

A Multivariate Analysis of the Human Factors and Preferences Towards
Digital Publishing Platforms for the iPad

By Anton Ninkov

A Thesis submitted in partial fulfillment of the requirements
for the degree of Master of Science
in the School of Media Sciences
in the College of Imaging Arts and Sciences
of the Rochester Institute of Technology

July 31st, 2014

Primary Thesis Advisor: Professor Chris Bondy

Secondary Thesis Advisor: Professor Pat Sorce

Technical Advisor: Professor Graham Anthony

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School of Media Sciences
Rochester Institute of Technology
Rochester, New York

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**A Multivariate Analysis of the Human Factors and Preferences Towards Digital
Publishing Platforms for the iPad**

This is to certify that the Master's Thesis of
Anton Boudreau Ninkov
has been approved by the Thesis Committee as satisfactory
for the Thesis requirement for the Master's of Science degree
at the convocation of December 13, 2013 Thesis Committee:

Professor Christopher Bondy, Primary Thesis Advisor

Dr. Patricia Sorce, Secondary Thesis Advisor

Dr. Patricia Sorce, Graduate Program Director

Professor Christopher Bondy, School of Media Sciences Chair

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Abstract

Tablet computers have been widely adopted in America today, with 34% of American adults ages 18+ owning this type of digital device (PEW, 2013). With the emergence of new portable computer technology, reading on digital devices has become more popular than ever before. In particular, tablet computers have enabled users to read enhanced e-book material that, while still text-driven, incorporates all facets of multimedia and technology. With many different digital publishing solutions available for publishers to deploy their content, the goal of this research study was to determine whether there are significant differences in user preferences and comprehension for a publication re-created with three different digital publishing solutions (i.e., Adobe DPS, iBooks Author, and EPUB).

The methodology of this research study was a human factors experiment testing for a significant difference in the reading experience of subjects exposed to one of three digital publications. A field experiment consisting of ninety subjects assessed these publications, thirty for each of the three output formats.

No significant difference among the publications was found for readers' pleasure with the overall experience or for their interaction with the multimedia elements. A marginally significant difference among the publications was found for the value added by the multimedia elements of the publication. A significant difference among the publications was found for the readers' ability to recognize information and comprehend material from the publication.

Ultimately, these results showed a trend that readers' of the digital publishing platforms that allowed for greater interactivity experienced more value added by the multimedia elements of the publication and increased ability to recognize information from the publication. However, the pleasure with the overall experience of the publication and the readers' interaction with the multimedia elements in the publication was determined to not have a significant difference between the publications.

Therefore, while readers did not tend to interact differently with the multimedia content or experience any greater pleasure based on the publication they read, readers of more interactive publications did tend to see more value added by the multimedia elements and were better able to recognize the information they had experienced.

Chapter 1

Introduction

Statement of the Problem

Reading has empowered education and human advancement for thousands of years. Sending a man to the moon, harnessing nuclear energy, conceptualizing and developing computers—these are some of mankind’s most important and influential achievements. None of these accomplishments, however, would have been made possible if it were not for reading and learning. Reading in the current age occurs with traditional printed books, but also on digital devices. With the emergence of new portable computer technology, reading has become more popular than ever on digital devices. In particular, tablet computers have been introduced into the market, enabling users to read enhanced E-book material that, while still text-driven, incorporate all facets of multimedia and technology. The role that the medium has on the reader experience, particularly in regards to digital publishing platforms, is a critical issue that requires an investigation to be understood.

Background

Today, the opportunity to publish onto digital devices is increasing. Every year, new tablet devices that are more powerful and more affordable than their predecessors are released into the market. The demand for these devices has increased, with a growing

range of everyday usage that is convincing people to spend their money to acquire this new technology. Tablet devices are widely adopted today, with 34% of American adults ages 18+ owning a tablet computer. As shown in Figure 1, this trend of tablet ownership has been increasing steadily over the past three years. With so many devices already on the market and with an increase projected for the near future, a new realm of opportunity for content producers and publishers has presented itself.

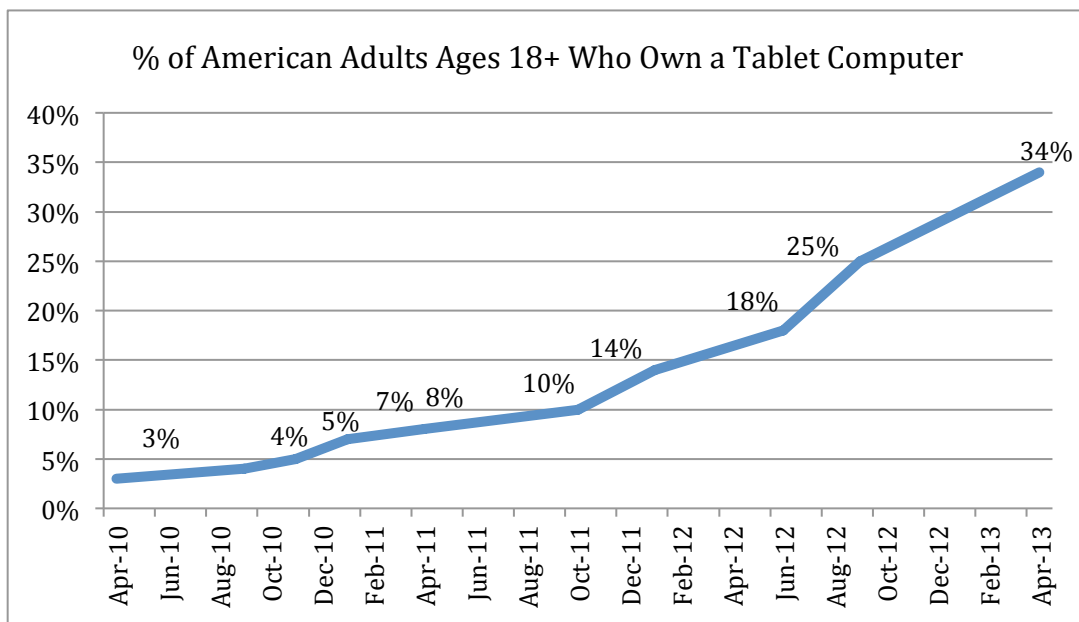


Figure 1. Tablet ownership over time
(source: Zickuhr, 2013)

Reason for Interest

Reading has been an important aspect of my life. Growing up, I would read the newspaper every day, browse through several magazines, and read many printed books. While at the University of Ottawa completing a Bachelor’s Degree in Communication and Sociology, I did much writing while maintaining a text and photo blog. I also focused on video production, working part-time for the local television station. Before college, I

played the violin for 18 years, 3 of those with the Rochester Philharmonic Youth Orchestra. Coming from a background with exposure to many types of media and art has driven my interest to investigate the production and adoption of various media.

“The medium is the message,” Marshall McLuhan once stated, and the harmony of this medium and the message has had a special impact on me. It is what fundamentally drives my interest and passion in quantifying the creation and development of the best experience of electronic reading.

Chapter 2

Literature Review

Introduction

A variety of topics are important to consider as background for research relating to the production of digital publications. These topics include e-books, hypermedia, content markup, e-book files, design, readability, digital publishing software, and human-computer interaction.

E-books

Chillemi (2007) states that “[an] E-Book is a computer file. The file is formatted to look and read like a book. It can be viewed on your computer monitor and various handheld devices or printed to your printer” (p.12-13).

To pinpoint when the e-book was first developed is difficult, since the concept of the e-book in the past has been vague; in fact, people may not have even realized that what they were producing was an e-book. However, Michael S. Hart was the first person to really concentrate on the concept. On the Fourth of July in 1971, Hart, who had been studying computing power at the University of Illinois and was inspired by a free printed copy of the U.S. Declaration of Independence, decided to hand-type the text into a computer. This began a project that still exists today (and is now known as Project

Gutenberg), which distributes millions of electronic books via the Internet for free (Project Gutenberg, 2012).

“Sharing information on the early Internet however was not easy... Download speeds were slow and basic transfer protocols were in their earliest iterations” (Polanka, 2011). As expanding bandwidth, technological innovations, and an increase of the numbers of people reading on digital devices drove the development of the Internet, the adoption of the e-book began to flourish. In November of 2009, the Internet Archive’s Text Collection was at 1,716,115 items (Polanka, 2011). As demand began to increase for digital books, businesses and individuals began to focus on how to make money by creating valued content. “It was only after the successful transition from print to electronic journals proved the viability and profitability of electronic that publishers warmed up to the idea of E-Books” (Polanka, 2011).

Sony released the first portable e-reader in the early 1990s with limited success, but the idea caught on as the technology began to improve. Various other devices began to emerge on the market from companies such as Barnes & Noble, Amazon, and PocketBook. Larger companies, such as Apple® , whose iPad® has recently seen tremendous growth, are now trying to lock in customers and dominate the e-reader market. With 29% of Americans now owning some sort of e-reader (Rainie, 2012), the rise of a new type of digital reading that incorporates multimedia elements is becoming increasingly popular and relevant. However, simply having many different media types jumbled together is not sufficient to deliver an effective reading experience. The mindful design of content is critical.

Hypermedia

Hypermedia and multimedia are similar to each other, and they are interrelated. However, there are some key differences between them that are important to consider in the creation of digitally published content. Multimedia is “the amalgamation of various information sources (written, text, sound, pictures, video) which exist in parallel. Each source uses a different technique of retention and delivery, and the data are heterogeneous” (Dauphin-Tinturier, 2007, p.163). In other words, multimedia incorporates various channels of media that are appropriately used together to give the user information on a subject. With the most basic multimedia, the author creates content that “only represents information in an essentially linear manner. Thus the author has to go through a linearization process to convert his knowledge to a linear representation” (Lowe & Hall, 1998). For example, the author uses a non-linear process to develop ideas and create valued content, but then dictates the information to the reader in a linear style where the user’s interactions are anticipated, step-by-step. This thought process is illustrated in Figure 2

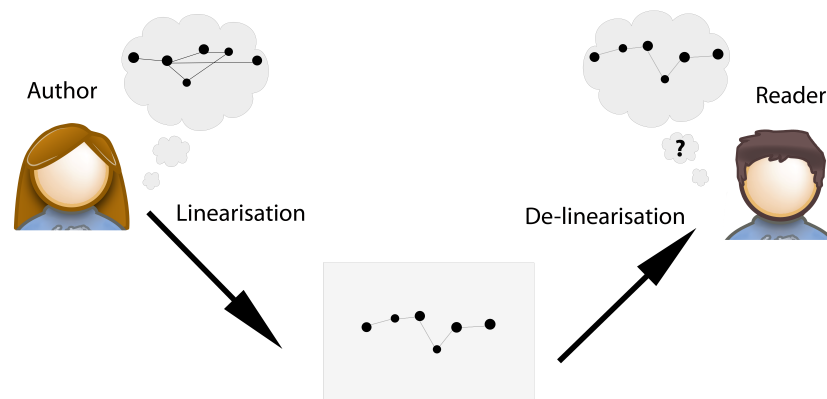


Figure 2. Traditional authoring thought process.
(source: Lowe & Hall, 1998)

Hypermedia, on the other hand, takes a user-based approach towards incorporating different forms of media. Hypermedia can be classified in its “ability to incorporate various media, interactivity, vast data sources, distributed data sources, and powerful search engines. These [applications] make hypermedia a very powerful tool to create, store, access and manipulate information” (Lowe & Hall, 1998).

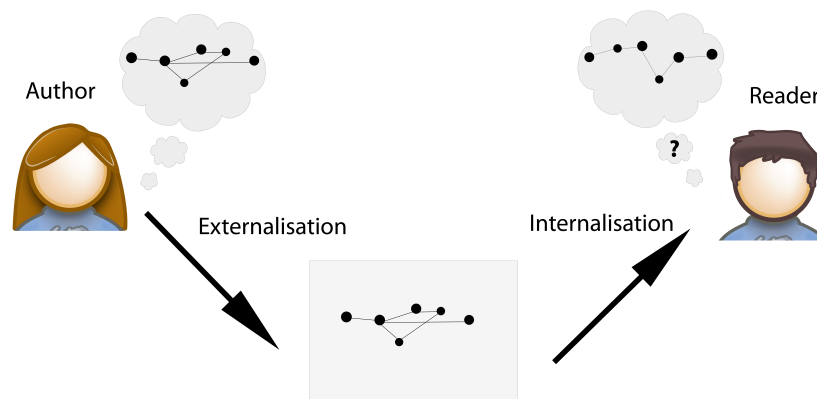


Figure 3: Hypermedia authoring thought process.
(source: Lowe & Hall, 1998)

While hypermedia, like multimedia, incorporates many media types together to create valued content, the end-user’s experience is taken into consideration while designing the content. As shown in Figure 3, this non-linear approach used in hypermedia creation allows the reader to explore further and to interact with the content on a more individualized basis. This can ultimately lead to a deeper, more fulfilling experience in which the end-user attains a personal understanding of the content being expressed.

“Hypermedia... allows us to partially mimic writing and reading processes as they take place inside our brain” (Lowe & Hall, 1998). The way that hypermedia content

is shaped to create an optimal experience for the user and to most accurately reflect their mental model. This is important because it means that the content being published is not the only factor. Developers need to consider the way in which information is designed and displayed to comply with user preferences for various media elements and interaction.

Content Markup

It is important to understand the rationale behind using markup languages to handle content. From a publisher's perspective, when dealing with any sort of valued content, it is beneficial to separate the content elements of the document from its presentational design. In order to do so, the creation of semantic markup separate from the presentational components for each output device is imperative. Semantically marking up a document requires “explicitly distinguishing (and accordingly ‘marking up’ within a document) the structure and semantic content of a document. It does not mark up the way in which the document will appear to the reader, in print or otherwise” (Walsh & Muellner, 1999). When marking up content semantically, the goal is to classify the content within tags that are meaningful to what the content describes, not what the content looks like.

An example of the importance of separating semantic from presentational markup is seen with lists. Without separating content from presentation, it would seem natural to mark up list items as indented, italicized, or any other format of its presentation. However, proper content markup is to declare those items to be within a list. The list can then be handled many ways, depending on the output device. Handling the list’s

appearance then comes from presentational markup where the specifications (such as how much it is indented and what are the font styles) can be further specified. The benefit in using such a system is that, even though in the beginning it may seem like the longer way of doing things, it ultimately will save significant amounts of time and energy if changes to the document itself later occur.

One of the first uses of this concept of separating content from presentation is Standard Generalized Markup Language (SGML). SGML was developed and standardized by the International Organization for Standards (ISO) in 1986 (DeRose, 1997). “The foundation of SGML is very simple: it lets you describe document structures directly, rather than describing something temporary like formatting, that depends on the structure. Simply put, SGML lets you tell the truth about your documents” (DeRose, 1997, p.193). Five key characteristics of SGML that build the basis include descriptive markup (tagging objects called “elements”), hierarchical structure, flexibility, formal specifications, and human-readability (DeRose, 1997). These fundamental aspects of SGML are the core to marking up content and have been carried forward to other markup specifications that have developed over the years.

Extensible Markup Language (XML) is a markup language derived from SGML which was developed in 1998. It is a markup language that is defined by a set of rules for encoding documents in a format that is both human-readable and machine-readable (Powell, 2006). Applying XML with Extensible Stylesheet Language (XSL), allows for the automation and processing of large amounts data relatively quickly. “XSL is a formatting language that applies templating to consistent data repetitions inside XML documents” (Powell, 2006). This can be very powerful, especially in situations arising in

publishing where much content needs to be handled in almost exactly the same way and comes in from various different sources. Using XML, an output file meeting specific requirements can easily be generated (as long as the content is properly tagged).

Additionally, “XML can be considered an extensible form of HTML [Hypertext Markup Language]. This is because HTML is restrictive in terms of tags it is allowed to use” (Powell, 2007, p.2). HTML is more like its own version of XML. By using XML, marking up information can be done to the exact specification of what the content creator finds appropriate for that information. Various other markup languages, such as DocBook, have stemmed from the XML model.

In 1989, Tim Berners-Lee developed HTML in collaboration with Robert Caillau while working at the CERN (the Conseil Européen pour la Recherche Nucléaire, or European Council for Nuclear Research) (Mercer, 2003). HTML itself is a subset of SGML, using tags to mark up documents by inserting commands. “The goal of HTML was to create a platform-independent language for constructing hypertext documents to communicate multimedia information easily over the Internet” (Mercer, 2003). The World Wide Web Consortium (W3C) is the organization responsible for maintaining and updating the specifications of HTML. “Rather than continuing to develop HTML, the W3C has begun recasting HTML into XHTML, a more formal version of HTML that follows the design principles of Extensible Markup Language (XML)” (Mercer, 2003). Using XML rules changed authoring requirements. For example, when writing in HTML, “broken” HTML markup can still work in a web browser and, by some estimates, over 99% of HTML pages have at least one error in them (Pilgrim, 2010). With an XHTML

page, web browsers have no choice when encountering an error but to stop processing, then to display an error message to the end user.

More recently, HTML5 (the newest version of HTML) has been introduced. HTML5 introduces many new tools to marking up that should be helpful. To start, the <head> of an HTML5 page has been simplified so there is much less text and only a few lines. The most notable new feature, however, is the addition of many new application programming interfaces (APIs) that can be used with JavaScript (W3C, 2012). Some of these added APIs (which do not seem to have as much relevance to the publishing industry but are important to web design) include APIs that prompt the user for information and allow for base64 conversion. Some of these APIs, however, seem as though they should have a major impact on the digital publishing industry; examples of API benefits include video and audio elements with APIs for controlling various aspects of the media, printing documents, prompting the user, enabling offline web applications, and forms (W3C, 2012). These new features give content developers the ability to interact with users like never before, and their implementation in the publishing world should become even more relevant as devices such as the iPad and Kindle™ increasingly use HTML5 as a file format for the distribution of e-reading materials.

E-book File Formats

EPUB, short for “electronic publication”, is an electronic file format. It is the distribution and interchange format standard for digital publications and documents based on Web Standards. Recently, the EPUB standard has been updated to EPUB3. “EPUB3 is a new exciting format, which is set to unleash a content revolution and become the new

accessible standard for E-Books” (Garrish, 2012). EPUB3 is based upon HTML5, so all the new APIs that add new interactivity are available on EPUB3, as well (Garrish, 2012). One particularly important example of EPUB3 is the new media tags and controls now available. EPUB3 plus HTML5 and the available APIs are enabling the redefinition not only what an EPUB document is, but what a book is. “Want to go fancy and add a video clip of a speech (to your document)? No problem... embedding your clip is still as easy as adding the HTML5 video element” (Garrish, 2012). With the easy-to-use new feature sets, the trend towards incorporating all multimedia together to produce content that can be classified as hypermedia is becoming a reality.

There are some limitations to using EPUB file format. “As an open standard widely supported by nearly all major E-Reader devices (with one notable exception), EPUB is an excellent option for doing HTML E-Book development” (Kleinfeld, 2011). One exception, however, is the Kindle, which operates using the MOBI format. Kindle does offer a tool called Kindlegen for conversion from EPUB to MOBI. However, Kindle does not support the embedded audio and video tags that are typical in HTML5 (Kleinfeld, 2011). This problem is similar to that created by Apple with its iBooks™ format.

DocBook is a standard for creating well-formatted plain text documents. It is mainly intended for, but not limited to, writing books and papers. Docbook is an XML vocabulary for writing that has existed since 1991. Originally designed with exchange in mind, DocBook has now largely become an authoring schema (Walsh & Hamilton, 2010). DocBook is particularly suited for creating books and papers about computer hardware and software, as well as handling academic and scientific papers, but now has

many more uses (Hunter, 2004). The various tags of DocBook have been revised and redone to simplify the process over the past five versions; many resources and references are available.

As for any markup language, the value is found within the automation of the process. When there is only one copy of a document, using markup languages seems like overkill since you can edit that single document to meet your own specific demands and requirements. Many people involved with electronic publishing are only familiar with this, as they are typically not writing their information so it can be easily transcribed and distributed. However, if that document needed to be submitted to a professional journal, or it was to become a chapter of a book, XML and DocBook would be appropriate since they standardize the content so it becomes platform-agnostic. The benefit is that, once the content is prepared properly in DocBook (or any XML) format, it can be published into a variety of formats, including HTML, XHTML, EPUB, and PDF. This is very powerful since this allows for the process of publishing to become automated to the point where the middleman between content creation and design layout is eliminated, allowing people to work on the important aspects of publishing—the content development aspect and design layout (i.e., creating valued content).

Design

Norman (2008) states that “ [it] is common to think of interaction between a person and technology as communicating with the technology, the real communication is between designer and person, where the technology is the medium”.

In Norman's *The Design of Everyday Things*, many key design elements are introduced that are relevant to the development of most every functioning object. These "psychological principles" ... (as Norman calls them)... "can be followed to make everyday things understandable and usable" (Norman, 1990, p.24). Norman is usually analyzing analog single-purpose goods, like a teapot, throughout the book. However, the principles that he discusses are applicable in the context of digital publishing, as well, since the user is actively interacting with the book, similarly to interacting with an analog device.

The most important principle of design is visibility. "The correct parts must be visible, and they must convey the correct message" (Norman, 1990, p.26). This is applicable to design needs of digital publications, since the only things the user processes are the elements that they perceive. If an image is out of focus, or if text is not visible or does not appear appropriately on the screen, then the user's experience is fundamentally flawed.

Norman also discusses affordances, another principle very closely related to visibility. Affordance "refers to the perceived and actual properties of the (object), primarily those fundamental properties that determine just how the thing could possibly be used" (Norman, 1990, p.30). Affordances are triggers to the user that there is some way to interact with the object.



Figure 4. Affordance example.
(source: Norman, 1990)

As we can see in Figure 4, two examples of affordances can be found as they relate to doors. In example A, the door has a long horizontal bar that “affords no operations except pushing” (Norman, 1990, p.31). In example B, there is a small and vertical bar that signifies to the user to pull (Norman, 1990). Norman would later revise this classification of affordances, stating that “affordances do not have to be perceivable or even knowable – they simply exist” (Norman, 2008). Instead, Norman decided a better term would be “signifiers”. A “signifier is some sort of indicator, some signal in the physical or social world that can be interpreted meaningfully” (Norman, 2008). The term, signifiers, according to Norman, better encompasses all of the traits of these powerful clues that dictate the way in which we interact with something. In e-book design, it is important for there to be clearly represented and intuitive signifiers of the media elements that allows the user to interact with the content.

Mapping is another important principle relating to creating an effective design of a digital publication. “Mapping is a technical term meaning the relationship between two things... between the controls and their movements and the results in the world” (Norman, 1990, p. 44). A digital publication should have mapping throughout its design in order to give the user a guide of where the content can take them. The orientation of the page swipe needs to be clear to the point where it is intuitive for the user. “Mapping problems are one of the fundamental causes of difficulties” (Norman, 1990, p.45). If readers do not understand where the device can take them, they cannot enjoy the content that has been produced.

Norman also states that people understand how things work because, before interacting with the device, they have a conceptual model of how it works (Norman, 1990). This conceptual model is often created from past experiences with the object, as well as affordances, constraints, and feedback. Reading on tablet devices is a somewhat new phenomenon, so the conceptual model of how an e-book should operate may not be completely understood. However, there are certain aspects of multimedia that have been cemented over the years. Some of these aspects are the play button symbols, arrows, Xs, and scroll bars.

Gestalt psychology, developed by Austrian and German psychologists in the 1920s, “refers to a structure, configuration, or layout that is unified and has specified properties that are greater than the simple sum of its individual parts... Gestalt theory provides rational explanations for why shifts in spacing, timing, and configuration can have a profound effect on the meaning of presented information” (Graham, 2008). Some principles of design have been developed from Gestalt theory on why simple changes in

spacing can dramatically change meaning. These principles (specifically, figure/ground, proximity, closure, continuation, and similarity) can also be applied to interactive media development (Graham, 2008).

Figure/ground is a fundamental law of Gestalt; it identifies objects from their surroundings. “The law of perception is dependent on contrast. Images and text must be visible to be understood” (Graham, 2008,). This can be seen on a website when the user hovers over text, then the text changes color, so that the user knows that is what is being selected.

Proximity is important to interactive design as it dictates the groupings of the content on the page (Graham, 2008). On a micro scale, letters that are located closer together allow the user to know that there is text. On a macro scale, in the design of e-books, grouping content together on a page will signify to the user that this content is all related to each other. If a video, for example, appears on a page, it will be related to the text that is on that page.

Closure is the idea that “humans have a natural tendency to visually close gaps in a form, especially in familiar forms” (Graham, 2008). When users have missing information, they tend to focus on what is presented to them and disregard the missing parts, filling in the spaces with something that is familiar. This can be useful for designing the background as it “often works closely with the law of continuation to form a stronger experience or perception” (Graham, 2008). A good example of closure is shown in Figure 5.



Figure 5. Closure example.

“Continuation occurs when the eye follows along a line, curve, or a sequence of shapes, even when it crosses over negative and positive shapes” (Graham, 2008). In other words, humans try to continue shapes and sequences when it is possible. An example of continuation is shown in Figure 6. “These sequences of screen shots from an animation show the law of continuation at work. Our eyes follow the arrow as it fades in turns and fades out” (Graham, 2008).



Figure 6. Continuation example.
(source: Graham, 2008)

Finally, similarity is a key principle of Gestalt psychology. “Visual elements that are similar in shape, size, color, proximity, and direction are perceived as part of a group, even if the items are spatially separated” (Graham, 2008). With e-books, it is important that similarities and consistency are maintained throughout the book, and that perhaps more importantly, dissimilar content are thought out appropriately to differentiate them from the rest. One font should be selected for use throughout the publication, and if a different font appears, it should be with the intention of differentiating it from the rest of the content.

Readability

Readability can be defined as “the sum total (including interactions) of all those elements within a given piece of printed material that affect the success that a group of readers have with it” (Edgar & Chall, 1949, p.23). The term, “readability”, is often associated with the difficulty of the linguistic features of the text. Formulas exist using primarily sentence length in words and frequency of difficult words to define how readable a particular passage is. The Flesch Reading Ease Score (FRES) is a highly regarded reading difficulty measurement, which is based on a scale of 0-100, with lower values for harder text and higher values for easier text. Figure 7 shows the equation that is used to calculate the FRES.

$$206.835 - 1.015 \left(\frac{\text{total words}}{\text{total sentences}} \right) - 84.6 \left(\frac{\text{total syllables}}{\text{total words}} \right)$$

Figure 7. The FRES equation.
(source: Flesch, 1948)

Yi (2011) states that “ [readability] may be improved with interface designs” (p.). In other words, the platform by which a person reads content can have an effect on their ability to comprehend it. This includes the appearance of font, spacing, background color, and possibly the publishing software that is used to output a digital publication.

In *The Magic of Reading*, Hill analyzes the essential elements of readability, specifically to find out if electronic books would ever be readable to the extent that a reader would spend the same amount of time looking at the screen as they do with print. Hill (1999) concludes that “reading is a complex and highly automated mental and visual process but makes no demands on conscious processing, leaving the reader free to distill meaning, to visualize, and to enter the world created by the writer. That world is in reality a combination of the writer’s creation and the reader’s own interpretation of it” (p.9).

Hill makes some impressive predictions about the evolution of e-books. He envisioned that there would be “more than one type of electronic book” including one device “that is smaller, more portable, and equates more or less to the printed paperback” and another device that “will have color and support for sound, and will take advantage of these and other capabilities to take electronic books beyond the books of today” (Hill, 1999). These two styles of devices are fairly accurate representations of the market of tablet readers today, with the Kindle Fire™ or Google Nexus representing the former and the iPad representing the latter.

Hill also discusses how books work. It is important to understand how people already use books while developing e-books because the conceptual model of how books currently operate exists and as Norman discusses, design is best when the user intuitively knows how to interact with the device. Hill (1999) views the book as “a 300 page

waterslide for human attention” (p.37). This waterslide is comprised of many components. On a micro level, the fonts, letter spacing, words, and lines are all important aspects of the reading experience; thus it is important to maintain consistency in the publication.

Hill makes observations that readers have certain expectations when they are interacting with a book. He notes that people consume books “from a top-down viewpoint” (Hill, 1990). Hill argues that the users prefer portrait orientation because it gives more lines of better length than landscape. Hill also describes visual cues which are “constants designed to help us” understand how to interact with an object (Hill, 1990, p. 39). Some of these cues include that lines go from left to right, the length of the lines are standardized, a paragraph is started with an indent, and chapter beginnings have spaces at the beginning. These visual cues are a part of a cognitive model that readers have when they go to experience written content. It is critical that these generally accepted traits of the book are not overlooked in e-book design.

Digital Publishing Software

The need for digital publications to be well-designed is more important now than ever before. With the market of e-readers growing, there is an increasing market of users ready to pay for downloading content from the Internet. In fact, as shown in Figure 8, 68% of all downloaded content put on the iPad by publishers is paid for.

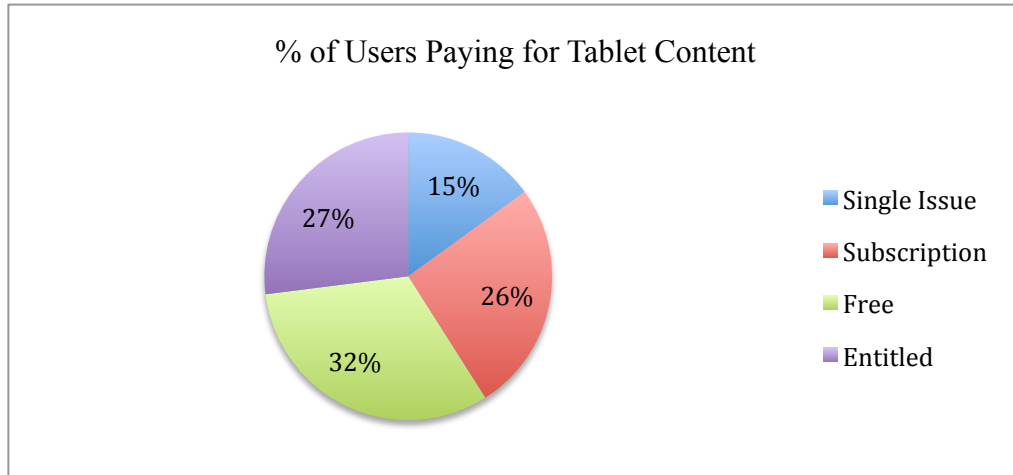


Figure 8. Users paying for tablet content.
(source: Joss, 2012)

As this market of users paying for content increases, so will demand for higher quality. In September, 2012, J.K. Rowling, author of the famous *Harry Potter* series published her latest novel, *The Casual Vacancy*. She released it to print, as well as on a variety of e-book files. The e-book version of the novel sold for £11.22, which is the equivalent of \$17.99 (BBC, 2012). The novel was highly anticipated. However, upon release, users soon reported major problems with the e-book version on a variety of devices. Users cited “massive frustration for the true fans” with the book and the publisher, Hachette, ultimately had to save face and fix the problem, then allowed affected customers to download a new copy (BBC, 2012). Publishers must understand that readers care about the quality of the e-books they produce and that no aspect of the medium can be ignored.

Adobe is one of the most widely used tools today to meet digital publishing needs. Their app-based digital publishing package includes InDesign® CS 6, which has powered more than 16 million digital publications during the last year (Joss, 2012).

Publications (including *New Yorker*, *Wired*, and *Self*) that use this solution are some of

the most renowned interactive publications, with all of them reaching the top 10 iPad Magazines, according to *Business Insider* (Kovach, 2011). More than half of the top 20 Newsstand Apps use Adobe publishing software as a tool to structure their content, clearly making Adobe an important software developer within the digital publishing industry (Joss, 2012).

Apple released iBooks Author™ in January, 2012. It was initially created as a tool for “educators and small publishers to create their own books” (Albanesius, 2012). Apart from the various digital textbooks that were created by Apple, some multi-touch books (as they are referred to in iTunes) currently being sold in the iBooks store created with this software include J.R.R. Tolken’s *The Hobbit*, Anna Sewell’s *Black Beauty*, and numerous cooking, travel, and how-to books.

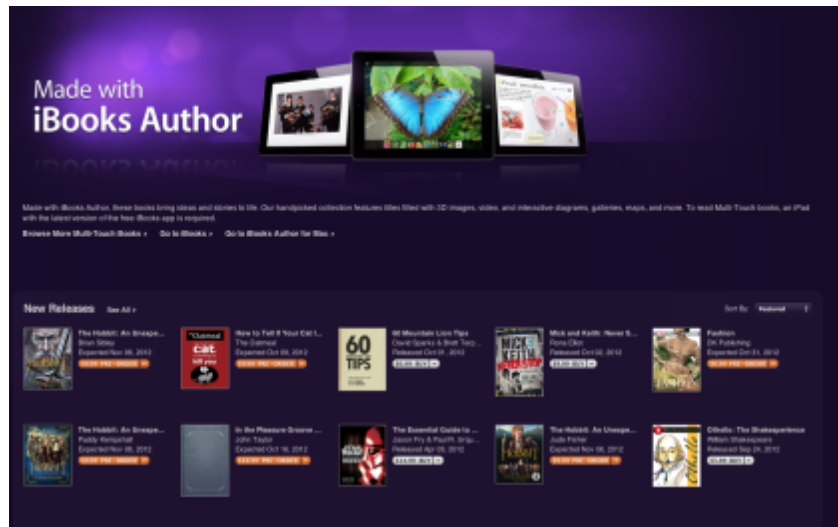


Figure 9. iTunes iBooks Author Bookstore.

The iBooks Author software is free for Mac OS X, which has given it quite a bit of recognition throughout the publishing industry. One foreseeable problem with the

iBooks Author is that it is proprietary, meaning that the file type of these books, iBooks, is structured like an EPUB file, but it does not use the same standards and has undocumented extensions for Cascading Style Sheets (CSS) (Bjarnson, 2012). If you are creating content that will be viewed on an iPad, this software is a great choice. However, exporting to the other devices will likely be impossible, or it will create problems.

Human-Computer Interaction

Carroll (2002) states that “Human-Computer Interaction (HCI) is the study and practice of usability. It is about understanding and creating software and other technology that people will want to use, will be able to use, and will find effective when they use” (p.2) HCI is critical in the development and understanding of how humans interact with e-books. E-books, at their core, are simply glorified computer data files. People interacting with e-readers are actually interacting with a computer. Therefore, a better understanding of HCI is fundamental to developing the complete picture.

Usability is a core concept of HCI, and it can be defined as “a measurable characteristic of a product’s user interface that is present to a greater or lesser degree” (1, 1999, p.1). User experience is a concept related to usability; it influences the way designers construct applications. If an e-book is designed with a focus towards incorporating as much interactivity and multimedia elements as possible, the experience of the user and the usability of the device will most likely be forgotten, and the result will be the user disliking the publication. User-centered design incorporates these various media elements by organizing them within a theme that emphasizes “the importance of involving the user throughout the entire process” (Rosanski & Haake, 2003, p.182).

Understanding the process by which the user will interact with the content in the publication is critical to the successful design of an e-book.

“HCI is a multidisciplinary field, which combines the theories and practices from cognitive and behavioral psychology, ergonomics, anthropology, sociology, computer science, engineering and graphic design, among others” (Rosanski & Haake, 2003, p.180). The broadness of research within the field of HCI results in there being many different sub-genres and focuses within the area. One particularly relevant HCI research experiment to this study is *Adaptive Layout Template for Effective Web Content Presentation in Large-Screen Contexts* (Nebeling et al., 2011). This research focus was looking at the user experience towards reading online news. They measured this by asking users to sit in front of a screen and read three online articles about current news for about 10 – 15 minutes. After they had finished reading the article, they were then asked to answer a series of questions about the material. Some of these questions were designed to test their reading comprehension, and there were five Likert scale questions asking them to rank their reading comfort, the positioning of elements, the image alignment, the font size, and scrolling behavior. The results were then plotted and analyzed to determine what users preferred in terms of reading text-heavy documents on computer screens and what hybrid of the three articles would have been favored amongst the users.

Another HCI study relevant to my research is *How People Recall, Recognize, and Reuse Search Result* by Jaime Teevan. This research’s primary focus was “on understanding how people recall, recognize, and reuse search result lists containing previously viewed Web information” (Teevan, 2008). Three separate experiments were

designed to test the ability of users to recall, recognize and reuse information that they had found while searching online. Recall and recognition are important aspects of understanding how a user engages with media elements. “Recognition data indicates how many saw (the media element). Recall Figures tell us how many of them did become sufficiently interested to actually look at it” (Stapel, 1998). In advertising, a relationship between recall and recognition has been found with average recall rate being 32% that of the recognition rate (Stapel, 1998). It will be interesting to see if media elements in a publication have a higher recall rate because it is more engaging, and as well if these rates vary amongst the different digital publishing platforms today.

To test human factors towards reading on various digital publication platforms, a benchmark of the content will also need to be developed that accurately reflects the needs of the experiment. The HCI of readers with digital publications created on a variety of digital publishing platforms will ultimately be assessed by the subjects of this research similarly to the format of the research described above in terms of reader comfort, comprehension, recall, and recognition.

Chapter 3

Research Questions

Research Questions

The Human-Computer Interaction (HCI) of digital publications for tablet devices can be influenced by: 1) the platform used to display the publication and 2) the publication itself. There are many ways to create digital publications, and companies are investing in software that assists in the process of transforming print-ready content into digital content. The look and feel of the resulting digital publication is constrained by the capabilities of the platform to which the transformation of the print content is made.

Therefore, the questions addressed by this research were:

Are there significant differences in user preferences in terms of

- the value added by multimedia elements,
- the reader's interaction with those elements,
- their comprehension of the content in the publication, and
- their pleasure with the overall experience of the publication)

for various publications produced by Adobe DPS, Apple's iBooks Author, and

EPUB?

Chapter 4

Methodology

Overview

The methodology of this research study was a human factors experiment testing for a significant difference in the reading experience of subjects exposed to one of three digital publication outputs of the same content: EPUB rendered in iBooks, and digital applications produced in iBooks Author, and Adobe InDesign. A field experiment consisting of ninety subjects assessed these publications, thirty subjects for each of the three output formats. Each publication was evaluated in terms of these criteria:

- The value added by the multimedia elements of the publication
- The reader's pleasure with the overall experience
- The reader's interaction with the multimedia elements
- The reader's ability to recognize information and comprehend material from the publication

Experimental Design

This methodology followed these steps:

1. Develop the article content.
2. Transform the content.

3. Output the content to three digital publications.
4. Assess the performance of subject groups.
5. Analyze the results.

The independent variables of this experiment were:

- The platforms used to develop the publication (Adobe Software, Apple iBooks Author, and EPUB)
- The age of the reader
- The education of the reader
- The reader's experience with tablets

The dependent variables assessed were:

- The value added by the multimedia elements (responses based on a 1-5 Likert scale)
- The reader's interaction with those multimedia elements
- The pleasure with the overall experience of the publication
- The reader's recognition of the content in the publication. (Refer to Appendix D for the full questionnaire.)

The impact of the platforms' utilization of hypermedia capabilities (various layouts, fonts, images, video, audio elements, and added features) was assessed by measuring differences in the dependent variables by manner of a questionnaire that the

subjects took after reading the publication. An initial assessment of the various platforms' hypermedia capabilities is displayed in Table 1.

Table 1. Attributes of publication interactive design options.

Attribute	Print	EPUB	iBooks	Adobe
Layout	●	◐	◑	●
Font	●	◐	◑	●
Hyperlinks	◐	◑	●	●
Images	◐	◑	●	●
Audio	◐	◑	●	●
Video	◐	◑	●	●
Added Features	◐	◑	●	●

LEGEND: ● Full Control, ◑ Lots of Control, ◐ Some Control, ◒ Little Control

Develop the Article Content

The content used in the article was very important to the ultimate success of this experiment. Although the experiment did not look at the subject's interest in the genre of the content, the goal was to use a topic for the article that would be universally likeable, not very well known, and would be able to lend itself to a great amount of multimedia interactivity. In order to gain a better idea about what topic the majority of people would be interested in, online survey of 50 people from the Rochester and RIT community was conducted that asked respondents to rank their top three choices in terms of publications

they would be interested in reading an article out of. These results are displayed below in Table 2.

Table 2. Publications' rankings (by 50 Subjects).

Publication	1 st Choice	2 nd Choice	3 rd Choice
<i>Time</i>	6	15	6
<i>National Geographic</i>	20	6	6
<i>Reader's Digest</i>	0	2	8
<i>Better Homes and Gardens</i>	0	1	2
<i>Entertainment Weekly</i>	5	5	4
<i>New York Times</i>	13	8	12
<i>Wall Street Journal</i>	0	5	4
<i>The American Legion</i>	0	2	0
<i>People</i>	5	2	8
<i>Newsweek</i>	1	4	0

Out of the choices provided, *National Geographic* appeared to be the most interesting publication for the subjects of this initial survey. Several topics covered by *National Geographic* were then considered and ultimately, it was decided to use the lynx, the genus of medium-sized wild cats, as the topic of the article. Aside from being a topic that would be of interest, several resources (including images, audio, video, and interactive images) would have to be used to enhance the publication. Collection of information online about the lynx began and continued until there was enough content to fill five to ten pages of digital content. The text selected to be the centerpiece of the content had a FRES score of 55, indicating it would be at a level that most people could read comfortably, but it would still offer information they likely did not know already. The final combination of images and text can be found in Appendix A.

Transform the Content

Once the article content had been prepared, conversion of the digital publications began. The researcher worked with one publishing tool at a time to allow it to be immersed with all the features of that tool. This, along with following the book and web design principles mentioned in the literature review, ultimately allowed generation of the most appealing publication.

Multimedia elements were added to each of these digital publications with the goal being to optimize the use of each publication, while maintaining as much consistency as possible within each rendition of the article. Although the features available on each platform differed, the content itself stayed the same throughout each publication. An example of this consistency of content is seen with the images. In the Adobe and iBooks Author version of the article, slideshows are used and contain three images each. In the EPUB version, slideshows were not used; instead, images were just placed in-line with the text.

Another important difference found between the interactions in these three articles was in the use of two maps that showed the differences between the range of the Spanish lynx from 1980-2003. In the EPUB version, the two lynx range maps were displayed in-line next to each other. In the iBooks Author version, a slideshow was used, so that the user could swipe the 1980 range-map to reveal the 2003 range-map. The Adobe DPS version had the greatest interactive design, where the map had a scanner bar; as the user's finger swiped across, the map changed accordingly from 1980 – 2003. Screen shots of the three complete publications can be found in Appendix B.

Output Three Digital Publications

Once each publication's design was finalized, the results were output to their respective devices. Each output required its own separate devices so that, while the experiment was being performed, the user had access to only one of the three publications.

During the output process, preliminary testing of the content was done for a variety of reasons. Assessing reader fatigue to ensure that the publications were not overbearing on my subjects in terms of their time and effort was important. As well, it was necessary to ensure that the design of the publication allowed, to the greatest extent possible, for the users to intuitively understand how to interact with the publication.

After the preliminary testing had been completed, some confusion with the controls of the publication had been observed among the users unfamiliar with tablets. To help with this, a page near the beginning of the article was added. On this page, the interactions that were found in the publication were explained and various sample media elements were provided so that users had a "practice" before going live to the publication itself.

Conduct the Experiment

Each of the three publications was tested by a total of thirty different subjects, making the overall sample group for this experiment ninety subjects. These subjects came from a variety of backgrounds, and all were fluent English speakers and readers.

Subjects usually signed up for the experiment online through a Google Form. This form asked subjects to provide a bit of background information, including whether they

owned a tablet device, their education, their age, and their self-ranking of their tablet use abilities from 1-5. Subjects who did not sign up online were asked these questions before the experiment process began. Assessing the tablet abilities of the subjects was important in ensuring that each publication had an equal representation of both experienced and non-experienced tablet users. As well, it was important to keep track of education and age to ensure that each group was an accurate representation of the whole population. The differences between these groups to navigate and interact with the media elements of the article was judged to be important enough to take into consideration.

Subjects were asked to come to a quiet and secluded location to participate in the study. Some of these locations included study rooms in the Wallace Center, as well as the Gravure Research Lab in the School of Media Sciences, both located at the Rochester Institute of Technology (RIT). These locations were ideal for their isolation, comfort, and accessibility. Since this experiment was not an exact replica of their home reading conditions, the goal was to make the setting as inviting as possible to the users, while also ensuring no distractions would take place. A sample experiment location is shown in Figure 10.



Figure 10. Sample experiment location.

Assessments were done individually with a maximum of three subjects taking the experiment at a time. When multiple experiments were running, the tests were set up in such a way that the subjects were not distracted by one another or felt rushed to finish.

Upon arrival, subjects were first asked to sign a consent form in which they agreed to participate in the experiment. Once this had been completed, the researcher then provided subjects with the essential information on the experiment. Once the subjects began the experiment, the researcher stepped out of the room and started the timer to keep track of how long they spent reading. Once they had completed reading the article, the researcher then stopped the timer, re-entered the room, and took the iPad away from them. The researcher then explained to them that the next step was a questionnaire that asked 15 questions about the information that they had just interacted with. These materials can be found in Appendix C.

The subjects were then provided with the questionnaire form, found in Appendix D, which they then completed and returned to me. Upon completing the questionnaire, subjects had finished the experiment, and they were asked to provide their name and contact information to register them for the drawing of \$100 gift card. Finally, the subjects were thanked for their participation and were dismissed from the testing location.

Analyze the Results

After all the data had been collected, inferential statistics were used to analyze the data. An analysis of variance test, or ANOVA test, was used to measure variation between the users of each publications time spent reading, image recognition score, overall score, and revised test score. Using an F-Test, the variance within all of the variables could be assessed to determine if there was a significant difference in the responses. By testing the null hypothesis, which is that each output will have the same score, a conclusion to whether a significant difference between the publications read by the subjects existed within each of the variables could be made. As well, a chi-square test was used to analyze the attitude-based questions by each publication group. Some of these results proved to be significant and revealed interesting differences in the experiences and comprehension of the readers of the three publications.

Chapter 5

Results

The data collection was completed over the course of a three-week period spanning March to April, 2013. The samples of each group were comparable in mean ages, tablet experience (with 1 being the least experienced to 5 being the most experienced) and education (with 1 being no high school diploma and 6 being a graduate degree), as shown in Table 3. This was indicated by an analysis of variance that showed no significant difference between the three groups and these controlled variables.

Table 3. Demographics of each publication's sample.

Controlled Variable	F Score / p-value	Adobe DPS	iBooks Author	EPUB	Mean
Age	0.271 / 0.764	35.7	32.27	34.8	34.16
Tablet Experience (1-5)	0.981 / 0.379	3.47	3.33	3.47	3.42
Education (1-6)	0.881 / 0.127	4.53	4.17	4.57	4.42

Multimedia Value Added and Pleasure with Overall Experience

The mean “value added of the multimedia elements (based on a 1-5 scale Likert scale) was found to be marginally significant ($F = 2.493$, $p = 0.089$) with a 3.97 and 4.27 average score for readers of the EPUB and DPS version of the publication respectively versus 4.47 for the iBooks Author version. The pleasure with the overall experience, however, showed no significant difference ($F = 0.176$, $p = 0.839$), as seen in Table 4.

Table 4. Media value added and overall pleasure among publications.

Criteria	F-Score / p-value	Adobe DPS	iBooks Author	EPUB	Mean
Media Value Added	2.493 / 0.089	4.27	4.47	3.97	4.23
Overall Pleasure with Publication	0.167 / 0.839	4.06	3.93	4	4

Video and Audio Question Recall

As for the readers' interaction with the media elements of the article, the analysis of variance indicated that no significant difference was observed in users' choice to interact with the video and audio media elements of each publication for the video elements ($F=0.109$, $p=0.894$) and for the audio elements ($F=1.481$, $p=0.227$). When asked a question about the media elements they interacted with (specifically, the audio elements) a minor difference was found ($F=2.146$, $p=0.121$), but was not statistically significant. The Adobe DPS users answered correctly more frequently than the others. Specifically, 17/30 and 18/30 readers of the EPUB and iBooks Author version of the publication, respectively, selected the correct answer vs. 24/30 of the Adobe DPS readers. As well, the percentage of subjects who got the video and audio questions wrong (not including those subjects who did not watch or listen at all) was far less for the Adobe DPS than the iBooks Author or EPUB version. These results have been displayed in Table 5.

Table 5. Video and audio variables among publications.

Criteria	F Score / p-value	Adobe DPS	iBooks Author	EPUB	Mean
# Saw Video	0.109 / 0.894	26	27	27	26.67
Video Question Right	0.801 / 0.443	23	19	19	20.33
Video Question Wrong	-	3	8	8	6.34
# Heard Audio	1.481 / 0.227	27	29	25	27
Audio Question Right	2.146 / 0.121	24	18	17	19.67
Audio Question Wrong	-	3	9	8	7.33

Layout and Information Application

Two questions were aimed at measuring the impact that the layout of the publication had on the users' ability to recall information, and the interaction in the publication had on the users' ability to apply the information to new content. The ANOVA indicated that no significant difference was observed for the questions on the weight of the lynx question ($F = 0.580$, $p = 0.562$) and applying the information to new material ($F = 0.993$, $p = 0.374$). These results are displayed in Table 6.

Table 6. Layout recognition and information application among publications.

Criteria	F Score / p-value	Adobe DPS	iBooks Author	EPUB	Mean
Layout Recognition Right	0.580 / 0.562	27	25	24	26.67
Apply New Information Right	0.993 / 0.374	22	18	17	20.33

Time Spent

In terms of time spent reading each publication, the ANOVA indicated no significant differences ($F = 2.158$, $p = 0.122$). Even though it was not significant, it appears that readers of the EPUB publication tended to spend the most time on average than the Adobe DPS readers and iBooks Readers. These results are displayed in Figure 10.

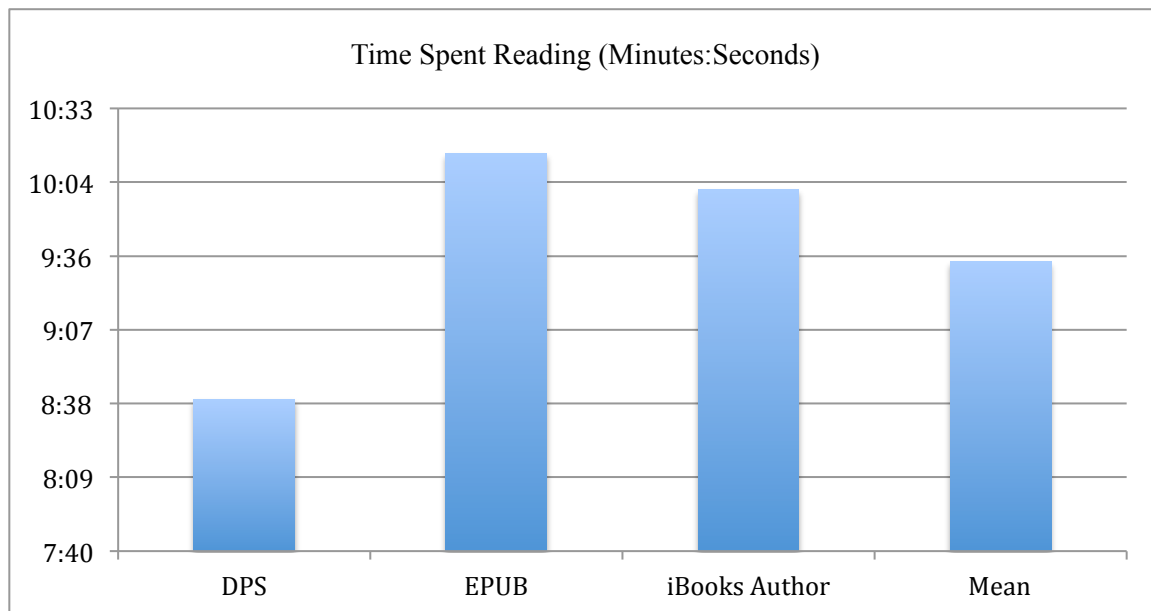


Figure 10. Time spent among publications ($F = 2.158$, Sig. 0.122).

Image Recognition

The ANOVA indicated that the readers' ability to recognize the images they had seen in the publication was not significant ($F = 0.181$, $p = 0.835$). However, when each image was analyzed individually, some marginally significant results were found. Image 2 was correctly recognized the most by Adobe readers ($F = 2.786$, $p = 0.067$), while Image 3 was correctly recognized the most by EPUB readers ($F = 2.812$, $p = 0.066$). These results are displayed in Table 7.

Table 7. Recognition score and images among publications (Sig. 0.122)

Criteria	F Score / p-value	Adobe DPS	iBooks Author	EPUB	Mean
Recognition Score (/6)	0.181 / 0.835	3.63	3.6	3.43	3.56
Image 1 Right	1.937 / 0.147	6	9	13	9.33
Image 2 Right	2.786 / 0.067	27	25	20	24
Image 3 Right	2.812 / 0.066	14	9	18	13.67
Image 4 Right	0.000 / 1.00	20	20	20	20
Image 5 Right	1.318 / 0.266	22	16	18	18.67
Image 6 Right	0.661 / 0.510	20	23	19	20.67

Interactive Map

One question assessed user's ability to remember the range of the Spanish Lynx according to a map displayed in the publication. After seeing two maps that compared the lynx range in 1980 and 2003, users were asked to select the map (from four choices) that accurately reflected the lynx range in 2003. This question monitored the impact that the type of publication, and ultimately the interactivity that was available for that map in the publication, had on their memory. A significant difference ($F = 6.824$, $p = 0.002$) was observed, which showed a strong tendency that greater interactivity increased the user's comprehension of the information. Specifically, 15/30 and 17/30 readers of the EPUB and iBooks Author version of the publication, respectively, selected the correct answer versus 27/30 of the Adobe DPS readers.

Overall and Revised Score

Finally, users' comprehension of the media elements of the article were tested by using the raw overall score, as well as a revised scoring metric in which the total of the 6 image recognition questions are divided by 2 (to make a more proportional representation of the questionnaire). An ANOVA determined a marginally significant result for the overall score ($F = 2.785$, $p = 0.067$), as well as a significant difference ($F = 4.253$, $p = 0.017$) when using the revised scoring metric. Readers of the Adobe DPS version of the article had higher test scores for both the overall (8.73 vs. 8.01 mean) and revised (6.92 vs mean of 6.23) scores than those who read either the iBooks Author or EPUB versions. These results are displayed in Table 8.

Table 8. Overall score and revised score among publications.

Criteria	F Score /p-value	Adobe DPS	iBooks Author	EPUB	Mean
Overall Score (/12)	2.785 /0.067	8.73	7.56	7.73	8.01
Revised Score (/9)	4.253 /0.017	6.92	6.12	5.93	6.23

Chapter 6

Summary and Conclusions

Summary of Results

The key results of this experiment determined that:

- No significant differences among the publications were found for the readers':
 - Overall pleasure with the publication
 - Correct answering of the recognition question after seeing the video
 - Correct answering of the recognition question after listening the audio
 - Recognition of information in relation to the layout
 - Application of knowledge to new information in relation to the interactivity
 - Time spent with the publication
 - Recognition of images

- Marginally significant differences among the publications were found for the readers':
 - Reports of media value added
 - Correct responses to image recognition questions for Images 2 and 3

- Significant differences among the publications were found for the readers':
 - Recognition score on the interactive map question
 - Overall and revised complete recognition score

Analysis of Results

The overall pleasure with reading the publication was a variable that the researcher felt would have shown that there is a preference towards the more interactive publication. However, this variable yielded no significant differences among the three publications in the experiment. A few possible factors may have had an impact on this result. First, some of the subjects in the experiment had never used a tablet device before. When these readers were presented with any type of digital publication, they were often simply impressed by the device itself and were inclined to give the publication a perfect score, not knowing that there was the possibility for more interactive publications out there. Second the reader's interpretation of the question could have had an impact on the way they answered. Some readers wrote comments expressing how they loved the article because of their interest in the lynx, specifically, and not necessarily the publication design and interactivity itself.

The multimedia value added criteria proved to yield marginally significant results among the publications, with the readers of the iBooks Author and DPS versions getting higher scores than those who read the EPUB version. This result was not too surprising, as the two versions of the publication that had greater amounts multimedia interactivity built in scored higher on the multimedia value added criteria. It was a bit unexpected, however, that between the DPS and iBooks Author versions of the publication, the iBooks Author version had higher scores. This could be a result of the fact that because the iBooks Author

environment restricts the amount of layout freedom one has, forcing the designer to use pre-made templates to include the interactive elements. Perhaps the DPS version of the article did a better job of integrating these media elements in and, therefore, instead of being a highlight, was more of an “accent” to the publication.

The readers’ interaction with the publication was measured in relation to several variables, some proving to be significantly different. The amount of time subjects of each group spent reading the publication did not show a significant difference. However, the results did reveal that the readers of the DPS and iBooks Author version spent less amount of time with the publication than did readers of the EPUB version. While the difference was not large enough to be considered significant, this difference is still interesting to examine and could be due to many factors. Perhaps the readers of the DPS and iBooks Author version were able to understand the publication with greater ease as a result of the multimedia elements and, therefore, spent less time reading. This would be supported by the fact that there was a marginally significant difference observed in the “value added” of the multimedia elements of the publication.

The readers’ interaction with the video and audio elements of this publication revealed interesting results. While there was not a significant difference in the number of people who saw/heard the video/audio elements or the number who got the video recognition question right, a marginally significant difference in the number who got the audio recognition question right was observed, with the 24/30 Adobe DPS readers getting the question right and only 18/30 and 17/30 of the iBooks Author of the EPUB readers, respectively. Also noteworthy is the difference in the number that got the video recognition or audio recognition question wrong after interacting with the media elements. The video recognition question was answered wrong by 8/30 readers for both the iBooks Author and EPUB sample groups, while only 3/30 got it wrong with the Adobe DPS version. As well,

9/30 readers of the iBooks Author and 8/30 of the EPUB sample groups got the audio recognition question wrong, while only 3/30 got it wrong with the Adobe DPS version. These data shows that, although readers of the more interactive version did not interact more than readers of the less interactive versions, they were more engaged with the media elements and did do better remembering and applying the information they saw. Perhaps it was the layout freedom of the Adobe DPS version (for example, greater freedom selecting the audio button image or the automatic video full screen) that enhanced the media elements attractiveness to the readers and increased their ability to get the question right.

One recognition question was designed to determine if having “information boxes” integrated into the layout of the publication at the bottom corners of pages reinforced the readers’ ability to retain the information better than did placing the text in-line. Given that the DPS and iBooks Author publications, and not the EPUB, had the corner information boxes integrated, it seemed as though the EPUB readers may be more likely to have gotten the recognition question wrong. This was not the case, with the results showing no significant differences between the publications. In fact, the EPUB readers ultimately got the recognition question right more frequently than did the iBooks Author readers, further disproving that the corner information boxes would reinforce that information.

Another recognition question examined the impact that the interaction in the publication had on subjects’ ability to apply the information they had learned to new information. The question showed a picture of a Lynx that was NOT displayed in the publication. The user then had to identify the species of the lynx based on the images they had seen and the descriptions they had read. This returned no significant results, either, with DPS readers getting the answer right only slightly more often than did those of EPUB or iBooks author.

Subjects' ability to correctly recognize from a series of images whether or not they had seen them in their publication proved to not yield a significant difference. This was another surprising insignificant variable, as it was expected that readers of the more interactive versions of the publication would fare better at recognizing the images. Images 2 and 3 from the questionnaire (in Appendix D) yielded marginally significant differences. Image 2, depicting a lynx kitten with its mother that was not in the publication, had the highest correct responses from the DPS readers, with 27 of them getting the question right, compared to 25 iBooks Author readers and only 20 EPUB readers getting them right. This could be related to the fact that the more interactive publications contained slideshows of images that readers could physically engage with. It is possible that their higher level of engagement may have increased the reader's ability to spot out the false image.

This possibility was debunked by the fact that 4 out the remaining 5 images, along with the overall recognition score, showed no significant difference. The only other marginally significant result came from Image 3—an image that was in the publication that showed a couple of lynx kittens at play. For this image, the readers' of the EPUB version were the ones who faired best, with 20 of them getting the question right versus 14 for DPS and 9 for iBooks Author. Overall, it appears that readers' ability to recognize images they saw in a digital publication is unchanged between those reading publications that display images in-line or in slideshows.

Another interesting observation was the number of people who could answer a recognition question about two maps presented to them in the publication. The maps were displayed differently in each publication and had a different level of interaction. The

EPUB displayed the two maps side-by-side, with the only interaction being the ability to view the image full-screen. The iBooks Author version displayed the two maps in a slideshow, similarly to how all the images in the publication had been displayed. DPS had the most interactivity with subjects swiping across one map to reveal the second map below. In terms of how well each group did answering the recognition question, readers of the more interactive publication fared far better, with 27/30 of them getting the question right, while only 17/30 and 15/30 of the iBooks and the EPUB, respectively, got it correct. This may have been because more DPS readers interacted with the map and were better able to remember the information they saw. This interaction is critical in showing that appropriate use of interactive features can be utilized on tablet devices to engage users and increase their abilities of retaining that information.

Finally, readers' overall recognition scores showed significant differences between the three publications in this experiment, with the subjects exposed to the Adobe DPS version faring better on the revised score than either the iBooks Author or EPUB groups. This better result could be due to several different factors. The layout freedom of the Adobe DPS platform could have affected the readers' ability to comprehend, with the neater layout better displaying the information. However, this is likely not the most important factor because the iBooks Author scores were much lower than the DPS scores, even though it also provided a high level of layout freedom. A more likely cause for the better scores by DPS readers could be that the greater interactivity of that publication increased their interest in the content they were reading, resulting in more careful, enthusiastic reading. If the higher level of interactivity in the DPS publication is what resulted in the better scores on the questionnaires, the implications could mean that, for

digital content intended for the most knowledge retention by the user, selecting a solution with a higher level of interactivity could be most suitable. This, coupled with the results from the interactive map question discussed previously, strengthen this notion of the value that the interactivity of a digital publication adds to readers' recollection of the information afterward.

Special Cases

All of the subjects who took part in this experiment were unique, and therefore had different criteria for what would have made the publication "optimal" to them. This was apparent from the comments that were left at the end of the questionnaire. Some subjects really enjoyed the images, while others preferred watching the video. There were those who would have preferred just text, and some that noticed mostly the layout and design. These preferences in "taste" and different ways of viewing the same content show an interesting array of people's personalities. However, there were some subjects who represented demographics of particular interest in regards to the unique needs in order to consume digital content.

Hearing Impaired Participants

One of the subjects was deaf. Right away it was clear that the audio elements of the publication could pose a potential problem. However, a solution was developed to this problem by rephrasing one of the questions to be more inclusive of his mode of communication. The question originally was stated as, "Did you listen to all three audio elements?" This was changed to, "Did you interact with all three audio elements?" He

clearly could not listen to the sounds. However, he could potentially press the buttons and read the labels, constituting “interacting”. Ultimately, the audio comprehension question did not need to be changed because it could be answered by reading the labels next to each audio element.

The video element proved to be the more a challenging problem, and ultimately resulted in his data being unusable. The video used in this publication had been pulled from YouTube. A work-around was to use the automatic closed captioning automatically provided by YouTube provides. This ended up not being suitable, however, because the closed captioning displayed text that was not even remotely close to the words spoken in the video. One example of this inaccurate translating was when the video stated, “A large mouflan can feed a family for several day” was translated to “allowed to move towards a reference”.

This subject’s experience participating in this experiment raised my awareness towards the special attention that needs to be paid to people with limitations. Customization of publications to meet the needs of these individual should be a focus going forward so people like this subject or others with similar special criteria can be included.

Participants 75+ Years of Age

I was fortunate to have the opportunity to go to a local retirement home and obtain a small four-person sample group. All four people were women over the age of 75, with the oldest being 95. Three of the four participants had never used a tablet device before and the one who did claimed to use it almost exclusively for playing games. All

four of the participants were able to read through the publication on their own and fared relatively well on the questionnaire at the end. It was interesting to observe the experience that these women had with the publication, as their experiences should be representative of the 75+ population as a whole.

The reader of the EPUB really liked that the text size was adjustable. In contrast, readers of the DPS and iBooks Author publications thought the text was too small and wanted to be able to zoom in or increase the text size. This raises interesting design questions for creating digital publications. While making a visually pleasing portrayal of the information on the screen is still critical, for this demographic, it is also important to consider readability. This may change which platform a designer chooses to produce the content on, depending on the demographic, with EPUBs allowing greater freedom for the reader to change the font size, or make the font sizes larger in DPS and iBooks Author.

The images, in general, were a hit amongst this group with lots of positive feedback on the value added by being able to see what was being discussed. As for the video and audio elements, two of the four older subjects were unable to use the audio buttons to access the sounds in the publication, while one was unable to interact with the video. Perhaps more clear affordances, even at the cost of esthetic appeal, need to be added for older target populations to ensure that the media elements are not being overlooked and used appropriately.

Children as Subjects

There were numerous requests from families with children of various ages interested in participating in the experiment. While this seemed like it could be

interesting to include these young participants in the study, the demographic was set for people ages 18 and up. Going forward, it would be very interesting and rewarding to expand this research to include children, or to exclusively look at children's reception of interactive digital publications. With younger audiences often times being visual learners and more "experimental" in their approach to these types of interactions, the results would likely show an even greater trend than is seen in this study towards the interactive layout resulting in higher scores (and possibly more pleasing experiences).

Limitations

A limitation of this research was the device chosen for the publication. This was limited due to financial and time limitations. The sizes and resolution of the tablets vary by device, so it was a limitation to represent by only one device. As well, operating systems other than Apple iOS, such as Android, are widely used in tablet devices on the market and were not considered in this study.

Viewing conditions were consistent throughout this research experiment, ensuring that each subject had a quiet, secluded environment in which to read the article and answer the questions. However, it was not necessarily the most accurate representation of where and when the user would most likely want to do this type of reading. Different distractions and perhaps more natural reading positions in a variety of locations could be important variables that are being overlooked by only using select locations.

The genre that was picked, while attempting to represent the most appealing type of publication to the greatest range of audience, was a limitation to this research. As discussed before, subjects' responses to how pleasing the article was often times were

influenced, intentionally or not, by the genre of the content. Had the genre been a more appealing topic to some of my subjects, the results could have been different. As well, the genre was a limitation in that it dictated what the content would be about and thus dictated what was relevant to include. Fortunately, the genre in this study (the lynx) lent itself well to images, audio, video, and added interactive features. Other genres may not serve multi-media elements as well, and therefore, the results in this study may not be applicable.

Future Research

Aside from looking at the reading experience of certain demographics like children, there are various other ways by which this research can be expanded upon. Looking at multiple different tablet devices would be an interesting way to continue this research study. Perhaps user comprehension and/or experience will be different depending on the device's size, resolution, or operating system. As new devices are continuously being released in the market, perhaps a new technology will expand the capabilities of digital publishing even further and will introduce a new dimensions that can be tested to see the impact it has on comprehension and the overall reading experience.

It would also be interesting to conduct this same test, but instead of having subjects take the questionnaire immediately after finishing reading, wait a day and then take the questionnaire. This would be interesting to see what the long-term retention of the information is and whether there would be any impact from the amount of interactivity in the publication. This style of testing, however, would most likely be

difficult to complete because of the amount of time a researcher must request from his or her subjects.

As well, it would be interesting to assess the impact that the genre/subject matter has on user interaction, information retention, overall pleasure, and media value added. This variable was controlled in this study by means of picking a topic that garnered universal interest and lent itself well to inclusion of multimedia. However, with a different subject matter, the results of this study most likely would not have been the same. A similar research study could be conducted that aims to measure various content output methods over a variety of genres and topics to determine trends in genre and interactive multimedia adoption.

Another interesting way to expand this research would be to use embedded analytics within the digital publications to observe the subjects' behavior in the background, rather than using the questionnaire method from this study. Using embedded analytics would greatly reduce the potential disparity between the subjects' responses to questions regarding their interactions with the publication and their actual interactions. As well, the ability to monitor user experience in the background without disturbing the subjects' reading environment or having a "quiz" to prepare for as a distraction would more closely replicate their natural reading environment and provide more meaningful, accurate data. Adobe DPS provides embedded analytics as part of their digital publishing packages where content creators can view data regarding their user behavior, devices they are using, and miscellaneous other information. In the publishing industry, these analytics are extremely valuable as they provide publishers a more complete picture of who their user base is and provide them with the ability to tailor their content to their

readers. A research study that monitors reader behavior via analytics embedded into the device would provide extremely valuable feedback on user behavior that would be, otherwise, impossible to get.

Finally, it would be fascinating to see the financial value added by including interactivity into a digital publication. In order to examine this, it would be interesting to see a publisher who produces digital publications already without interactivity, then recreate that content using a different platforms, and lastly see if the demand for the publication varies based on the interactivity. Along with this, it would be interesting to see a case study that examines one of these publishers who has gone from static to interactive content, and then see the impact that this has had on the workflow. Observing how new problems are being addressed by these publishers could indicate a model for others. For example, where does the inspiration for interactivity come from: the designer, the author, or the digital content producer? Observing a real life workflow to break down the keys to the decisions being made by digital publishers could provide a great amount of needed guidelines for what constitutes a successful publishing workflow.

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Appendix A: Article Content

The Lynx: Nature's Wonder



Tufts & Bobs

(Lynx Kittens are born with their eyes closed and their ears folded)

The lynx is known by the tuft of black hair on the tips of its ears and its short, or “bobbed,” tail. In fact, one species of lynx is called a bobcat! What’s the purpose of those hair tufts on the ends of the ears? Some researchers think the lynx use them like whiskers to feel things around them. All lynx also have a mane of longer hair around the face and neck. And the back legs are longer than the front legs, so the lynx looks a bit like it’s tipped forward.

Although considered part of the small cat grouping, the lynx is much larger than your average housecat-up to 84 pounds (38 kilograms). The four species of lynx are physically different from each other and have adapted to their various habitats.



Family Life

The lynx is a solitary animal, with males and females only coming together for breeding purposes. Lynx kittens are usually born in the early spring in dens that are found under fallen tree branches, large tree roots, or in rock piles. There are usually one to four kittens in a litter and Mom is a single parent. Lynx kittens are born with their eyes closed and their ears folded. If there is a lot of food for the mother, the kittens grow quickly; if food is scarce, few kittens survive. A lynx kitten will nurse for four to five months, and during the last few months of nursing it will also start eating solid food. Researchers recently discovered that one kitten may kill one of its littermates at about the same time as it is weaned from mother's milk to meat, but we don't yet know the reason for this.

Young lynx can fend for themselves at the age of 10 months, but they usually hang out with their mother for up to a year and don't reach adult size until they are 2

years old. Sometimes siblings that have just left their mother's side will travel and hunt together for several months before going their separate ways.



Hunting

Like other cats, the lynx is a stalk-and-ambushhunter. It will slowly sneak up on its prey, such as a rabbit, while the prey is busy eating, and then pounce on its victim. The cats rarely chase after potential food, especially if the snow is deep. Instead, they hide behind tree stumps or rocks until a potential meal walks by. Depending on where they live, lynx feed on pigs, beavers, rabbits and hares, rodents, or deer; some eat birds such as grouse.

What Did You Say?

(A mother lynx will often purr while nursing or cleaning her kittens)

Lynx can make a variety of sounds similar to those made by a housecat: mews, yowls, spits, and hisses. And just like our own kitties, they can also purr. A mother lynx will often purr while nursing or cleaning her kittens. Lynx usually yowl and growl most often during the breeding season. The cats also use scent marks, facial expressions, and different ear positions to help get their message across to other lynx.

The Canadian Lynx

Also known as the North American lynx, the Canadian Lynx weigh 18 to 24 pounds (8 to 11 kilograms) and are 19 to 22 inches (48 to 56 centimeters) tall at the shoulder. The Canadian lynx has extremely thick, light brown or gray fur with light black spots. Adult males are just slightly larger than the females. Some features unique to the Canadian lynx include a black tail tip and huge paws with long, thick fur to keep its toes warm in the winter. The Canadian lynx can spread its toes out wide like snowshoes to help it walk in soft snow.

Canadian lynx live in dense forests where their main prey item, the snowshoe hare, is found. Since the hares are nocturnal, so are the cats. These lynx are so dependent on the snowshoe hare for survival that when the hare population drastically drops, so does the lynx population.



The Eurasian Lynx

The Eurasian lynx has long, thick, light-colored fur that is silky in the winter, shorter, thinner, and darker-colored in the summer. This is the most numerous of the lynx species and the most widespread. Eurasian lynx are currently found in 46

countries of Europe, northern Asia, and the Middle East! A subspecies of Eurasian lynx, the Siberian lynx, is the largest of all the lynx; some males can weigh up to 84 pounds (38 kilograms)!

Large paws with fur on the soles give the Eurasian lynx traction; long legs also help when walking in deep snow. These cats are good swimmers, too, and have been seen crossing rivers. In the wild, their preferred diet is deer and other hoofed animals. Lynx living in Russia's Ural Mountains follow the winter migration routes of roe deer, reindeer, and moose.



The Spanish Lynx

This smaller lynx has the most spots on its coat and its hair doesn't grow in as long or as thick as with the other lynx species. Found only in Spain and Portugal, Spanish lynx *Lynx pardinus*, or Iberian lynx, live in an area where millions of migrating birds gather together each spring and fall. So, although rabbits are the mainstay of their diet, the cats also hunt ducks and other low-flying birds.

The Spanish lynx population currently numbers less than 300 individuals in their native land. Sadly, this makes them one of the rarest of all cat species and probably the most endangered carnivore in Europe. What caused the cat's decline? The loss of its main

food source, rabbits. In the 1950s a doctor released a disease called myxomatosis to control the rabbit population in his garden. It worked too well, and the rabbit population was almost wiped out.

Ironically, conservationists are now breeding rabbits, vaccinating them against the disease, and releasing them into the wild to replenish the wild rabbit populations and help feed the lynx.



Also a Lynx: The Bobcat

Bobcats *Lynx rufus* are known by lots of names: wildcat, bay lynx, and lynx cat. Some people call them the spitfires of the Animal Kingdom because they seem fearless and won't back down from a fight! Found throughout North America, they are our continent's most common native cat. Bobcats look very similar to the Canadian lynx. But bobcats have smaller feet and don't have the furry soles of the other lynx, so they are not as well equipped to live in areas of heavy snow. Bobcats are able to survive in a variety of habitats, as long as there are places where they can hide. They often live in rocky areas that give them shelter from extreme cold or heat. Bobcats often compete with coyotes for the same food and shelter. They are good climbers and can escape up a tree if needed, but they'd rather spend their time on the ground. Bobcats will swim if they need to, but it's

not their first choice!



Struggling For Survival

The world is not a safe place for the lynx right now. As people move into the cats' habitats, the cats have a harder time finding food. And in some areas, their forest homes are being cut down for agricultural uses. Hunting is still a problem for these beautiful animals, too. The soft, luxurious coat that keeps the lynx warm and comfortable in the colder months is also popular in the fur industry, especially the lighter-colored belly fur. It is estimated that about 90,000 bobcat and lynx pelts are sold each year to the world's fur markets.



Appendix B: Article Outputs for DPS, iBooks Author, and EPUB

Adobe DPS

iPAD NAVIGATION INTRODUCTION
This article has many media elements that you can interact with! Just press or swipe any images with the following indicators to enhance your reading experience:

SAMPLE VIDEO



SAMPLE SLIDESHOW



NAVIGATION LEGEND



TAP: This symbol indicates that the media element can be interacted with by just tapping it on it.

VERTICAL SWIPE: This symbol calls for a vertical swipe. For this article, this is only needed to swipe between the pages.



HORIZONTAL SWIPE: This symbol indicates that the media element can be interacted with by swipping on it horizontally.



SAMPLE AUDIO



Tufts & Bobs

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“Lynx kittens are born with their eyes closed and their ears folded”



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LYNX ROAR



LYNX CALL



LYNX HISS



“A mother lynx will often purr while nursing or cleaning her kittens.”

The Canadian Lynx

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Canadian Lynx weigh 18-24 pounds

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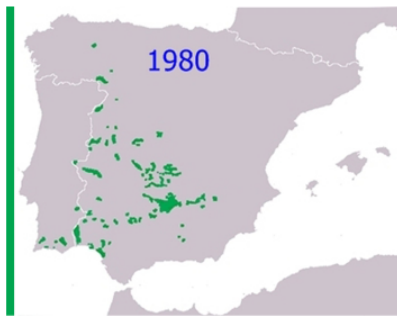
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Struggling For Survival

The world is not a safe place for the lynx right now. As people move into the cats' habitats, the cats have a harder time finding food. And in some areas, their forest homes are being cut down for agricultural uses. Hunting is still a problem for these beautiful animals, too. The soft, luxurious coat that keeps the lynx warm and comfortable in the colder months is also popular in the fur industry, especially the lighter-colored belly fur. It is estimated that about 90,000 bobcat and lynx pelts are sold each year to the world's fur markets.

Interactive Map To View Change In Spanish Lynx Range Over 23 Years



END

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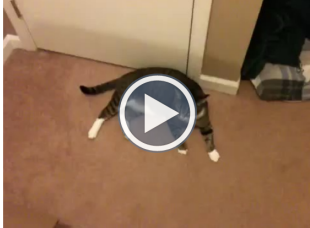
iBooks Author

iPad 10:37 AM 98%


IPAD NAVIGATION GUIDE

This article has many media elements that you can interact with! Just press or swipe any images with the following indicators to enhance your reading experience!


Sample Video: Cat Sliding Down Stairs




Sample Audio: Cat Meow

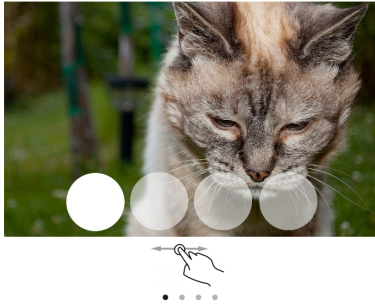


Navigation Legend


 **HORIZONTAL SWIPE:** This symbol indicates that the media element above can be interacted with by swiping on it horizontally

 **TAP:** This symbol indicates that the media element above can be interacted with by tapping on it.

Sample Slideshow: Funny Cats



Horizontal Swipe this page to begin article



Tufts & Bobs

The lynx is known by the tuft of black hair on the tips of its ears and its short, or "bobbed," tail. In fact, one species of lynx is called a bobcat! What's the purpose of those hair tufts on the ends of the ears? Some researchers think the lynx use them like whiskers to feel things around them. All lynx also have a mane of longer hair around the face and neck. And the back legs are longer than the front legs, so the lynx looks a bit like it's tipped forward.

Although considered part of the small cat grouping, the lynx is much larger than your average house cat- up to 84 pounds (38 kilograms). The four species of lynx are physically different from each other and have adapted to their various habitats.

Family Life

The lynx is a solitary animal, with males and females only coming together for breeding purposes. Lynx kittens are usually born in the early spring in dens that are found under fallen tree branches, large tree roots, or in rock piles. There are usually one to four kittens in a litter and Mom is a single parent. Lynx kittens are born with their eyes closed and their ears folded. If there is a lot of food for the mother, the kittens grow quickly; if food is scarce, few kittens survive. A lynx kitten will nurse for four to five months, and during the last few months of nursing it will also start eating

solid food. Researchers recently discovered that one kitten may kill one of its littermates at about the same time as it is weaned from mother's milk to meat, but we don't yet know the reason for this.

Young lynx can fend for themselves at the age of 10 months, but they usually hang out with their mother for up to a year and don't reach adult size until they are 2 years old. Sometimes siblings that have just left their mother's side will travel and hunt together for several months before going their separate ways.

"Lynx kittens are born with their eyes closed and their ears folded."



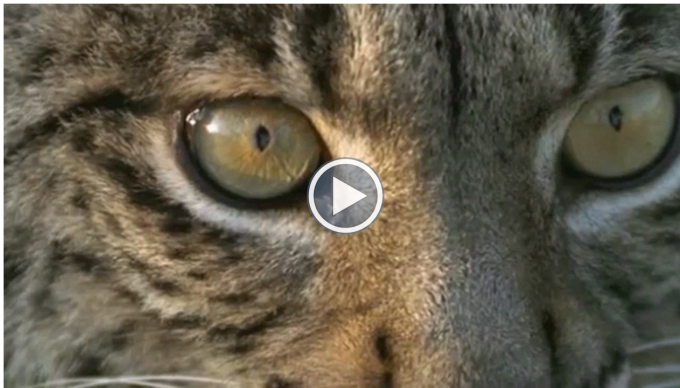
Hunting

Like other cats, the lynx is a stalk-and-ambush hunter. It will slowly sneak up on its prey, such as a rabbit, while the prey is busy eating, and then pounce on its victim. The cats rarely chase after potential food, especially if the snow is deep. Instead, they hide behind tree stumps or rocks until a potential meal walks by. Depending on where they live, lynx feed on pigs, beavers, rabbits and hares, rodents, or deer; some eat birds such as grouse.

What Did You Say?

Lynx can make a variety of sounds similar to those made by a house cat: meows, yowls, spits, and hisses. And just like our own kitties, they can also purr. A mother lynx will often purr while nursing or cleaning her kittens. Lynx usually yowl and growl most often during the breeding season. The cats also use scent marks, facial expressions, and different ear positions to help get their message across to other lynx.

Video: Selected Clip From National Geographic's "Spain's Last Lynx"



Audio 1: Lynx Call



Audio 2: Lynx Hiss



Audio 3: Lynx Roar



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Large paws with fur on the soles give the Eurasian lynx traction; long legs also help when walking in deep snow. These cats are good swimmers, too, and have been seen crossing rivers. In the wild, their preferred diet is deer and other hoofed animals. Lynx living in Russia's Ural Mountains follow the winter migration routes of roe deer, reindeer, and moose.



5

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This smaller lynx has the most spots on its coat and its hair doesn't grow in as long or as thick as with the other lynx species. Found only in Spain and Portugal, Spanish lynx, or Iberian lynx, live in an area where millions of migrating birds gather together each spring and fall. So, although rabbits are the mainstay of their diet, the cats also hunt ducks and other low-flying birds.

The Spanish lynx population currently numbers less than 300 individuals in their native land. Sadly, this makes them one of the rarest of all cat species and probably the most endangered carnivore in Europe. What caused the cat's decline? The loss of its main food source, rabbits. In the 1950s a doctor released a disease called myxomatosis to control the rabbit population in his garden. It worked too well, and the rabbit population was almost wiped out.

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Bobcats are known by lots of names: wildcat, bay lynx, and lynx cat. Some people call them the spitfires of the Animal Kingdom because they seem fearless and won't back down from a fight! Found throughout North America, they are our continent's most common native cat. Bobcats look very similar to the Canadian lynx. But bobcats have smaller feet and don't have the furry soles of the other lynx, so they are not

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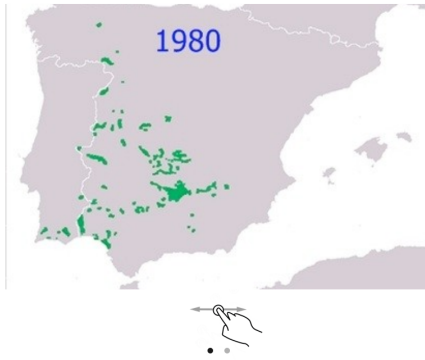


6

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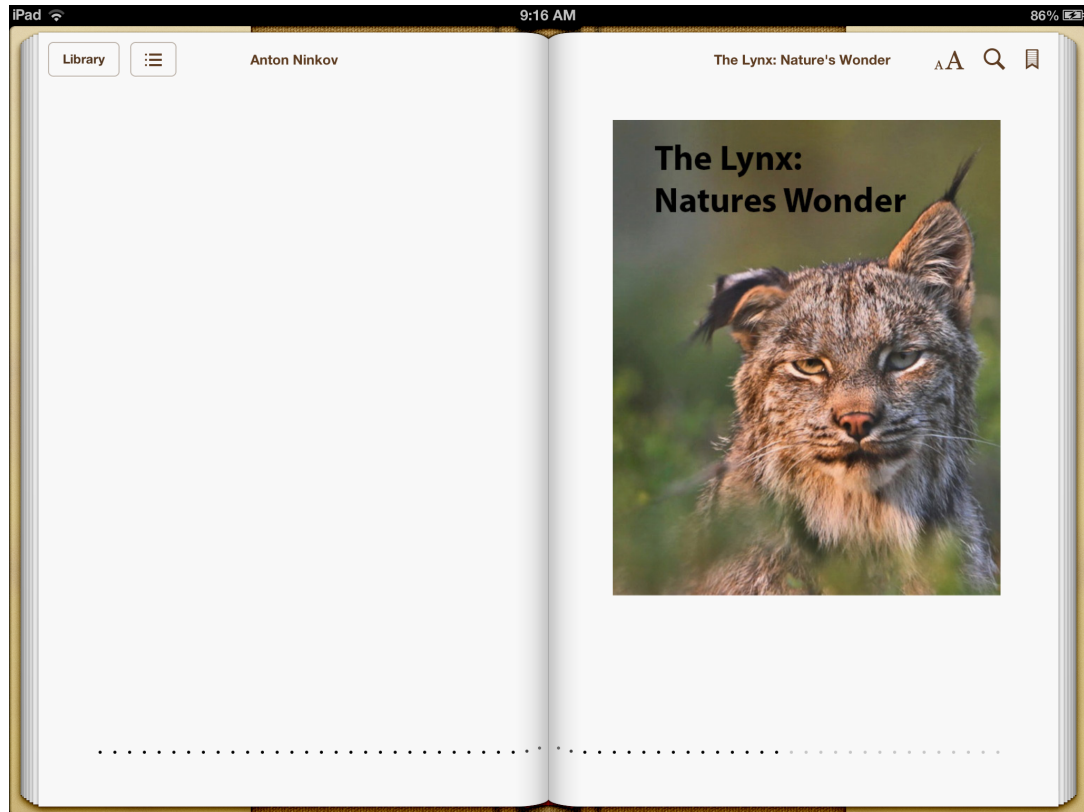
Spanish Lynx Range Comparison 1980 vs. 2003



END



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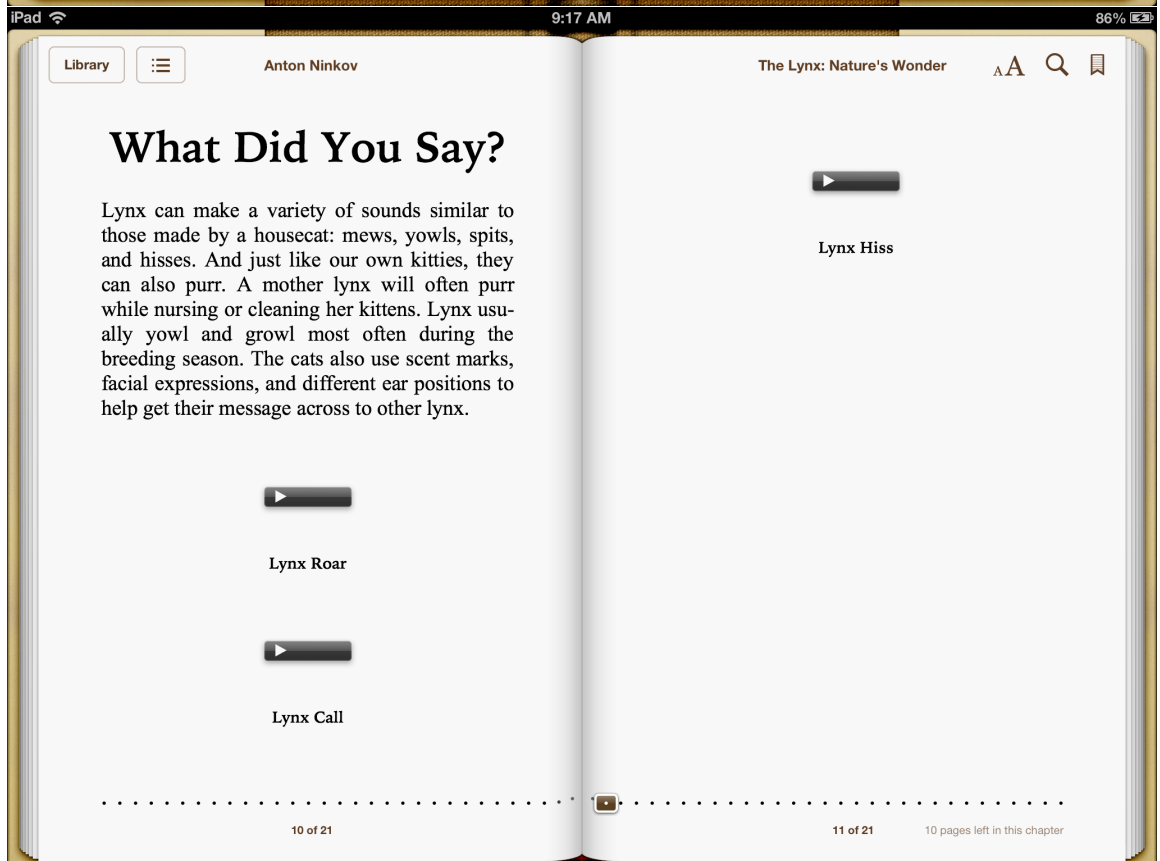
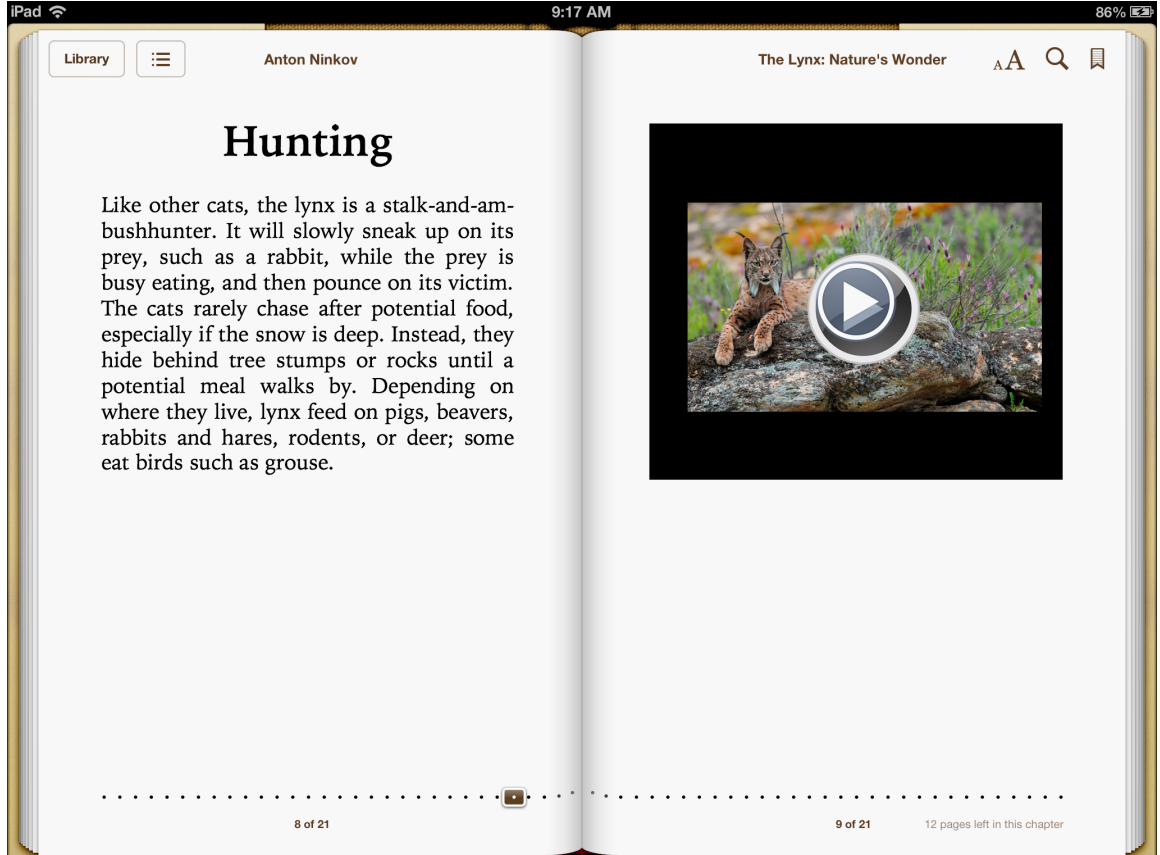
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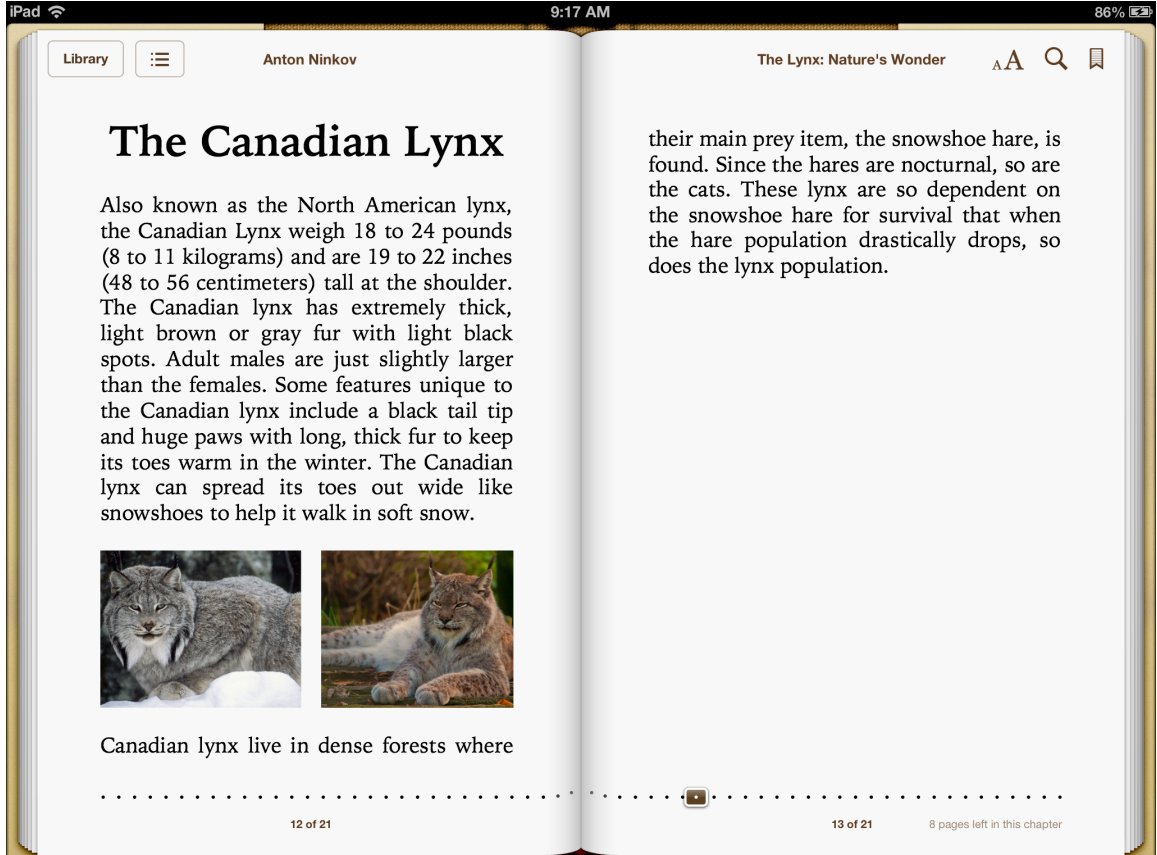
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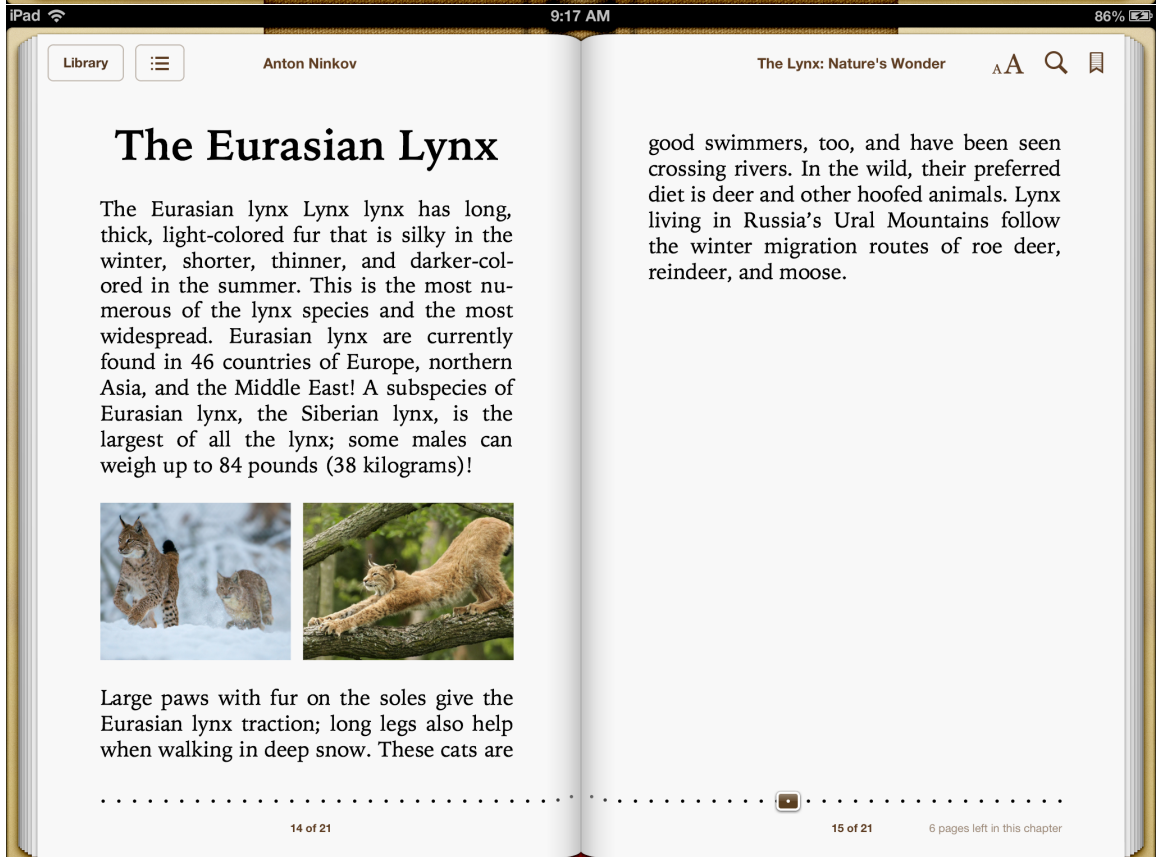


Canadian lynx live in dense forests where

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8 pages left in this chapter



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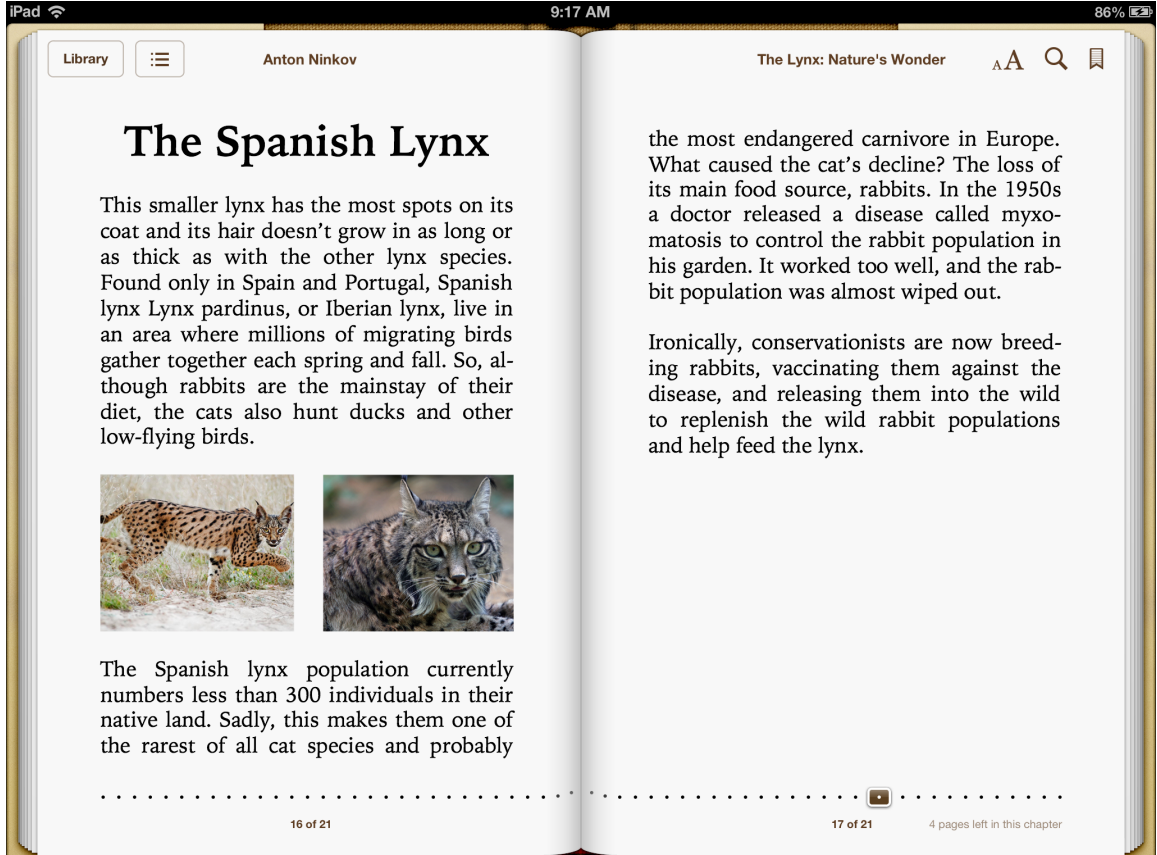


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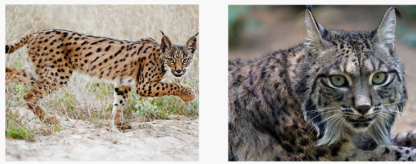
15 of 21

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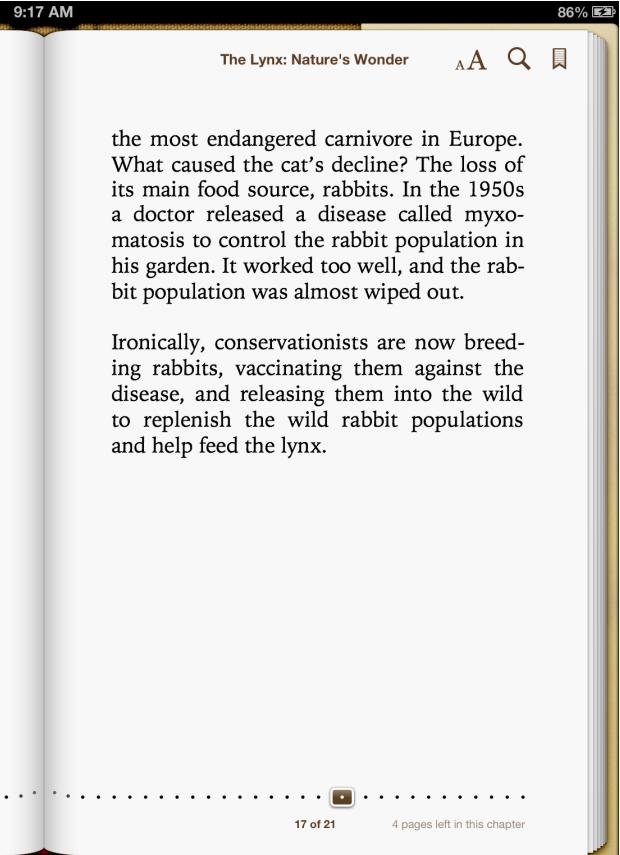
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16 of 21

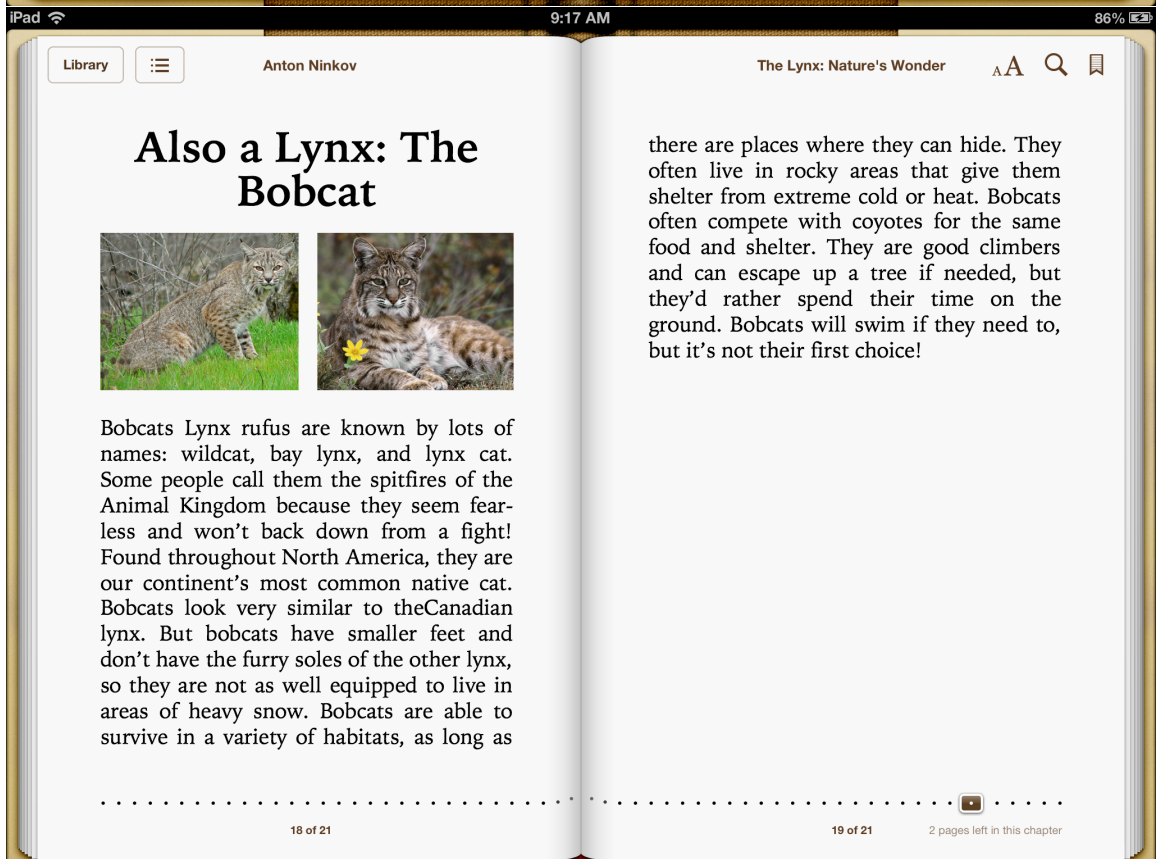


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4 pages left in this chapter



Also a Lynx: The Bobcat



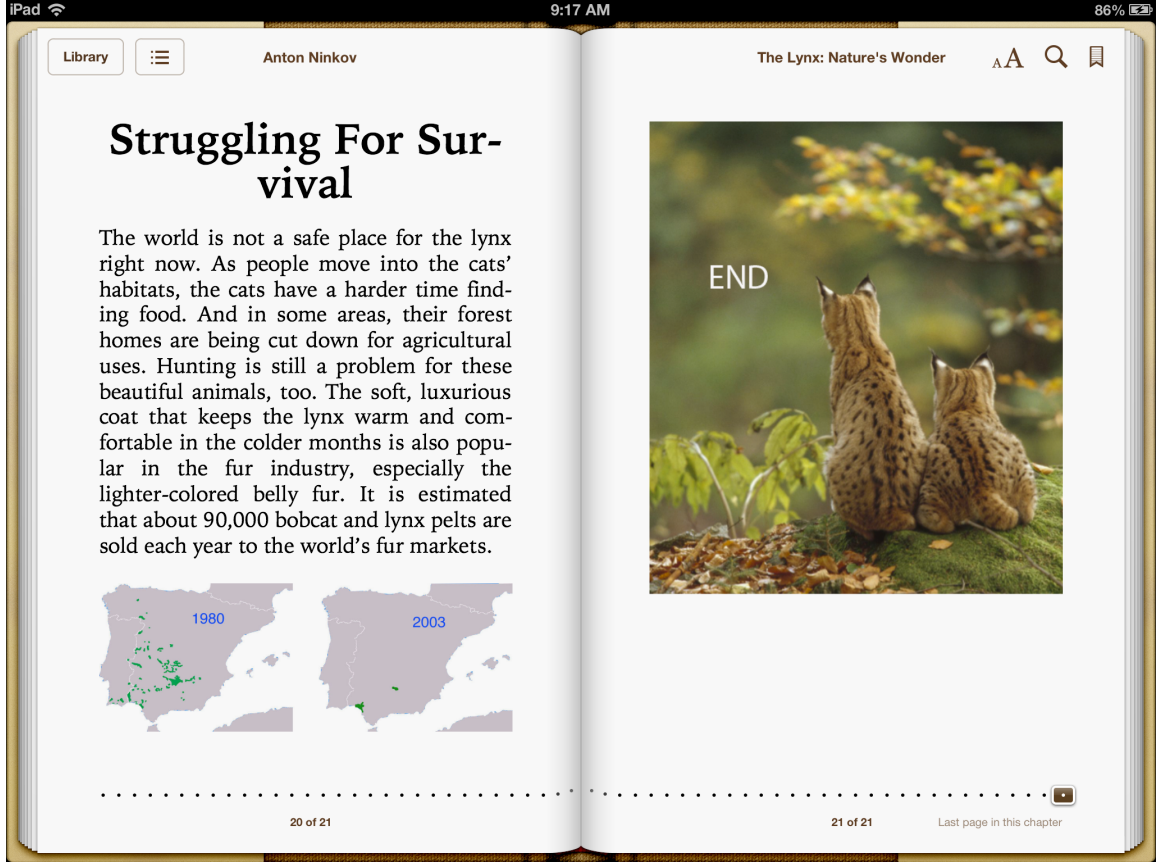
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2 pages left in this chapter



Appendix C: Pre-Experiment Researcher Monologue

Introducing Subjects to Experiment

In this experiment, I have taken a set of content and recreated it on the computer using three different in order to produce a publication for the iPad. You will receive one of these publications and be asked to read through it casually, as you would a magazine like National Geographic, Sports Illustrated, People, or whatever magazine you typically read. Afterwards, there will be a short questionnaire asking about your experiences with the publication and some questions looking at your recognition and comprehension of the various media elements in the article. The first page of this publication is an introduction guide describing how you can interact with the various media found in this publication. Feel free to use this for practice, but the content that the questionnaire will be covering begins on page 2 and continues until the end. Do you have any questions for me?




Explaining Questionnaire Section of Experiment.

The next step of this experiment is a 15-question questionnaire. I ask that you use the information you have just read to answer the questions. Some questions look at your recognition and comprehension of information provided in the article as well as ranking your attitude towards certain aspects of the article. For the attitude-based questions, it is important to be completely honest, as I am not looking for any particular responses except honest responses.

Appendix D: Post-Experiment Questionnaire

Please answer the following questions based on the information provided and your experience with the publication you just completed reading.

1) Which of the following images were displayed in this article?

Media Element	Displayed?
	<p>YES <input type="checkbox"/></p> <p>NO <input type="checkbox"/></p>
	<p>YES <input type="checkbox"/></p> <p>NO <input type="checkbox"/></p>
	<p>YES <input type="checkbox"/></p> <p>NO <input type="checkbox"/></p>



YES

NO



YES

NO



YES

NO

2) *Did you watch the sample video in this publication?*

YES

NO

3) *If yes, for how long could the catch (the prey) feed the lynx's family?*

A) One feeding

B) Several days

C) One week

D) Two weeks

4) *Did you listen to all the audio samples in this publication?*

YES

NO

5) *If yes, which of the following lynx sounds was **NOT** available to listen to in this publication?*

A) Roar

B) Call

C) Hiss

D) Purr

6) *What is the maximum weight a Lynx can reach?*

A) 12 lbs.

B) 24 lbs.

C) 84 lbs.

D) 112 lbs.

7) Which species of Lynx is displayed in the following image?

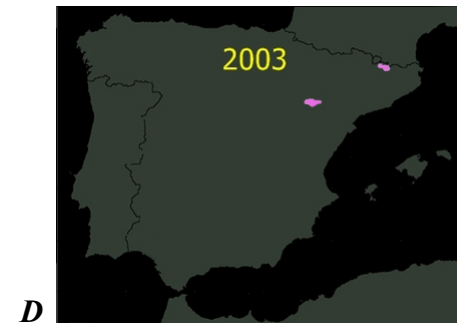
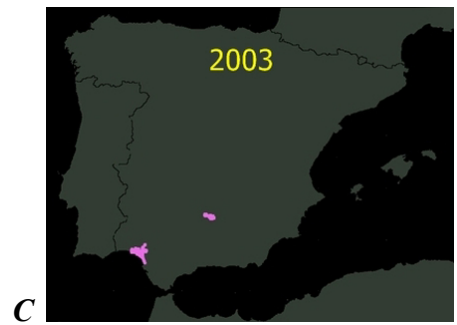


- A) Spanish Lynx
- B) Bobcat
- C) Canadian Lynx
- D) Eurasian Lynx

8) What is the most accurate description of how the Lynx hunt?

- A) In packs to overwhelm pray.
- B) Chasing its pray until it is tired out.
- C) Sneaking up on pray and attacking when they don't expect it.
- D) The Lynx do not hunt, they are herbivores (only eat plants).

9) Which of the following images accurately displays the range of the Spanish Lynx in 2003?



Answer: _____

15) Please provide any comments on this experiment, or any additional information about your experience interacting with this publication.
Thank you for your participation.