to television commercials.[10]
Readers would also have the opportunity to step across a different kind of digital
thresholds as online bookstores and online archives began to provide access to
rare and digital-only titles through online portals.

While Genette focused on the print versions of text, his theories were recon-
textualized by the creators and researchers of on-screen literature to reflect the
changing nature of text in a networked world. Online literature looks beyond
Genette's original premise that paratextual elements are created only by author
and publisher to explore how new digital interactions with a book have the
potential to create epitextual elements that provide additional context to the
book, but are separate from the main text due to the nature of how digital content
is stored by publishers and distributed over a network. Everything in a text or
connected to the text—from CSS stylesheets and reader's textual highlights to
author interviews on a publisher's website and the ratings on Goodreads[11]—has
the potential to be a threshold into the text. Readers of on-screen literature also
have several new kinds of entry points. No longer limited to encounters in the
specific economic and cultural context of the bookstore, readers of digital text
now encounter covers and sample text through online distributors, non-profes-
sional book reviews on social media sites, author websites, and hyperlinks from
other online resources. Readers also have access to customizable page layouts
for each title they download onto their device. Amazon, for example, has made it

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[7]   Tufts University: Perseus Digital Library. https://www.perseus.tufts.edu/hopper/ (last access: 28.10.2022).
[8]   ISO 8879:1986. Information processing — Text and office systems — Standard Generalized Markup Language (SGML). https://www.iso.org/standard/16387.html (last access: 28.10.2022).
[9]   Text Encoding Initiative: n. d. *History*. https://tei-c.org/about/history/ (last access: 28.10.2022).
[10] Gray, Jonathan: Show Sold Separately: Promos, Spoilers, and Other Media Paratexts. New York 2010.
[11] Goodreads. n. d. Meet Your Next Favorite Book. https://www.goodreads.com (last access: 28.10.2022).

so consumers can read hundreds of reviews on a book by other readers through either the Goodreads website or the product page on Amazon's website. After reading other reader's reviews they can also read the publisher's marketing copy on the main Amazon page for a book and then read sample text from the book through the "Look Inside" feature. They can then purchase the book alongside furniture, clothes, and groceries without leaving their domicile. This is a far cry from Genette's discussion of professional book reviews and accessing marketing copy on the back of the physical book. The thresholds expand beyond the cover treatments and placement on bookstore shelves[12] to purchase links within an online publication and menus on e-readers that allow readers to change the page layout for easier reading. These interactions moved the relationship between reader and text far outside the rigid container of the codex where a book's layout was decided by the author or publisher of the work. Digital is different. So different that it requires an expansion on Genette's schema of epitext and peritext, which represent the internal and external transactions within the book. This paper will look at how ebook readers, or e-readers are generating new paratextual instances through their engagement with the larger Internet of Things (IoT), where connected devices track and interact with human readers.

1. Accessing Meaning Through Paratexts

Genette's theory on paratexts provides a theoretical framework for looking at the ebook and e-reader not just as another format like the hardback and paperback, but as a form that creates unique context. An understanding of digital text requires an understanding of what Genette means when he notes that both the design and distribution of a book is what enables "a text to become a book and to be offered as such to its readers, and, more generally, to the public."[13] Up until the introduction of the e-reading device, the control of the page design and the method of distribution were managed by publishers for the authors. Devices like the Kindle have minimized distribution to an instantaneous digital file transfer and have provided the reader a way to control margin, leading and typography, something that was previously the domain of publishers. These technologies require a reconsideration of how readers connect to the text as well as redefining the reader to include the systems and algorithms that are scanning text to provide full-text searching and properly reconstructed ebooks. It should be noted that the latest generation of screen readers, programs designed to read text on screen out loud for the blind or those with bad vision, are now able to read text using different voices for different characters. Genette's narrow focus on human readers made sense at the time as print books were inexpensive and common as

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[12] See Miller, Laura J.: Reluctant Capitalists: Bookselling and the Culture of Consumption. Chicago, IL 2006.
[13] Genette, Gerard: Paratexts. Thresholds of Interpretation. Cambridge 1997, p. 2.

compared to personal computers which were still expensive metal boxes, but now the roles have reversed.

On the distribution and marketing front, the promotional and critical material produced at the time of the publication of *Seuils / Paratext* was also mostly ephemeral: appearing in print newspapers or as printed inserts meant to be discarded. The eventual move to an online mode required new non-human reader / actors to transmit text over a network and a creation of ephemeral epitextual elements that were essential for the discovery and delivery of the text on digital device. Genette's work focused mostly on the print-centric world of peritexts and left the discussion of epitexts to the very end of his book. In a print model this focus makes sense as peritexts includes devices that give the print codex order: format, cover, spine, title page, typesetting, the layout of the page. Genette identified epitexts as outward-looking thresholds that were not part of the text. These included reviews, sample chapters, and author interviews in magazines. In the intervening years, these epitextual elements have come to carry more importance in the online world. It's the reviews and marketing copy that now appear as results in search engines long after the publication of the book. They continue to be thresholds long after a publisher's marketing campaign is over thanks to the use of hyperlinked text in blogs, online magazines, podcasts, and book tracking sites like Amazon's Goodreads.

In the years since Genette first proposed his paratextual theories, digital text has moved away from the limitations of the fixed format of print into a fluid model that relies on a perpetual network over a fixed container. In other words, readers can now access text in multiple formats, but readers cannot hold digital text as they can with print—although e-readers try to simulate that experience—and that changes the interaction with that text. Readers can only hold an intermediary device when reading digital text, but that intermediary does not bind the text the same way as the print codex. Of course, Genette's writings on paratexts is clear that these paratextual elements should not be seen as boundaries or sealed borders, but as thresholds (*seuils*), or, as he quotes from Borges, "vestibule[s] that offers the world at large the possibility of either stepping inside or turning back."[14]

These thresholds then are not one-way streets into a text, but bridges between text and the larger world. This bridging is something that text on networked devices do incredibly well. Over the last two decades, technology companies have provided e-reading applications for e-reader, phones and laptops that allow communal reader interactions including sharing highlights, notes, and reviews with other networked readers. This information is not kept with the text itself, but on the servers of the publishers and distributors where it can be linked to different editions of a book. All of which still fit into Genette's concept which he

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[14] Genette 1997 (note 13), pp. 1–2.

explains "consists of determining its location (the question of *where?*); the date of its appearance and if need be, the disappearance (*when?*); its mode of existence, verbal or other (*how?*); the characteristics of its situation of communication—its sender and addressee (*from whom? to whom?*); and the functions that its message aims to fulfill (*to do what?*)."[15]

At the time of the book's original publication in French as well as the translation into English, these questions were mainly tied to a print ecosystem where information existed in a limited physical format that did not automatically link to other pieces of information. Publishers now work in a rich digital ecosystem where internal and external databases use distribution metadata to connect title, cover, and chapters together. On a website or e-reader a reader can jump from one text to another through hyperlinked footnotes. Digital versions of ephemera epitext (book reviews, marketing copy, sample chapters, etc.) are now stored on a publisher's website for longer than the life of the book. The cover treatment of different editions can be found through an online search so that scholars can see how publishers change covers based on market demands.[16] Even a publisher's literal creation process is reflected in the semantic markup used to code an ebook. Digital text can capture the whole creative process within the coding and metadata of a book's data files. It also allows for the creation of new paratextual elements from not only the author and publisher, but also the reader and the distribution systems.

The clearest example of the addition of digital entry points to a text are the epitexts that are adjacent to the text itself. These epitexts are not part of the original text but added material to the text. As mentioned above, publisher add a semantic markup to the text when creating a book's layout. Adobe InDesign, the most common layout software for books, uses a specific instance of XML that allows for semantic markup of the text that can include markup tags and other metadata on the role and relationship of the text beneath the surface of the screen. The text can also include the aforementioned hypertext links that connects the text to a different work. On top of this markup a reader can add their own notes and highlights, both of which are stored on the distributor's servers. These highlights as well as reading speed, completion rates, and the points where readers close text are also recorded by the distributors to understand human interaction with the text.

The expansion of Genette's ideas into the world of digital content has already been addressed by several researchers including Ellen McCracken,[17] Patrick Smyth,[18] and Marie-Laure Ryan[19]. Their work expands upon Genette's spatial

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[15] Genette 1997 (note 13), p. 4.

[16] Alworth, David J.: Paratextual Art. In: ELH 85,4, 2018, pp. 1123–1148.

[17] McCracken, Ellen: Expanding Genette's Epitext / Peritext Model for Transitional Electronic Literature: Centrifugal and Centripetal Vectors on Kindles and iPads. In: Narrative 21,1, 2013, pp. 105–124.

feature and explores the new textual relationships that include "metadata ele-
ments and tag clouds linked to digital objects, the supplementary materials and
datasets that accompany scientific publications, and the extra-textural indicators
of quality, [and the] trustworthiness and credibility that are built into websites."[20]
Ellen McCracken has even suggested new paratextual elements to describe on-
line interactions in order to expose the "outward and inward pathways of se-
miotic engagement"[21] that happen when readers deal with text on an e-reader.
With digital text readers can perform both "centripetal movement", that is the
ability to move outside the digital text to related content, and "centrifugal move-
ment", which allows for the control of layout and the reading experience, both of
which are not possible in the limited printed experience.[22] The movement into
and away from the main text in a digital environment allow for a continued
experience of the text itself in ways that were not designed by the author and
publishers. A reader now has the power to change the layout of a text for a
personalized reading experience, one that can also mean the transition of one
text to the next based on hyperlinked content.

Elements unique to ebooks including file structures, rendering software, and
user interfaces of the e-readers provide new moments for transaction between
the text and the outer world. Unlike print where text is stored as ink on a
physical page, an ebook stores the text as a disassembled collection of files that
requires the e-reading device to reassemble and render the text as well as track
the interactions between human reader and text. While the non-human objects
participate in the reading transaction, they themselves do not "read" the text for
meaning. They "read" the files for instructions on organization and layout. But
the devices also need to remain active to read and respond to interactions be-
tween reader and text. And it is this kind of "reading" that require new epitextual
elements to understand what these non-human readers are doing.

2. The Internet of Things

When someone opens a print book to read, the text can be said to be in a ready
state: the words and images are fixed on the page and stay fixed even when not
in use. A book stores its content in the specified reading order as defined by the
author. This means books require a large physical space (the bookshelf) for

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[18] Smyth, Patrick: Ebooks and the digital paratext: Emerging trends in the interpretation of digital
       media. In: Examining Paratextual Theory and Its Applications in Digital Culture. Edited by
       Nadine Desrochers and Daniel Apollon. Hershey, PA 2014, pp. 314–333.
[19] Ryan, Mary-Laure: Cyberspace Textuality: Computer Technology and Literary Theory. Bloom-
       ington, IN 1999.
[20] Cronin, Blaise: Foreword. In: Examining Paratextual Theory and Its Applications in Digital
       Culture (note 18), pp. xv-xix, esp. p. xvii.
[21] McCracken 2013 (note 17), p. 106.
[22] McCracken 2013 (note 17), p. 107.

storage. They also require some kind of information (spine title or cover art) so that they can be differentiated on the shelf. A book also requires additional physical elements like bookmarks to identify where the reader stopped reading and a pen to take notes. Books can be said to have a straightforward series of reader-to-text interactions. Ebooks on digital devices do not need as much physical interaction or space, but they need several mediators to connect the reader to the text. E-readers operate in a reader-to-device-to-network-to-server-to-text interaction. Here the reader negotiates with a series of networks and programmatic protocols in order to read their text on the screen. While there is not enough space here to detail the full process of downloading and rendering ebooks in e-reading applications, it is important to outline the process to show how these devices create new thresholds.

E-reading applications, the programs that render ebooks on a device, request and download an ebook's files from a distributor's server. The downloaded files contain the whole of the readable text, often in several HTML or XML files, alongside a series of files that provide the instructions for the assembly and layout of the book. The application reads through the files and reconstructs the text on the screen based on those instructions, but it also creates a layout for the text according to the publisher's stylesheet and any preferences a reader has set on the device. Finally, the application checks locally stored information for the last part of the text that appeared on screen, a virtual bookmark, and opens the book to that point. Some companies have even developed applications that communicate this information across different media. Amazon's Whispersync service allows a user who owns both ebook and audiobook to switch between formats without losing their place in the narrative.

This moves the access to a book from print's limited interactivity of fixed placement in a physical object to a process where readers can move between formats and can manipulate the size of text and margins of those texts as well as store notes and highlight within the book files. The reader joins the author and publisher in creating and attaching paratextual elements in digital editions. Take the case of highlighting. In a print book, highlighting is a personal interaction with the text, but with ebooks any highlight is shared with other readers who bought the text.[23] In addition, e-reading devices also provide full text search and support for audio and video within the text, things not possible in print. These new interactions create new thresholds. A person reading digital text can now locate a word, either by touch or by using a thumb stick, and look up that definition of that word without leaving that text. Beneath the screen the reading

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[23] Not only is it shared on the screen with the reader of the text, but it can also be turned into marketing material. See for example Isabella Biedenharn's 2015 article: Here are the top-highlighted passages from E. L. James's 'Grey' from Entertainment Weekly. https://www.eonline.com/news/669592/the-most-popular-quotes-from-grey-aren-t-nearly-as-dirty-as-fifty-shades (last access: 28.10.2022).

application starts a search routine to retrieve information from a local database, i. e., the loaded dictionary file, or connects to a wireless network and searches the internet for non-localized information while the text remains visible on the screen of the device. It is a perfect demonstration of McCracken's spatial metaphor where readers engage with "outward and inward pathways of semiotic engagement" in order to retrieve supplemental information.

While these interactions will appear seamless to the person using the e-reading device, that device will have done a lot of communication through a network, to search and process the requested information. This communication needs to be done across a series of protocols that are part of the Internet of Things architecture, what Peña-López et al. define as "a paradigm in which computing and networking capabilities are embedded in an object so that it can transmit information and data to other objects."[24] While developers in the IoT space have several models to explain the architecture required for this networked activity, the three-layer model as outlined by Sethi and Sarangi[25] provides a broad enough framework of the interactions for this paper. They define the three layers as:

– Application Layer: the actual programs used by the device
– Network Layer: the networks between smart devices
– Perception layer: the physical layer that creates interactions

Each of these layers have specific transaction points where text must be manipulated by non-human actors within a network in order to move it from a reader's list of purchased titles on a distant distributor's server to text on screen. In the case of searching for the definition of a word as described above, the application will use similar protocols as a web browser when it goes beyond the stored dictionary. In both cases the application negotiates agreements with the telecommunication programs, often called handshakes, and the distributor's servers to both request and retrieve the information. To the person reading the text it should feel instantaneous, but between the clicking of a word on the screen and the pop-up of a definition from Wikipedia or other online resource there are dozens of interactions in order to find and retrieve that information. A brief explanation of how these three layers work will help to clarify how these interactions create or rely on new paratextual elements.

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[24] Peña-López, Irene: Itu Internet Report 2005: The Internet of Things. Geneva 2005.
[25] Sethi, Pallavi / Khanna, Rajesh / Sarangi, Smruti R.: Internet of Things: Architectures, Protocols, and Applications. In: Journal of Electrical and Computer Engineering 2017, p. 1–25.

3. Perception Layer Paratexts

The perception layer as outlined in Sethi and Sarangi describes the interactions that happen between the human reader and the e-reader. Of the three IoT layers, this one has the closest analogues to the physical experience of reading a print book. The companies that offer e-reading software have made them to simulate the experience of reading a paperback through both the dimensions and weight of their devices and the display of peritextual elements from print including publisher-chosen fonts, a typographic hierarchy on the page, margins, and line spacing. The devices also allow a human reader to make modifications to those elements of the page layout described above as well as page color, turning what Genette terms allographic peritext into reader-controlled epitext.

The Kobo Clara provides a case study on how e-readers provide interactive elements as paratextual elements. The Clara has a 15.25-cm touchable e-ink screen where readers can slide their fingers across the screen to simulate turning a print page. The touchscreen also allows readers to words to look up definitions and highlight text. The screen is non-glare to allow readers to read in full sun, but it also has a built-in light for reading at night without the need of an external light source. The device has 8 GB of storage, which is enough storage for 6,000 titles, and weighs 166 grams. The Clara also offers 12 different fonts and over 50 font styles, not including the fonts provided by publishers for a specific title.[26] In order to use the installed fonts, there is a menu that allows the reader to change font face, font size, line spacing, justification, and margins. Changing the reading interface does not change the ebook files themselves, only the rendering by the device of the text on that one screen.

Beneath the surface the e-reading application uses a local stylesheet that records the reader's preference for the layout of the text and reconciles that with the layout defined by the publisher, similar to the way a web browser manages stylesheets. In paratextual terminology, e-reading devices provide human readers a centrifugal way to replace the publisher's peritext with a local set of epitexts that reflect a user's accessibility needs over the publisher's indication of cultural signification. If, as Genette points out in *Seuils / Paratext*, the choices made by author and publisher on how the text should look provides the reader with an indication of the nature of the text,[27] the ability to individualize those same features rewrites that relationship between author / publisher and reader to give the reader more control over the look of the book's text. An argument can be made that these epitextual modifications have an antecedent in reader's marginalia in a print title, but unlike print where the reader's notes sit on top of the

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[26] Rakuten Kobo: n. d. Kobo Clara HD. https://us.kobobooks.com/products/kobo-clara-hd (last access: 28.10.2022).

[27] Genette uses the specific example of French pocket edition as being "long synonymous with canonization." (See note 13), p. 21.

text, here the reader changes the design at the textual level. Unlike a print book's peritextual layout that carries with it an understanding of how we are to perceive the value of the text, a digital book allows a reader to change the publisher's layout with new epitextual elements *chosen by the reader*. The ability to change or even erase the context of the paratextual elements in a book requires us to rethink the modern reading experience and its relationship to the larger world of cultural production. It is no longer a simple exchange where an author / publisher is providing a cultural product to a consumer / reader, but the reader is also now reproducing the cultural object in a way that is meaningful to them. At the same time, they are also providing the cultural producer with new content that can be used in revisions or as marketing material (see Bidenharn's article on highlights from E. L. James above).

4. Network Layer Paratexts

The second layer in Sethi and Sarangi's IoT model is the network layer, which is the collection of protocols and programs that a device uses to connect to other devices and servers. This network layer allows readers to purchase or rent ebooks and display them across multiple online devices while keeping track of the collective reading progress.

The network layer bridges the servers that host the online services with the physical points of interaction executed on the perception layer and the programmatic processes described in the application layer below. The requirements for communication with third-party programs to access content on servers also create new paratextual elements that did not exist for print publications where the text's container held the whole of the work. As noted above, an e-reader is an empty container that can contain an ever-shifting library of thousands of titles. In order to get the content into the e-reader, a series of communications are necessary between the device and the distributor of the text. These activities required with an online network generate new epitext *in situ* instead of by an author or publisher at the time of creation.

An example of *in situ* epitexts created on the network would be the transmittal of text and notes between e-reader and distributor. In the Amazon ecosystem, readers can purchase Kindle editions through a web page on their computer or through the e-readers itself and download that ebook onto multiple devices. Amazon also allows readers to store their purchases on the company servers and download them when needed across devices. Amazon also records where a user stops reading in their ebooks and shares that stopping point across the network of devices and servers. This creates for the reader a seamless transition of narrative between devices, which can be seen in Amazon's Whispersync option explained above. In order for this to happen, Amazon's servers and the e-reading application on the device need to communicate updates whenever a major action

(highlight, return to library, power off) is performed. This requires both device and Amazon to open a series of network protocols to send said updates. It's worth noting that I've focused on Amazon's services as the company handles a majority of this data transfer in North America, but it isn't the only bookseller to use this kind of connectivity to manage users. Similar services offered by other e-reader retailers including Barnes and Noble's Nook, Kobo's digital library and the Tolino system in Germany also provide a near constant connection between book and distributor.

Regardless of what e-reader a person is using, the text of the book will need to be transmitted from a server to the device and any highlights or notes that a person makes in the ebooks will also need to be sent back to the server to update the stored version of the ebook. Any transmission between device and server requires text to be split into small data packets with new metadata and encryption added in order to travel over telecommunication services and be reconstructed. These transmissions can be explained by yet another model from information architecture: the Open System Interconnection (OSI) model.[28] The OSI outlines the protocols and steps for transmitting information between devices and describes how information is turned into small information bundles, sent across telecommunications services and reconstructed by the receiving device. This process of splitting and recoding information creates new epitexts not meant for human readers but for the devices themselves. While Genette's theory is focused solely on human access, I would argue that these additional points of access create new, invisible paratexts[29] that influence our understanding of text, specifically when these network protocols corrupt the new paratexual elements making the text display oddly or not display at all.

The activity enacted on this layer makes it clear that an ebook can never truly be an analogue to print even if it looks the same as print. In print the text and layout are intertwined with the physical object. To break the book down into separate chapters would be to destroy the book itself, but when an ebook is sent from the server to the device this is exactly what happens. An ebook only exists in a form similar to print at the moment of reading. Up to that point the text is a series of digital files that gets deconstructed into smaller packets so that it can travel across the network. Each packet is given additional metadata that an application uses to reconstruct the file once it has been sent between devices.

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[28] Conrad, Eric / Misenar, Seth / Feldman, Joshua: CISSP Study Guide. Waltham, MA 2016, pp. 219–291.

[29] These paratexts are invisible in the sense that they cannot be seen by readers. The paratexts described by both Genette and McCracken both provide the reader a discernable signal within the text: A quote from a review has an attribution; a hyperlink is underlined and bolded. When text is transmitted from a distributor and reconstructed by devices there is information added to the file that is never meant to be seen by humans. The same can be said for the XML files within ebook files that provide structural information. The only time a human is aware of these files is when something goes wrong, or a file is corrupted.

Any corruption of the order of the files that occurs has the potential to be identifiable to the reader / user, i. e., text won't render on the screen, but there are also cases where these errors are accepted by readers as part of the text. When Neal Stephenson's *Reamde* came out in 2011, the ebook was of such poor quality that Amazon had sent out messages to purchasers of the book about replacing digital copies due to "missing content"[30]. As the book's title is a typo of the readme file used by programmers, Stephenson's fans assumed the typos and errors were intentional. At a reading in San Francisco, Stephenson was asked "if the typos and errors, there being so many of them, might be intentional and part of some kind of code. He answered something along the lines of, 'people thought the same thing about *Cryptonomicon*, but there wasn't a code, just a lot of typos. But if there were a code, I wouldn't tell you.' Long Pause. 'But there isn't.'"[31] With every transmission to different applications there is an ever greater risk that the file may get corrupted as the applications process or read through the text's instructions. This "reading" is a specific action to locate and follow a set of instructions sent by the originating device on how to recreate the organization of information that is transmitted as linked packets. And once the device has "read" the instructions on how to reconstruct the ebook file, it then needs to "read" the files within the ebook to identify the type of media files and the layout of the page to create a version of the print book that reflects the author's and publisher's intentions with the added layout choices of the reader. The final step of this reconstruction happens in the third and final layer of Sethi and Sarangi's IoT model.

5. Paratext of Application Layer

The application layer in this model is used to describe the collection of programs, or applications, on a computing device like an e-reader or smart phone, that are engaged to convert machine-readable information into human-accessible text, is the final place where new ebook thresholds are created. The manipulation of digital files, when done properly, adds new thresholds related to the display of information as the applications need to record a user's interaction with the content while managing who has access to that content (Genette's *where*, *how*, *to whom*, *from whom*). To be clear, the previous two layers manage interactions between human and machine and machine and machine, but they do not save those interactions. It is the application layer that manages and records the de-

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[30] Shankland, Stephen: Amazon fesses' up to Stephenson e-book glitch. In: cbsnews.com. 30. September 2011. https://www.cbsnews.com/news/amazon-fesses-up-to-stephenson-e-book-glitch/ (last access: 28.10.2022).
[31] McIlroy, Thad: Sloppy eBook Conversions in the Spotlight. In: The Future of Publishing. 8. October 2011. https://thefutureofpublishing.com/2011/10/sloppy-ebook-conversions-in-the-spot light/ (last access: 28.10.2022).

cisions made for the rendering of the text. The applications make sure the text is both findable and searchable. They also manage access through Digital Rights Management and lock text from non-authorized users. Unlike the previous layer, applications do not change the text. They only add new information about display and access.

The application layer provides the reader with an illusion of their library. The layer can project a shelf of a user's purchased books, up to 6,000 titles in the case of the Kobo Clara, as if they were stored locally as whole codices on a bookshelf instead of links to compressed files that need to be downloaded and transformed into linear text. When a human reader begins their reading application, that application finds the files for a book based on the user requests and then reconstructs the text based on the user's layout preferences.[32]

These applications demonstrate that not only is the reading on an e-reader not analogous to print, but that the reading experience, if not the text itself based on personalized layout, notes, and highlighting, is now wholly unique for each reader. Unlike print books where everyone reading the same edition has the same text in the same layout, e-readers provide a unique edition for each reader. Even if readers chose the same choices for the layout, the devices themselves have different screen sizes and different versions of e-reading applications which may render the text differently on the screen. The only way to ensure every reader has the same experience reading an ebook as a print book is to fully replicate the reading experience, not just the text, of a print codex on a digital device.

This would defeat the point of an e-reader which utilizes specific applications designed within the legal frameworks of patents and contracts to create a personalized experience. To understand how these legal issues change access, one only needs to look at the previous example of searching words in an online dictionary. When a user looks up a word on their e-reader, the definition they receive will be based on what dictionary has been licensed for that e-reader. In the United States, Amazon has a license with Oxford for both the *New Oxford American Dictionary* and the *Oxford Dictionary of English* while Barnes and Noble has a license with Merriam-Webster to use their *Collegiate Dictionary* on the Nook e-reader. This means readers of the same book on different devices will receive definitions that create different contexts.

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[32] In the case of Kindle and EPUB, the two most common ebook formats, text is often split across multiple HTML files. These files are not stored in narrative order but have a manifest that instructs the e-reader on proper display order.

6. Conclusion

There is more to be done on the way ebook applications change a reader's entry to a text. As mentioned above, McCracken proposed ideas of centripetal and centrifugal paratexts that help to expand Genette's schema to reflect how text is structured in the digital realm. I would argue e-reading devices change the reading experience by giving the reader an illusion of a digital library where books are stored in some kind of sequence, when, in actuality, ebooks may not even be present on the machine and are downloaded when needed. Individual ebooks continue this illusion by presenting the digital files as a modern codex with organized text that is ready to be read, when the ebook is a file folder that contains a series of text files that need to be transmitted and reconstructed before a human reader can access them. Every time an ebook is loaded, it is created anew. And every time it is created anew there is another chance for the text to become corrupted. In digital publishing there is no fixed "book", only linked files. Even when the text had been reconstructed for reading, the human reader has the ability to manipulate the layout and the applications on the device will continually process new information about the reader's interactions: they confirm digital rights, load multimedia files, and note the human reader's progress through the text. The device must also access the publisher's stylesheet as well as the user's display preferences and reconcile the two to create the proper layout for the reader. All of this happens between the time a user taps on the screen and when the text appears on that screen!

In this paper I've shown how a digital text is "read" several times beneath the surface of the screen in order to make the human experience of reading unique for each person. By examining the way e-readers process text through the dual lenses of Genette's paratextual theory and the Internet of Things, I've shown how digital text expands the entry points for a given text and each of those new thresholds has potential to create unique contexts for the reader. We can expand upon the idea further by looking at the interfaces that allow for the creation of a more accessible text based on the needs of each reader. E-readers, therefore, manage books that have multiple audiences—both in terms of the human readers who access the files and the devices themselves. In order to manage the needs of these readers they need to create new thresholds between the text and the outside world beyond what is needed in a print ecosystem.