Exploring Sensed Aesthetics in Digitized Print Collections through Visualization

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Declaration

I, Malak Sadek, hereby certify that this dissertation, which is 14,998 words in length, has been composed by me, that it is the record of work carried out by me and that it has not been submitted in any previous application for a higher degree. Credit is explicitly given to others by citation or acknowledgement.

This project was conducted by me at The University of St Andrews from June 2020 to August 2020 towards fulfilment of the requirements of the University of St Andrews for the degree of MSc under the supervision of Dr Uta Hinrichs and Dr Loraine Clarke.

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There were no extensive ethical considerations for the project besides conducting a short user study in the form of a virtual demonstration followed by a questionnaire to evaluate the final product. The signed artifact evaluation form is included as an appendix (Appendix A). Royalty fees for any resources or materials used in the design have been fully paid for.

Malak Sadek (14/08/20)
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It takes a village.
Abstract

Libraries and bookstores have been struggling to provide potential readers with rich, meaningful online experiences. While many factors contribute to this lacking experience, the most prominent issues are the emphasis on literary works’ content as opposed to their physical properties, and the frustration caused by traditional nested, keyword-based search mechanisms. Accordingly, this project aims to tackle these shortcomings by focusing on a unique collection of hand-made, idiosyncratic Science Fiction anthologies. A prototype is proposed to facilitate both open-ended explorations and targeted searching while emphasizing the physical appearance and material properties of the anthologies in every component. The prototype includes two separate but supplementary visualizations, each focusing on different visual elements of the anthologies, and a collection of interactive filters that simultaneously provide unique overviews of the collection. Finally, a search bar was designed to allow for direct yet open-ended searches, facilitating the formulation of search queries while preventing frustration due to empty result lists. Participants that explored the prototype found it aesthetically pleasing. They also felt that it offered a more immersive experience that allowed them to more freely explore the collection from a multi-faceted perspective as compared to generic, grid- and list-based library interfaces. They especially appreciated the novelty and comprehensiveness of the filters but felt that more explicit instructions were needed regarding how to use them, in order to prevent confusion. The effect of incorporating sound was somewhat disruptive, but the reasons as to why this is the case require further investigation. Overall, these promising findings encourage a more extensive exploration of the benefits provided by emphasizing the material, physical and aesthetic properties of literary works as opposed to just focusing on their content, which is currently commonly the case with library and bookstore interfaces.

Various versions of the prototype, as well as a walk-through video and the project’s poster can be accessed using the following link: [http://malaksadekapps.com/Hub.html](http://malaksadekapps.com/Hub.html)
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1 Introduction

The atmosphere of the place soothed her automatically; the rich lantern lights, the sheer scent of paper and leather, and the fact that everywhere she looked, there were books, books, beautiful books.

from The Invisible Library by Genevieve Cogman

Libraries have always been a haven for bibliophiles. Countless visitors find serenity in the calm, soothing atmosphere found in libraries and the company of shelves upon shelves of books. In more recent times, the “Net generation” [1, p. 2] who have learnt how to read after the Internet became mainstream, have fostered very different reading habits as people adapt to the ever-quickening pace of their digitally-dominated lives [2]. Digital media has become an inescapable part of life, shaping how people interact with, exist within, and even think about the world [3, 4]. While everything seems to be ‘going digital’, libraries and bookstores are struggling when it comes to creating online experiences that are enriching and fulfilling. In fact, numerous studies have found those digital experiences to be unsatisfactory and lacking [5–9].

Consider a common scenario; one encounters a unique collection of reading material online, whether intentionally or by chance, and becomes curious of the collection (as illustrated in the first frame of Fig. 1). They then face one of two interface alternatives:

1. A vague search bar (Fig. 1 frame 2) which Whitelaw (2015) eloquently metaphorizes as a ‘security guard’ blocking the entrance to the collection and asking the person interested in knowing more “Yes, what?” [10, p. 1]. The traditional search bar is, therefore, a tremendous road-block if one has not encountered the collection before and therefore does not know what to search for, or if one does not want to search for something specific, but would like to engage in a more open-ended exploration [5]. While being efficient for purposeful look-ups [2, 9, 11, 13], traditional search bars were found to hinder open-ended exploration and ‘information encountering’ [9] in numerous studies [2, 8, 10, 13, 16].

2. A generic visualization (Fig. 1 frame 3) that provides an overview of the collection. While insightful, these clean, precise visualizations often lose touch with the unique ‘spirit’ of literary and cultural collections that often have a strong visual personality or include distinct items. While focusing on quantitative aspects of the collection and its content, generic visualizations often fail to take into account the physical, material and aesthetic properties of such collections [4, 17, 18].
1 INTRODUCTION

1.1 Problem Statement

Traditional search interfaces are hindering, even frustrating to people who simply want to browse or explore a literary or cultural collection with no informational need or specific end-goal other than opportunistic browsing. They also hinder people who are looking for something specific but are unable to articulate their information needs or are unfamiliar with the content or structure of the corpus [5]. One-size-fits-all visualizations are one way to address this, but disregard much of what makes book collections special. While organizations typically want to be as cost-effective as possible by creating a scalable, generic system that can display almost any piece of work [19], this comes with a cost. The true cost of this efficiency is the deafening of collections’ unique personality and appearance, and ultimately the decreased interest in and engagement with them [7, 10, 17, 18, 20, 21]. As the field of Digital Humanities continues to develop and wield increasing importance, much theoretical and practical work has been done across several disciplines to address these issues [2, 5, 7, 22]. Nevertheless, there has been almost no widespread, commercial adoption of the prototypes or theories established.

Figure 1: Scenario sketch illustrating the limited options offered by traditional browsing interfaces for literary collections.
1.2 Objectives

Consequently, this project aims to explore how information visualization can create what is known as a ‘living classification’ [23], which is one that is imbued with the soul of the collection. The resulting interface should present people with a stimulating and engaging overview of a one-of-a-kind digitized print collection that does the items’ physical appearance and material properties justice. Accordingly, the objectives of the project are specified as follows:

Primary

- Review existing similar works and research various techniques for digitally conveying physical properties.
- Come up with a number of sketches and low-fidelity prototypes that explore how to convey the appropriate aesthetics and reflect the uniqueness of the collection.
- Implement or prototype the selected visualization concepts that come out of the design process described above.

Secondary

- Evaluate the visualization with an online user study.

Tertiary

- Incorporate other modalities (e.g. sound or animation) to increase the richness and immersive power of the visualization.

1.3 Contributions

The resulting prototype (Fig. 2) incorporates two visualizations that aim to facilitate serendipitous discoveries and encourage people to engage in open-ended exploration. The visualizations showcase the collection’s unique physical features and overall aesthetic in order to put people in an ‘aesthetic attitude’ [13, 19, 24] to maximize their emotive receptiveness to the experience. Using two alternative visualizations also presents multiple views of the corpus to support visitors with different preferences and objectives, rewarding both short-term and longer exploration sessions [7]. A novel search bar and interactive filters also offer multiple entry points into the collection based on items’ different material properties, and also to provide visual overviews of the collections’ various physical qualities. The power of the concept lies in using standard elements, such as the search bar, and injecting them with the material properties of the collection, creating an interface that is unique to the given collection, yet possibly extensible to other ones. Finally, sound was explored as a medium for conveying information, as well as to provide a more immersive, multi-modal experience.
1 INTRODUCTION

1.4 Dissertation Structure

Chapter 1 introduces the project’s topic and scope, outlining the initial objectives and eventual outcomes.

Chapter 2 contextualizes the project based on various frameworks that should be taken into account when visualizing digitized print collections while preserving their aesthetics.

Chapter 3 provides a brief review of existing similar projects.

Chapter 4 introduces the literary collection being visualized as part of this MSc project. This collection can be considered a case study used to explore how material, physical, and aesthetic properties of literary and cultural collections can be represented as part of unique, visualization-based interfaces.

Chapter 5 provides a review of the tools used and the process employed throughout this MSc project.

Chapter 6 introduces and analyzes the various prototype design alternatives that were created and explored as part of this project.

Chapter 7 introduces the final visualization prototype and describes its features.

Chapter 8 discusses the findings of a study conducted to evaluate the final visualization prototype.

Finally, Chapter 9 concludes this MSc dissertation.

Figure 2: An example of using one of the filters (cover color) on one of the visualizations (pile layout).
2 Literature Review

The frame, the definition, is a type of context. And context, as we said before, determines the meaning of things. There is no such thing as the view from nowhere, or from everywhere for that matter. You can’t understand the view without the point of view.

Noam Shpancer, The Good Psychologist

The following chapter introduces two problematic aspects of existing browsing interfaces:

1. The use of generic layouts and visuals that do not incorporate items' physical properties and so dim collections' visual aesthetics, weakening the browsing experience.

2. The use of black-box search mechanisms that are at odds with how people physically search through print collections

The complexity of these two issues is discussed, and possible implications and solutions are explored.

2.1 Going Digital

The process of digitizing print materials has opened up unimaginable possibilities. It has greatly improved accessibility to a vast amount of global items, helping make information distribution fairer. For print collections especially, digitization also allows individual items to simultaneously exist within multiple groups and categories, as opposed to a single physical copy residing in only one location [5]. This multiplicity allows for faceted searching where an individual item can co-exist within different search results, making it easier to understand relationships between items, look for related materials, and get a better sense of the broader context of a collection [8, 25]. It also facilitates the exploration and analysis of massively large-scale collections in ways humans would never have been able to achieve manually, leading to an abundance of cultural and historical discoveries [17, 26, 27].

2.1.1 Digitizing Print Collections

Despite its numerous advantages, much is lost due to digitization’s focus on preserving literary works’ content, with little emphasis, if any, on the physical and material properties of the works [17, 19, 27-31]. The physical appearance and material properties of literary items shape how people interpret them [19, 32] and interact with them [4]. This appreciation of their aesthetics goes well beyond simply deciding whether such items are attractive or not [19], and the rise of commercial products such as book-scented candles speaks to the pleasure derived from the “multi-sensory experience” [28] of reading. During digitization, the physical aesthetics of books and other media are often disregarded as “window-dressing” [17, p. 14] or “an after-thought” [35, p. 5] even though these aesthetics are considered art in the items’ physical counterparts [3, 19, 28, 36-40]. To summarize, “the more unusual the print object, the more its total form matters” [41, p. 307] and so the greater the loss incurred by ignoring that form during digitization [17].

https://www.frostbeardstudio.com/products/old-books
2.1.2 Digital Aesthetics

It becomes clear that the aesthetics of literary works are important, but what exactly is meant by aesthetics? The term aesthetics is generally concerned with the experiences that arise during people’s interaction with physical objects and are derived from sensual engagement as opposed to logical or analytical thinking. An ‘aesthetic’ piece is one with purposeful, open-ended ambiguity, allowing the viewer to assign their own meanings and interpretations. Viktor Shlovsky, an art critic, coined the term ‘defamiliarization’ in 1998, referring to the fact that any creation should not be familiar and comfortable. Instead, it should be evocative and unusual in order to capture viewers’ attention for as long as possible, since this allows the imagination to run free. An antecedent to this view is Kant (1987) who held similar views and regarded objects that allowed this prolonged perception and free play as ‘aesthetic objects’. Nevertheless, with aesthetics typically arising from a human interacting with a physical object through its material properties, how is this then communicated digitally through a screen?

An apt starting point is to ask the question: “When we say, in response to a still or moving picture, that it has a digital ‘look’ about it, what exactly do we mean?” It is because of aesthetics that our senses allow us to immediately categorize creations before we even consciously begin to think about them. Here, a distinction must be made between digitized works of art and digital works of art. The former refers to objects that were physically created using an analogue medium and then converted into a digital form – i.e. digital technology is a tool in the process, while the latter refers to work that has been created from the offset partially or entirely digitally – i.e. digital technology is a medium of creation. This distinction helps separate the term ‘digital’ as referring to a tool, a medium, or a sensory quality and aesthetic. An object that was created using analogue techniques (e.g. a painting) can possess a digital quality to it (examples of this exist especially in modern and abstract art). In contrast, an object created digitally can look as if it was hand-made. In short, the medium and tools used to create an item can have little to do with how it is perceived to have been created (see Fig. 3).

![Illustration](https://www.picuki.com/media/2331870403008204856)

![Illustration](https://www.digitalartsonline.co.uk/features/illustration/42-tips-for-how-make-digital-artworks-that-look-hand-made/#5)

Figure 3: The tools of creation and the conveyed aesthetics of works are independent.
The multiplicity of roles that the term ‘digital’ plays complicates matters as digitization allows analogue objects to have digital counterparts. The ineffective amalgamation of digitally aesthetic elements (such as grid- and list-based layouts) and objects that have an analogue aesthetic (i.e. images of the books themselves) creates a confusing hybrid experience that does not garner the benefits of either end of the spectrum. For many people the word ‘digital’ is synonymous to ‘clean’, ‘lightweight’, ‘seamless’, and ‘minimalistic’ [19,29,49], while they attribute physical books, anthologies, comic books, and other print materials with density, or even messiness [29]. It is, therefore, challenging to combine the two effectively. To tackle this challenge, digitization should focus on providing a unique experience instead of simply attempting to copy or replicate physical experiences [3,4,6,17,21,28,50]. One useful approach is to provide a multi-modal experience through technologies such as haptic interfaces [51,52] or virtual reality [50]. Sound is also particularly useful for encoding data [53–55] and for evoking the atmosphere of the environment that items were created in [7]. It also tends to increase immersion as people rely more on their intuition and previous real-world experiences when dealing with audio [52].

2.2 The Dreaded Search Bar

Not only do libraries’ and bookstores’ digital interfaces represent items in a restrictive way, but they also hinder search and exploration processes. While facilitating targeted searches for those who know exactly what they are looking for and how to articulate it properly in a way appropriate to the organization of the collection, traditional search bars leave everyone else lost [2, 8–10, 13, 14, 16]. There has been previous work done on augmenting traditional search interfaces with overview visualizations [56, 57]. However, when it comes to exploring cultural collections, especially unique or non-traditional ones where one does not necessarily know what to expect, a measly search bar hides the full potential and variety of a collection behind an ungenerous rectangle with a flickering cursor [10].

2.2.1 Is It Even Called Searching?

There are various activities that constitute searching. Munzner (2015) breaks down searching into ‘looking up’, ‘locating’, ‘browsing’, and ‘exploring’ based on whether the target and/or location of the item in question is known [11]. Complementary to Munzner’s model, White et al. (2006) divide searching into ‘looking up’, ‘learning’, and ‘investigating’ [16]. Look-ups return specific items while learning and investigating are synonymous to browsing and open-ended exploration simply for the derived pleasure [10]. Historically, targeted searching and open-ended browsing were considered as two separate and independent activities [12,58]. Recently, however, there has been a shift towards integrating the two, with search engines adding in browsing capabilities as opposed to simply supporting fast retrieval and query-answering [2], and browsing-oriented, exploratory interfaces bringing in search and filtering facilities for targeted searching [59].

Regarding literary collections, in 2005, Moretti introduced the concept of ‘distant reading’ [60]. The idea was to quantitatively analyze collections of text by converting them into numbers, statistics, and graphs to essentially visualize the aggregations instead of carefully analyzing each item separately (which he calls ‘close reading’) [18,31,60]. Similarly, Jockers (2013) defines ‘microanalysis’ and ‘macroanalysis’, which are synonymous to Moretti’s close and distant reading [61]. Based on this distinction, interfaces and visualizations concerned with literary works typically either focus on close reading or distant reading or provide a combination of both [12,20,31] (often found to be the best approach in terms of comprehensiveness [8,17,18]). Most visualizations that accommodate both
kinds of reading follow a ‘top-down’ approach where they start with a general overview and then allow zooming into a detailed view of the source texts. Conversely, a ‘bottom-up’ approach from source text to overview is rarely used [31]. Additionally, side-by-side views of both modes have also been created [7,62].

2.2.2 Enhancing the Search Experience

It becomes clear that between searching, browsing, and open-ended exploration, as well as close and distant reading, a single search bar or overly-technical content-based filter is insufficient at supporting how people physically search for literary works. As a result, different techniques have been developed to enhance the experience, such as Rich-Prospect Browsing introduced by Ruecker et al. (2011) [63], Information Encountering developed by Erdekeze (1999) [9], Exploratory Searching developed by White et al. (2006) [16], and Generous Interfaces developed by Whitelaw (2015) [10]. All complementary to each other, they aim to highlight the diversity of cultural collections, allowing viewers to get an ‘at a glance’ overview of the items and the relationships between them [2,10,16,63,64]. These interfaces are especially suitable for non-expert users who, studies show, prefer browsing features [65] which, in turn, promote open-ended exploration and serendipitous discoveries [2,5,10,16].

In the techniques mentioned above, there is an emphasis on the importance of (1) stability and coherence to give viewers a sense of context and continuity [2,13,66], (2) providing both an overview and more detailed views [10,67], and (3) providing appropriate navigation tools [2,9,10]. As previously mentioned, it is also a heavily supported notion that most people employ more than one search technique when exploring collections of literary works, which is why it is crucial to support as many search and exploration strategies as possible [5,8,13,16]. On a deeper level, two underlying concepts form the basis of the different techniques mentioned: Overview, Filter & Zoom, Details on Demand, and Supporting Serendipitous Discoveries.

Overview, Filter & Zoom, Details on Demand

Shneiderman’s Information-Seeking Mantra [67] has permanently altered the way people interact with interfaces. The idea is to begin with an overview of the data, then provide more detailed views and filtering capabilities, and, finally, give people the option to view even more details if they want to. Particularly pertinent to information visualizations, the technique has revolutionized the design of visualizations while emphasizing the importance of fluidly alternating between large-scale to specific and detailed views [3,20]. A complementary approach is presented by Dörk et al. (2011) who introduced the notion of the ‘information flaneur’ as an “information-seeking model” [22, p.1]. They make the distinction between ‘horizontal exploration’ (which is essentially a high-level overview) and ‘vertical immersion’ (which represents diving into detailed explorations on individual items). Much of Dörk et al.’s work with the Urban Complexity Lab in Potsdam, Germany explores this concept from a design perspective (see Chapter 3 for a more detailed discussion).

There has also been a strong emphasis on interactivity within the realm of information visualization. Shneiderman particularly emphasizes its importance [67], while other research asserts that it can help a wide variety of audience engage and play with the data [2,10,12,16,21,68,70]. Interactivity is especially beneficial when searching or filtering a collection of items and can help people to comprehend the filtering process and its effects more profoundly, and, therefore, allow them to have more fruitful explorations [71,73].

Supporting Serendipitous Discoveries

Serendipity can be defined as “making happy and unexpected discoveries by accident” [5, p. 5]. The core of facilitating serendipitous discoveries lies in exposing people to items or perspectives that they would not have usually seen or experienced within their typical bubbles of interest [5, 8, 12]. Research has shown that there are specific visualization characteristics and techniques that can help anyone make these discoveries. Using visually appealing and unusual elements, making it easy to highlight trends and relationships, and using visual metaphors can all encourage any type of person to engage deeply with the data, increasing the chances of making serendipitous discoveries [5, 7, 13]. By widening people’s horizons, giving them the flexibility to decide what to see and how to see it, and not limiting them to pre-curated collections, serendipitous discoveries can take place.

This chapter discusses the importance of not only focusing on items’ content during digitization but also focusing on the collections’ physical properties and analogue aesthetics and how those can be represented digitally. Afterwards, the shortcomings of traditional search mechanisms were explained, especially with regards to print collections, which lend themselves to different modes of reading, with possible remedies also outlined. This chapter has served to contextualize this MSc project in terms of existing limitations and potential solutions. Based on the findings of this review, the final prototype will focus on two aspects. Firstly, emphasizing the physical properties of print items to offer an experience similar to how people physically browse books. Secondly, streamlining and simplifying the search and filtering process while basing it on material aspects as opposed to technical, content-related, keyword-dependent dimensions. The next chapter discusses various existing visualizations that also attempt to tackle some of these problems.
3 Visualizing Print Collections

If I have seen further than others, it is by standing upon the shoulders of giants.

Isaac Newton

There has been extensive work done regarding visualizing various cultural collections using the techniques discussed in the previous chapter (whether literary works \(^6\), text documents \(^7\), illustrations \(^3\), or museum collections \(^7\)). A few interesting and relevant examples that have inspired this MSc project are presented below.

3.1 Online Library, Museum, and Bookstore Interfaces

As mentioned earlier, traditional interfaces for libraries and bookstores tend to provide a generic, one-size-fits-all experience \(^6\). Much like search engines, they focus on “minimizing the number of irrelevant search objects” \(^2\) as opposed to “maximizing the number of relevant objects” \(^5\) (which can increase the chance of serendipitous discoveries, and information encounters \(^9\)). Figure 4 shows some examples of said interfaces, including one by the University of Calgary which presents a sample collection of the Gibson Anthologies (see Fig. 4b) which is the focus of this MSc project. The interfaces look almost identical, and all use a grid-based layout and image thumbnails of the book covers. They do not change based on the different books’ properties and make very little use of the items’ physical appearance. They also employ complicated, nested search bars and filters, allowing refinement and showing similar items only after an initial query has been entered, with limited options for exploring or browsing from the offset.

![Barnes & Noble Books](https://www.barnesandnoble.com/s/visualization?_requestid=2789566)

![The University of Calgary Libraries and Cultural Resources Digital Collections’ interface for The Gibson Anthologies](http://contentdm.ucalgary.ca/digital/collection/gcsf/search)

Figure 4: Common examples of online book stores and digital library interfaces.
3.2 The Bohemian Bookshelf

The Bohemian Bookshelf is an interface for representing digital book collections that offers a unique set of visualizations for a collection of library books, emphasizing their physical and aesthetic properties, besides standard content-based metadata (see Fig. 5). Each visualization considers a different aspect of the books (such as their size, cover color, or author name) to provide people with multiple entry points into the collection. These entry points then allow people to playfully explore the books and become exposed to items they might not have otherwise seen. Also making use of multiple coordinated views, the visualizations feel lively and organic. Inspired by the visualizations of The Bohemian Bookshelf, this MSc project aims to create something similar for the Gibson Anthologies, but with a sharper focus on conveying the aesthetic personality of the collection and emulating the state of mind people find themselves in when interacting with books physically.

Figure 5: A screenshot of the Bohemian Bookshelf’s interface.
3.3 Visualizing Frederick William IV’s Illustrations

The visualization below was created using the VIKUS viewer developed at the Urban Complexity Lab. VIKUS viewer was created as a framework to facilitate the visualization of any cultural collection\textsuperscript{[7]}. The resulting visualization focuses on a collection of drawings created by Frederick William IV (1795–1861) \textsuperscript{[34]}. A bar chart shows the number of drawings created each year, where the bars consist of thumbnails of the artworks themselves arranged horizontally and vertically, instead of aggregating individual drawings into generic shapes \textsuperscript{[34]}. The interface implements ‘semantic zooming’ \textsuperscript{[11]} (which is used in other projects for similar purposes \textsuperscript{[79]}) to allow honing in on an illustration and viewing more information about it (see Fig. 6). By showing the entire collection, the interested viewer can get an overview \textsuperscript{[67]} of all the items present. The pictures’ preparatory organization into bars, however, mandates that the collection be explored in a certain way (mostly browsing through it bar-by-bar unless the viewer is looking for something specific). While supporting both close and distant reading in a top-down approach \textsuperscript{[31]}, the use of the thumbnails of the images makes it difficult to see fine details when fully zoomed out, losing the aesthetic effect intended. The thumbnails are scaled to reflect the dimensions of each illustration, but there is little use of the items’ material properties otherwise.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{fig6.png}
\caption{VIKUS visualization of Frederick William IV’s Illustrations.\textsuperscript{[8]}}
\end{figure}

\textsuperscript{[7]}https://uclab.fh-potsdam.de/projects/vikus-viewer/
\textsuperscript{[8]}https://vikusviewer.fh-potsdam.de/fw4/vis/
3.4 EMDialog

EMDialog is a visualization that was developed as a museum installation by Hinrichs et al. [7]. It addresses the life of Canadian artist Emily Carr, drawing from a large corpus of data surrounding what people have said about her, as well as her life-long journal. The visualization is visually unique, using a visual metaphor of a tree trunk and an abstract tree diagram since Carr was an avid environmentalist (see Fig. 7). Both visualizations dynamically change when someone interacts with either of them. The installation itself represents a drafting table with accompanying ambient sounds meant to emulate Carr’s working environment as she created her work out in the woods [7]. Overall, this project is a rare gem in terms of drawing on more than just the content of a cultural collection and using a multi-modal approach [53]. The visualization does not, however, draw on any aesthetics of Carr’s actual work or the items she produced, but, rather, from the metaphors of her personality and life. It serves as an inspiration for this project in terms of its overall emotive effect.

Figure 7: EMDialog’s visualization.
3.5 Coins

Urban Complexity Lab also developed an interesting example of a visually rich interface that is simply called Coins [80]. It displays an impressive half a million coins and medals from a variety of countries and periods (see Fig. 8). The coins are initially presented as a heap, much like they would be laid out physically. Website visitors can drag individual coins around and zoom-in and pan almost without limits. Interactive filters allow people to focus on specific groups of coins based on different material properties such as weight, material, and diameter, as well as contextual properties such as date or minting place. Once filtered and organized, the metaphor remains and the coins are still scattered and spread out. People are, again, free to drag the coins around or choose from a variety of layouts (bar charts, scatter plots, etc.). Interactive tool-tips also show more information on a selected coin upon zooming in. This visualization makes excellent use of the coins’ aesthetics, both in its property-based filters, and the analogy to the way coins are scattered in real life. The flexible, interactive capabilities also encourage exploration of the collection, retaining visitors for a large amount of time (which promotes serendipitous discoveries [42, 43]). This rich-prospect browsing [63, 64], spirit-preserving technique of visualization with high interactivity has not been extended to print collections, and therefore inspired this MSc project.

![Figure 8: The Coin’s visualization showing coins categorized by material.](image)

3.6 Close Up Cloud

This project by the Urban Complexity Lab offers both close and distant reading [60] in a novel approach that simultaneously gives both an overview and a zoom into details at the same time [62]. While focusing on glass negatives as opposed to literary works, the technique is very effective at highlighting the material properties of the items, showing small imperfections and the effect of aging (Fig. 9). Individual items can be singled out and examined, offering details on demand [67], and the user is free to zoom and pan as they like – easily getting an overview. While providing a truly parallel view of both resolutions, the visualization, however, does little else with the items’ material properties.
3.7 Summary

Overall, most of the projects presented somehow incorporate the physical appearance or aesthetics of print collections in their visualizations. This incorporation is done either through the use of static, minuscule thumbnails, sometimes also reflecting the items’ dimensions, or through the creators’ personal, semantic interpretations of the collection. Generally, the visualizations are still missing out on the richness that the material properties of the collections have to offer [8, 10]. Alternative incorporation possibilities have not been extensively explored, and the material properties of the collections (e.g. paper quality, wear and tear, binding, or weight) are seldom included. This existing gap in focusing on highlighting collections’ physical properties and overall aesthetics, as well as incorporating them into the search process and browsing experience is what this MSc project aims to address. The next chapter introduces the specific collection of anthologies chosen to be visualized by this project.
4 The Bob Gibson Anthologies of Speculative Fiction

The beauty of the handmade lies in their imperfections. Anything perfect is machine-made.

Unknown

Bob Gibson (1908-2001) was an avid collector and fan of Science Fiction (SF) stories. Over many years, he would buy a diverse range of literary magazines, cut out interesting SF stories, and hand-make the anthologies. He created them from start to finish; drawing covers, writing out contents pages, glueing in stories, drawing symbols to rate and classify the stories, and binding the booklets together [17,18,20,28,35]. The result is an unparalleled collection of over 800 anthologies containing SF stories, prose, comics, and non-fiction from as early as the 1840s (see Fig. 10). Indeed, no two anthologies are the same in terms of the combination of typography, color, size, paper type, etc., each having a unique scrapbook-like appearance. Overall, the collection contains more than 10,000 SF items. It is important to note that it is easy for viewers to become overwhelmed if shown everything at once. Multiple studies have shown that a comprehensive yet tamed overview that does not necessarily show every single element is most effective [8,31] to avoid “the problem of abundance” [81, Chapter 14] and this should be considered when designing the visualizations.

This specific collection was chosen as a case study because the fact that each anthology was made by hand over a very long time means that each one is incredibly unique in its physical appearance and material properties. The choice of collection is thus meant to emphasize the notion that because each item is fundamentally idiosyncratic, so much of the collection’s spirit would be lost if it was displayed using a generic template where each item looks and feels the same. Instead, by showcasing and celebrating individual items’ unique properties and the diverse range of material characteristics present in the collection, a spiritful representation that utilizes the collection’s full potential is created, leading to a more meaningful and enjoyable browsing experience.

![Figure 10: Some of the covers of Gibson’s Anthologies.](image-url)
4.1 Metadata on the Anthologies

Thanks to previous work done on Gibson’s Anthologies led by Stefania Forlini from the University of Calgary \cite{18,20,28,35}, metadata is available on the physical, material, and content-related properties of a subset of the collection. The data is stored in an SQL database and encompasses anthologies as well as individual stories within them. The structure of the data facilitates the implementation of various filters and search mechanisms on several dimensions such as cover color(s), paper size, paper type, binding, paper alignment, illustrations, typography, source journal, number of stories, story author gender, and story publication date.

4.2 The Speculative W@nderverse

The Speculative W@nderverse developed by Hinrichs et al. is currently the only other visualization created for the Gibson Anthologies \cite{17,18,20,28,35} (Fig. 11). Naturally, this made it a focus and starting point for this project. The interface begins with an overview-providing, high-level radial visualization that links between the topics of stories in the anthologies and an established framework for categorizing SF stories using a series of keywords \cite{82}. People can then hone in on individual stories to view them, thus employing a top-down combination of close and distant reading from the general overview down to specific stories \cite{31}. A tag cloud and the radial visualization are coupled with a timeline to provide coordinated views \cite{10,11,15,17,78} similarly to other projects \cite{5,20,22}, and make use of faceted searching \cite{8,25}. Their use of filters and a search bar means that the interface can support targeted searching and look-ups, as well as allowing the visitors to explore broader trends and patterns based on different dimensions (such as author gender). By facilitating different search practices \cite{11,16}, the interface supports both open-ended exploration, and traditional searching \cite{20}.

![Figure 11: The Speculative W@nderverse visualization.](image-url)
The use of the hand-made anthology covers as thumbnails also considers the aesthetics of the collection; however, the greater focus is on content-based categorization. During the project’s user study, the team found that participants were interested in seeing more of the collection’s physical and material aspects, which, as discussed earlier, are crucial to portraying unique collections such as the Gibson Anthologies. Accordingly, this gap in visualizing the Gibson Anthologies was the perfect opportunity to fulfil this MSc project’s objective of creating a visualization that emphasizes the collection’s unique physical qualities, stays true to its aesthetic, and evokes a sense of immersion similar to physically browsing such a collection.

The next chapter describes the design methodology used throughout the project, narrating the different stages and detailing the tools utilized.
Like any design process, this project undertook several phases and iterations. This chapter provides a synopsis of the design method adopted and the design directions explored, highlighting the tools and techniques used throughout.

### 5.1 Design Methods

Design iterations generally followed a funnel pattern where horizontal prototyping initially took place to generate a large number of possible designs (following an adaptation of the 10 plus 10 method), and then vertical prototyping followed where the more promising designs were further developed. The initial sketches were hybrids containing drawings, inspirational images, and clippings, and were consistently annotated for further clarity with their fidelity increasing throughout the successive stages of development. These explorations resulted in three distinct design directions for the visualization, with several iterations under each one (Fig. 12). More initial sketches can also be found in Appendix B.

1. The first direction makes use of a visual metaphor of a ‘book pile’, where the anthologies’ covers are scattered out in different layouts to reflect how they would appear if the physical copies were fanned out. This layout could then dynamically change as different filters were applied or as people interacted with individual anthologies, such as by dragging them around, leading to the collection arranging itself into several smaller piles, or in one larger heap.

2. The second direction utilizes a ‘bookshelf’ metaphor, where the anthologies were arranged in different linear layouts. This layout aims to be more organized and structured than the book pile layout.

3. The third direction uses glyphs with varying levels of abstraction to represent the anthologies. Several iterations of glyphs were developed, mostly focusing on the source journal (which is the journal or magazine where the stories in the anthology came from and also forms the title of the anthology itself), cover color, number of stories, and paper type as data dimensions. These dimensions were chosen based on the fact that in previous studies, people were especially attracted to colors or patterns, and textures or paper types.
After further consideration and refinement, some alternatives were disregarded, others were developed further, and multiple designs were combined. A Pinterest board was created to inspire the prototype’s theme (Fig. 13a), and a wireframe was designed to finalize the layout (Fig. 13b). The visualization alternatives were then added into the layout to create an interactive prototype. This step facilitated picturing how the outcome would look and exploring various interaction and transition possibilities. Three designs emerged from this process:

1. The various ‘scattered pile’ layouts were aggregated and connected through user interactions and filtering.

2. The linear layout that uses the book titles as ‘book spines’ was supplemented with the dominant colors blocks.

3. The Anthology Scrapbook glyph was further refined and considered.
5 METHODOLOGY

5.1 Design Methods

(a) The Pinterest board created to inspire the visualization’s theme.

(b) The wireframe for the overall page structure.

Figure 13: Source of inspiration for the final prototype.
In the following phase, interactive filters were designed. The aim was to have the filter dimensions include physical and material properties of the anthologies in order to mirror how people search for and interact with books in real life. The designs explored three different dimensions: cover color, anthology size/dimensions, and anthology stories’ time-frame (which is the range of dates that the stories in an anthology span) (Fig. 14). Additionally, filters for story author gender and paper quality were explored through the use of audio to encode data. Other filter explorations can be found in Appendix C. Finally, several different concepts were combined in order to create the final visualization layout, and the prototype design was changed to provide a sleeker, more task-based layout.

Figure 14: Alternative filter designs explored for various dimensions.
5.2 Sketching and Prototyping Tools

For the initial phase of generating and conceptualizing ideas, hand-drawn sketching took place using a stylus and an iPad drawing application\(^9\). Hand-drawing was preferred since digital visualization tools can dictate certain practices and restrict the design process \(^{35,86}\). Oppositely, sketching by hand is quick, nonrestrictive, and cheap. The rough/messy style of drawing also communicated that the ideas were in an embryonic stage and that various alternatives were still being considered \(^{83}\). Balsamiq Wireframes\(^{10}\) was then used to create a wireframe for the entire layout of components supplementing the visualization layouts.

Higher fidelity sketches were then created using Adobe XD\(^{11}\). This higher fidelity allowed for the incorporation of the anthology covers to get a more realistic sense of the end-result and to explore the emotional effect of seeing the actual collection \(^{85}\). Finally, an interactive prototype was developed using Axure RP \(^{12}\). The final prototype had a much more polished, refined fidelity to reflect its near-finished status \(^{83}\), and focused on consummating the layout, and on user interactions and animations that work in unison with the visualization to provide the desired overall experience. The prototype was designed to work in a Wizard-of-Oz way \(^{83,85}\), focusing on conceptualization to show how specific scenarios would pan out, such as using two filters in unison or using the search facilities.

Tableau\(^{13}\) was used to visualize the data itself in order to understand its range and outliers more clearly. It was not, however, used to develop the final visualization. Tools like Tableau, RawGraphs\(^{14}\) and PowerBI\(^{15}\) are more suited towards traditional and rigid visualizations with an emphasis on accuracy and effectiveness as opposed to more aesthetically-driven, personal, unique, or artistic visualizations \(^{86}\). By visualizing the data in Tableau, however, many useful insights were gleaned, like the fact that all the anthologies had a portrait orientation, that there was no correlation between thickness and weight, and that the majority of anthologies were bound using staples (Fig. 15).

The following chapter presents the various designs that have emerged from the described process, discussing why some designs were favored, while others were not further developed.

\(^{9}\)https://www.goodnotes.com/
\(^{10}\)https://balsamiq.com/
\(^{11}\)https://www.adobe.com/uk/products/xd.html
\(^{12}\)https://www.axure.com/
\(^{13}\)https://www.tableau.com/en-gb
\(^{14}\)https://rawgraphs.io/
\(^{15}\)https://powerbi.microsoft.com/en-us/
5 METHODOLOGY

5.2 Sketching and Prototyping Tools

(a) Exploring the different types of bindings and their frequency.

(b) Exploring orientation and the relationship between length and width.

(c) Exploring the cover and paper properties of different anthologies.

Figure 15: Examples of how Tableau was used to explore the anthologies’ properties.
6 Design Process

When you come to a roadblock, simply take a detour.

Mary Kay Ash

This chapter introduces the various designs created throughout the project and discusses their strengths and limitations, justifying why some were not taken forward.

6.1 Visualization Designs

The project uses the visual properties of the anthologies as data, as aesthetic inspiration, and as visual elements used to depict the underlying metadata of the collection directly [86]. The visualizations explored are imbued with a sense of randomness, messiness, and irregularity to free viewers from the constraints of digital interfaces, which can be perceived as too technical or rigid. This direct contradiction to the cleanliness and preciseness that are characteristic of digital aesthetics is a nudge to make viewers aware that in this instance, digitization is only a tool and not the medium of creation. By retaining the analogue, organic aesthetic of the collection, viewers are constantly reminded that they are looking at the anthologies through a screen, which is purposefully not meant to be the same experience as interacting with them physically.

6.1.1 Book Pile Layouts

The book pile layouts make use of the visual metaphor of a scattered pile of books. It also makes use of thumbnails of the anthology covers as a direct reference to the uniqueness and variety of the collection, and to establish a perceived affordance regarding how to interact with them (e.g. being able to drag them around) [85]. The initial idea was to have all the anthologies laid out in a single large heap (Fig. 16). While appearing random, there would be an underlying arrangement order (e.g., cover color, as shown in Figure 16b or source journal). One would be able to single out an individual anthology to examine it more closely and obtain more information about it (thus providing details on demand [67]) and would be able to drag the anthologies around freely, in order to see other obscured ones. The layout captures the irregular essence of the collection, highlighting the anthology covers, their dimensions, and the overall diversity of the collection. The ability to change the order and layout of anthologies (arbitrarily through dragging, or in a data-driven manner through filtering), and to pick out individual anthologies and bring them to the front, also helps to overcome representational issues that might arise [10,13,14] by helping make sure that smaller or less frequently occurring items are not less emphasized or overshadowed by larger, or more ‘significant’ works. As the number of anthologies included increases, however, this type of layout might become overwhelming or intimidating to viewers as has been the case in previous case studies [8, 31, 81]. In order to alleviate this inundation, a selection of anthologies must be chosen, but this artificial interference might then introduce data provenance and integrity concerns [87].
An alternative pile-based layout that addresses scalability concerns could instead show several smaller piles. Each pile would then represent a dimension level (e.g., cover colors as shown in Figure 17a), and so the number of piles would be less and would not drastically change as more anthologies are added. On the other hand, the limitation in this design is that only one cover from each pile is visible at a time, arguably veiling much of the collection. A possible remedy is to have the piles fan out as they are hovered over or clicked on, as shown in Figure 17b.
6 DESIGN PROCESS

6.1 Visualization Designs

(a) Arranging the anthologies in piles by color.

(b) Fanning out anthology piles as an interaction.

Figure 17: Different anthology layout possibilities for the pile metaphor.
6.1.2 Linear Layouts

The second design direction also utilizes the anthology covers as thumbnails but arranges them linearly as opposed to piling them up or heaping them. A linear layout improves the visibility and readability of the covers (especially as there is no rotation). Nonetheless, it is arguably less visually captivating than the pile-based layout. In order to address this triteness and deviate further from the traditional grid-based layout, the anthology covers were slightly overlapped, similarly to a spread-out deck of cards (Fig. 18a). Another opportunity to introduce novelty was explored by juxtaposing three blocks showing the three dominant colors present in each anthology cover (see Fig. 18b). This addition of color blocks is especially interesting as it supplements the analogue-looking thumbnails with digitally-extracted information, thus acting as a subtle nod to the possibilities opened up by digitizing the collection. Ultimately, both these designs were deemed too similar to traditional grid-based layouts and were not taken forward.

(a) Arranging the anthologies linearly by color.

(b) Juxtaposing the anthology covers with their dominant colors.

Figure 18: Initial linear layout explorations.
Taking the linear layout a step further and stepping away from the simple use of thumbnails; more abstract designs were explored (Fig. 19a). One such design uses the anthology titles to create the visual metaphor of book spines on a shelf (Fig. 19b). This view highlights the unique typography reflected in anthology titles, while also showing the cover color and the dimensions of the anthology. Since there are many visually distinct features on the covers, particularly interesting elements (such as illustrations) can be displayed as ‘zoom-ins’ either consistently or as someone hovers over an anthology. This view also supports the re-ordering of anthologies based on various dimensions, and they could potentially be dragged them around, giving the same level of playful interaction as the pile-based layouts. While the design is visually novel and compelling, it does not show the covers in their entirety at first glance. Instead, it only gives a glimpse into the ‘personality’ of the cover, which could be considered a strength or weakness.

An alternative idea was to retain the concept of book spines on a shelf, but to use the dominant color blocks, either in constant sizes (Fig. 19d), or to fill in the dimensions of the anthologies (Fig. 19c). These color blocks provide a much more abstract, digitally aesthetic even, view of the collection. It could be argued that the distinct appearance of the covers is lost (since elements like paper texture are no longer visible). However, these elements could easily be juxtaposed or utilized (as tool-tips for example). Using the dominant colors to show the anthologies’ dimensions was favored over having them be a fixed size since it encodes more information and conveys the book spine metaphor more clearly.
6 DESIGN PROCESS

6.1 Visualization Designs

(a) Sketch of linear layout possibilities.

(b) Using anthology titles as spines while showing illustration details.

(c) Using dominant colors to show dimensions.

(d) Using equal sized blocks of dominant colors.

Figure 19: More linear layout explorations.
6.1.3 Glyph-Based Layouts

The final design exploration relied less on using the anthology covers as they are, and more on developing glyphs with varying levels of abstraction to represent them in insightful and compelling ways. Multiple glyphs were developed, each one focusing on a different set of data dimensions regarding the anthologies’ appearance. The only content-based attribute taken into account was the number of stories in an anthology. The designs could, however, be extended to encompass other content-based elements, such as stories’ topics, in order to provide a gateway for people interested in finding stories that are relevant to them.

Anthology Cover Summary Glyph

This glyph provides an ‘at a glance’ summary of the anthology covers by showing the top left corner juxtaposed with the bottom right corner. The number of stories is represented as the number of squares beneath the glyph, colored in the covers’ dominant color(s) (Fig. 20). As the name suggests, the idea is to show the viewers a summary or glimpse of the covers’ features (color, paper texture, typography, source journal, illustration, and binding), without giving away the entire cover, in order to evoke further curiosity to explore and engage. Interacting with the glyphs can then provide more information on the anthology while clicking on a story square could potentially link straight to it. A weakness of the design is that the representation of the number of stories is not intuitive, especially if more than one color is used, which then suggests that the stories are different from one another. The perfect squares and equally sized rectangles also give off a ‘polished’ aesthetic that mismatches the collection’s personality and feels somehow grid-based and digital, which is why the design was not favored.

(a) Low-fidelity initial sketch of glyph.  
(b) High-fidelity sketch with anthology covers.

Figure 20: Anthology Cover Summary Glyph.
Anthology Snippets Glyph

The anthology titles are utilized in this glyph by ‘snipping’ them out. The irregularity of the crops also highlights the underlying lack of uniformity in the overall appearance of the collection. Paper snippets stick out from behind the title, representing the number of stories in the anthology (Fig. 21), which - similarly to the Cover Summary Glyph - can link to individual stories. The overall appearance is also a nod to scrap-booking, which is essentially what Gibson has been doing. Illustrations (if present) and the dominant color blocks can also be juxtaposed to provide a more extensive amount of information. The irregularity of the title cropping, however, does not harmonize coherently with the more precise cut-outs of illustrations and perfect color squares, becoming slightly disorienting to look at, which is why the design was not pursued.

![Anthology Snippets Glyph](image)

(a) Low-fidelity initial sketch of glyph.  
(b) High-fidelity sketch with anthology covers.

Figure 21: Anthology Snippets Glyph.

Anthology Scrapbook Glyph

Further exploring the idea of gathering inspiration from scrap-booking practices, the idea for this glyph was to represent the anthology covers as a scrapbook page by ‘snipping out’ certain elements and ‘glueing them’ back in (Fig. 22a). The original sketch for the idea included the title, illustration (if present), and contents page. The background of the glyph represented the dominant cover color, while the color of the flap represented the second most dominant cover color. The number of circles on the flap represented the number of stories. Underneath the flap, there can either be a generic lined paper (which could have stains to represent the varying levels of deterioration or quality of the anthology’s paper) or the original cover (thus showing only a glimpse of it) as shown in Figure 22b.

While the sketches were promising, they felt uncomfortably digital. The cleanliness of the lines and preciseness of the shapes betrayed that this was not a hand-made scrapbook (as opposed to the physical anthologies).
To understand the elements contributing to the hand-made aesthetic of the anthologies, paper prototypes \[83,85\] were developed for six sample anthologies (Fig. 23a). It was observed that the lack of straight lines, the discrepancies between the shapes of various cut-outs, and the shadows present, all contributed to the overall hand-made, analogue feel. The exercise also inspired the addition of the binding method and using Gibson’s marks to represent the enclosed stories, as opposed to perfect circles. The resulting digital sketch can be seen in Figure 23b. The revised glyph was, however, arguably still too similar to the original anthologies to feel that a distinct and significant abstraction has been made. Accordingly, it was not considered for the final visualization.
Source Journal Collage Glyph

Inspired by the extent of variation within the collection, and especially the fact that even within a single source journal, various fonts, cover colors, and illustrations are used, the Source Journal Collage glyph was created. Each glyph is a collage of snippets from each anthology that belongs to an individual source journal (Fig. 24). The division sizes depend on the total number of anthologies available for each journal. While the concept is promising, it then becomes difficult to discern and pick out individual anthologies, suggesting that this glyph is perhaps more suitable as a filtered view or supplemental view as opposed to being the main visualization.

![Collage of Journal covers](image)

(a) Low-fidelity initial sketch of idea.

(b) High-fidelity sketch with anthology covers.

Figure 24: Source Journal Collage Glyph.

Anthology Mural Glyph

Inspired by work done on creating summaries of TV episodes[16], the idea behind the glyph was to create a mural using the three dominant cover colors, that also shows the title of the anthology and illustration or contents on the cover (Fig. 25). While artistically pleasing, the glyph is much less informative and comprehensive than others, mainly only showing the dominant colors.

![Anthology Mural Glyph](image)

(a) Low-fidelity initial sketch of idea.

(b) High-fidelity sketch with anthology covers.

Figure 25: Anthology Mural Glyph.

After an extensive exploration of various alternative directions and designs, the decision was made to include two alternative visualizations; one that employs the pile layout, and another that employs the book spines layout. The glyphs were not taken forward on the basis that the focus should be on the anthologies themselves and their appearance, as opposed to digitally created abstractions of them. For the pile layout, the large heap was chosen as the initial view, encouraging open-ended exploration and browsing. The smaller piles that fan out on hovering were incorporated when someone chooses to sort the anthologies (e.g. by color or source journal) to make it easier to narrow down their search for something specific. For the book spine layout, the book titles design was used, and the dominant color design was juxtaposed on top of it to be shown when hovering on an item in order to utilize both views and supplement the material view of the anthologies with a digitally created one.

(a) The final pile-based layout chosen.

(b) The final shelf-based layout chosen.

Figure 26: The appearance and interactions of the chosen layouts.
6.2 Filter Designs

Following the visualization design conceptualization, the next phase focused on developing novel filters that convey the collection’s physical and material properties, and also potentially act as visualizations in their own right, giving overviews of the dimensions they represent. Three dimensions were explored: cover color, anthology size/dimensions, and anthology time-frame (which represents the range between the earliest and latest story included in an anthology in terms of their publication dates).

6.2.1 Cover Color

The most extensive exploration took place for cover color filters (Fig. 27): two approaches were adopted. For the first approach, the colors were conceptualized as physical cards. The scattering of cards was analogous to the scattering of the anthologies themselves and was thought to work especially well with the book-pile layouts. This idea was fleshed-out using the dominant cover colors (Fig. 28a), and using actual snippets from the covers to also show the textures, patterns, and blemishes (Fig. 28b). The cover texture design would not, however, function as a filter since each ‘card’ is unique to a single anthology, and thus would work more as an overview or alternate method of visualizing the collection. For the colors version to work as a filter, the colors would have to be aggregated into groups (e.g. ‘reds’ or ‘blues’), but the beauty of the metaphor and layout would be lost as the number of cards would then be significantly reduced. Ultimately, it was decided to use the cover texture cards as a supplemental view that would work dynamically with another color filter, showing all the materials/textures present for a chosen color.

Figure 27: Initial exploration sketches for color filter designs.
The second approach focused on creating visualizations as filters. The initial idea was to display common groups (e.g. ‘yellows’, or ‘reds’) which people could use to filter the anthologies, and then expand those to show all the different shades that fall under a group (Fig. 29a). Clicking on an individual shade would then show the specific anthology that has this shade (or more than one if present). This technique showcases the variety of color shades present, emphasizing the number of different materials that Gibson used to create his anthologies. Additionally, it also gives a top-down view going from an overview of general color groups down to specific shades.

Another idea was to show a simple color wheel, which most people would be familiar with, and then to provide them with several ‘magnifying squares’ that they could drag around the color wheel. As they drag across several shades, the squares would fill up with snippets of the anthology cover materials themselves that are that color shade, showing their textures (Fig. 29b). This juxtaposition of the solid dominant color (from the color wheel) with the actual anthology covers’ textures is again an interesting combination of the anthologies’ physical appearance and digitally-extract information. The presence of more than one magnifying square also allows for more sophisticated and expressive filtering. By presenting the colors in the form of a familiar color wheel, it can also be more inviting to explore while being inclusive of all the available cover colors. An alternative idea is to simultaneously show cover snippets for all the anthologies juxtaposed onto the color wheel at the same time. This alternative, however, would not allow aggregate filtering (Fig. 29d).

The final idea was to create a radial bar-chart where the color of each bar represents the color shade it corresponds to and the radial length of the bar represents the number of anthologies (or stories included in anthologies) that have that shade as a cover color. This filter gives a quick overview into which colors occur more, and can be used dynamically with other filters. As bars are hovered over, a sample cover having that color can be shown in the central circle.

Due to time constraints, only the color wheel design was implemented and included in the final prototype. The other two designs are promising, however, and merit further exploration and testing.
6 DESIGN PROCESS

6.2 Filter Designs

(a) Dominant Color Variations design.

(b) Interactive Color Wheel design.

(c) Radial Color Bar-chart design.

(d) Alternative Color Wheel design permanently showing a subset of anthology snippets in the position of their dominant color on the color wheel.

Figure 29: Visualization-based color filter designs.
6.2.2 Anthology Size/Dimensions

The second dimension explored was anthology size. Investigations conducted in Tableau showed that there was a limited number of widths and heights, meaning that different sizes could be roughly aggregated into a few distinct groups. Two alternative designs were created. The first shows a row of the different sizes linearly arranged as different sized rectangles to complement the bookshelf layout (Fig. 30a). The relative dimensions of the rectangles represent the sizes of the anthologies, and luminosity is used as a visual channel to represent the number of anthologies (or stories included in anthologies) that have these dimensions.

The second design uses the same rectangles, but instead of arranging them linearly, they are arranged in a pile (to complement the book-pile layout) (Fig. 30b). There are two alternatives; one where luminosity is used in the same way as the first design, and another where the rectangles have no fill but rather the thickness of their outlines represent the number of anthologies or stories. On the one hand, the design that uses luminosity suffers from decreased readability as some rectangles are only very slightly visible while the design that uses outlines is more discernible. On the other hand, the differences in line thicknesses are more subtle and thus harder to make out. The linear design was chosen in the end due to its intuitiveness and ‘at a glance’ clarity.

![Image](a) Size silhouettes linear layout.  
![Image](b) Two variations of the size silhouette nested layout.

Figure 30: Size filter designs.

6.2.3 Anthology Stories’ Time-frame

The final dimension examined was anthology stories’ time-frame. It proved difficult to create a traditional timeline for anthologies since an individual anthology can include stories published over several dates. Instead, the designed timeline shows anthologies aggregated using their cover colors and uses semi-transparent triangles to highlight the range of dates that their stories span (Fig. 31). For example, if the earliest story published in any anthology with a blue cover was in 1845, and the latest was in 1870, the blue triangle would span that era on the timeline. Individual stories are shown as smaller squares on the timeline, filled with the textures of their specific enclosing anthologies. The filter provides an excellent overview of different anthologies’ time-frames, can again be used in conjunction with other filters for further explorations, and can also be used to pick out individual stories, providing a gateway into the anthologies’ content.
6.3 Audio Explorations (Extension)

In addition to visual filters, audio was also considered as a supplement to create a more immersive overall experience. Sounds were used as a part of various interactions, but also as a form of filters.

6.3.1 Multi-model Interactions

From the first time someone interacts with the prototype, sound is established as part of the experience by using the sound effects associated with scrap-booking (e.g. cutting up paper, using a pencil, crumpling up paper, etc.) thus putting visitors in an ‘aesthetic attitude’ [13, 19, 24]. Sound is also incorporated when hovering on a pile of books to fan them out, as shown in Figure 17. The type of sound varies and represents the number of anthologies in that pile (whether there are four or less anthologies, or more than four anthologies).

6.3.2 Story Author Gender Filter

Sound is also introduced to filter by the stories’ authors’ genders by highlighting how many males vs females wrote stories in an anthology. The sound was created by recording a neutral hum and then altering its sampling frequency using Matlab to make the sound higher-pitched (to represent females) and lower-pitched (to represent males). Both sounds are played simultaneously, but their play duration and amplitude vary based on whether more males or females are contributing to the stories in an anthology. The individual male and female sounds can play out when the filter is selected to inform people which gender each sound represents. The combination of hums for each anthology can then play out when they are hovered over, only after the sound filter is activated (to not be disruptive to the experience). This exploration was not included in the final prototype due to time constraints.

The sounds were created in Matlab as follows:

```
[y, Fs] = audioread('humming.m4a'); % Neutral hum
sound(n*y, 1.5*Fs) % High pitched female hum
sound(m*y, 0.5*Fs) % Low pitched male hum
% m and n represent amplitudes depending on the anthology’s data
```
6.3.3 Number of Stories Filter

Additionally, sound was used for another filter to represent the number of stories in an anthology. Initially, the sound was meant to represent the paper quality/type in order to indicate whether the paper used was thin, glossy, or thick and coarse. After testing and consideration, it was found that these sounds were not immediately discernible in the way intended. Instead, the sounds were used in another filter to represent the number of stories in an anthology. This is represented based on the amount of paper being flipped in the sound (a small, medium, or large amount). Again, the sound can either play when hovering over an anthology or can be used as a filter.

Moving forward, the color-wheel cover color filter, linear anthology dimensions filter, and anthology time-span filter were chosen. The card-based layout of cover textures was used as a supplement to the color-wheel filter. It shows the textures of the different covers that are a filtered color. A filter was also created for the number of stories in anthologies to make use of the audio-based filter. The following chapter presents the final prototype incorporating all the mentioned elements.


7 Final Visualization Prototype

In good information visualization, there are no rules, no guidelines, no templates, no standard technologies, no stylebooks... You must simply do whatever it takes.

Edward Tufte

This chapter introduces the final web-based prototype, showcasing the visualizations and their interactive features, and going through the different components.

Various versions of the prototype, as well as a walk-through video and the project’s poster can be accessed using the following link: [http://malaksadekapps.com/Hub.html](http://malaksadekapps.com/Hub.html)

When using the prototype, for the ideal experience, please deselect any item clicked (by clicking it again) before clicking on a new item.

For convenience, the video explaining the project and interface and walking through its different features can also be directly accessed here: [https://universityofstandrews907-my.sharepoint.com/:v:/g/personal/mfzs1_st-andrews_ac_uk/EYrWZMQXGtxBql2uxEYhiGMBZz2xnPJVNZ-0Srzo-r6vA?e=SplX5J](https://universityofstandrews907-my.sharepoint.com/:v:/g/personal/mfzs1_st-andrews_ac_uk/EYrWZMQXGtxBql2uxEYhiGMBZz2xnPJVNZ-0Srzo-r6vA?e=SplX5J)

7.1 The Interface

When opening the visualization-based prototype, a few of the anthologies are shown to introduce their style and appearance (Fig. 32). Upon clicking ‘explore’, the anthologies animate, backing out of the screen, while sounds associated with scrapbooking play in the background (e.g., rustling paper, using pencil on paper, cutting paper, etc.). The opening page aims to set the tone for the exploration experience to come in terms of aesthetics (by showing covers and fonts), and in terms of immersion and interactivity levels (by using sound and animation). It also puts people in the right ‘aesthetic attitude’ [13, 19, 24] to ensure that they are as emotively receptive to the experience as possible, similar as to how walking into a library or bookstore would make someone feel.

The opening page and animation was created using Photoshop and can be seen here: [https://universityofstandrews907-my.sharepoint.com/:v:/g/personal/mfzs1_st-andrews_ac_uk/EQ8m_2AaTNpEnPITls-r8D0R1LmIfKZrq_4ahSEiB951rg?e=cKk018](https://universityofstandrews907-my.sharepoint.com/:v:/g/personal/mfzs1_st-andrews_ac_uk/EQ8m_2AaTNpEnPITls-r8D0R1LmIfKZrq_4ahSEiB951rg?e=cKk018)
7.1 The Interface

Following, a short tutorial screen introducing Bob Gibson and his collection (which is crucial to ensure proper data provenance [87]), and explaining the various filters and possible interactions is shown (Fig. 33). The tutorial screen can be re-accessed anytime via the information button in the bottom left corner.

The user is then directly taken to the main visualization screen (Fig. 34) which is composed of the visualization at the centre (1), a toggle button for alternating between visualization layouts (2), a search bar (3), a size scale (4), an information button (5), and the filters panel (6). As previously mentioned, the prototype employs a Wizard-of-Oz [83,85] technique whereby only specific interactions are fully implemented in order to illustrate design concepts and usage scenarios and to show how components would appear and interact in different states.
7.2 Visualization Layouts

The pile-based layout (Fig. 35a) and shelf-based layout (Fig. 35b) were both chosen as complementary layouts for the final visualization. A toggle button allows people to alternate between either design since each one emphasizes different aspects of the collection and caters to different user needs.

Figure 35: The two visualization layouts.
The pile-based layout as introduced in Chapter 6.1.1 focuses on showcasing the collections’ variety in terms of colors and dimensions using a layout that is familiar to people when dealing with printed works in general. The pile is also more ‘casual’ and ‘messy’ than an organized bookshelf, inviting website visitors to explore freely and move books around. With this layout, the aim is to help people forget the constraints of digital environments where items are usually bound to fixed locations and only allow for a limited number of possible interactions. The overview-providing layout is also supplemented with tooltips (Fig. 36) that appear when an anthology is clicked on, providing details on demand [67] and using a top-down approach by starting with the overview-providing layout and then drilling down to individual anthologies or even stories [2,10,16,63,64]. Instead of content-based information, the tooltip focuses on delivering more information on the physical appearance and material qualities of the anthologies, as well as the three dominant colors present in the cover. As mentioned earlier, this juxtaposition of the physical, hand-made appearance of the anthologies with the digitally extracted colors provides an interesting amalgamation of analogue and digital aesthetics.

Conversely, the shelf-based layout (presented in Chapter 6.1.2) introduces more organized structure and highlights the typography, source journals, illustrations, and paper types of the anthologies. It makes more targeted searching easier by presenting the titles of the anthologies as if they were the spines of books on a bookshelf. While arguably offering less interactivity than the pile-based layout, it is very visually novel and thus interesting to look at and explore. By hovering over different titles, people are also able to see zoom-ins on interesting visual aspects of the covers, such as illustrations, fonts, or visual blemishes (like stains or other signs of deterioration/discoloration), as well as the three dominant colors present in the cover (Fig. 37). Similarly to the pile-based layout, a tooltip, as well as the full cover, appears when an anthology is clicked on (Fig. 38), and the anthologies can be ordered by size, cover color, source journal, etc.

Figure 36: The pile-based layout’s tooltip.
(a) An anthology before hovering.

(b) The same anthology being hover over.

Figure 37: The effect of hovering on an anthology in the shelf-based layout.

Figure 38: The shelf-based layout’s tooltip.
A scale is also present on the right side of the interface and serves several purposes. Firstly, it allows people to drag anthologies to it while using the pile-based layout in order to see their dimensions. It can also be used with the shelf-based layout, but estimates must be made as the anthologies cannot be dragged. Secondly, it provides information regarding the current zoom level. This information is useful because, in some instances, when filtering or searching produces a smaller number of anthologies, the anthology covers are shown larger in order to make use of the extra space available. When that is the case, the scale dynamically changes to reflect this increase in size and remain accurate. Lastly, the scale can be used to zoom in or out on the pile-based layout freely using the red rectangle in order to further increase the flexibility with which people can interact with the collection and explore it.

Figure 39: The dynamic scale on the interface.

7.3 The Search Bar

As highlighted previously, the data available on Gibson’s Anthologies also facilitates the creation of a modified search bar which uses auto-complete-assisted natural language to search for anything regarding the anthologies (color, author, part of the title, topic, etc.). This method of searching is closer to how people use popular search engines that understand almost anything anyone types. Conversely, most Online Public Access Catalogues (OPAC) systems used by libraries and some bookstores use nested/layered and keyword-dependent search mechanisms, which tend to hinder open-ended explorations [88][89]. Using a natural language, flat search bar provides a more intuitive gateway into the collection and has proven to be a much more effective, understandable, transparent,
and enjoyable method of searching [89]. This is also especially true because such a search bar would eliminate the possibility of people receiving empty search results, which is frustrating and confusing, and because it opens up the possibility of “subject searches” and “free-form queries” as opposed to keyword-based searches [89, p. 4634]. Keeping in theme with the emphasis on anthologies’ visual aspects, the auto-complete menu features snippets of the covers, depending on what was searched for (e.g. searching for title names would show snippets of the titles) as shown in Figure 40.

![Figure 40: The interface’s search bar.](image)

### 7.4 Interactive Filters

The filter panel can be opened using the icon in the top left corner of the interface and features three tabs that lead to filters addressing three different data dimensions: anthology time-span, cover color/texture, and anthology size (Fig. 41). When a filter is applied, breadcrumbs appear in order to inform people which filters are currently active. The aim behind the breadcrumbs is to reduce memory and cognitive user loads [85] and to maintain transparency and context [89]. The breadcrumbs are in the form of Venn Diagrams. When one filter is active, a single circle is filled with snippets of all the anthologies that fit within the filter criteria. When more than one filter is active, those snippets fill in the circles or the intersection of the circles instead depending on their amount (Fig. 42).

![Figure 41: Different filter tabs.](image)
(a) The breadcrumb appearance for one filter.\hspace{1cm}(b) The breadcrumb appearance for two filters.

(c) The breadcrumb appearance for three filters.

Figure 42: The Venn diagram breadcrumbs for filters.
7.4.1 Anthology Time-Span Filter

The first filter addresses anthology time-spans and was incorporated as previously discussed in Chapter [6.2.3](#) with no further changes (Fig. [43](#)). It should be noted for any filter in general, if the result of filtering is five anthologies or more, they are displayed as a zoomed in pile (as shown in Fig. [45b](#)), but if the result is four anthologies or less, they are displayed with their respective tooltips in order to utilize the available space (as shown in Fig. [44b](#)).

![Figure 43: The time-span filter in the filter panel.](#)
(a) Appearance of the filter.

(b) Filtering result.

Figure 44: Using the time-span filter to filter by cover color.
Figure 45: Using the time-span filter to filter by story publishing date.
7.4 Interactive Filters

7.4.2 Cover Color/Texture Filter

The following filter addresses anthologies’ cover colors using the color wheel design previously introduced in Chapter 6.2.1 (Fig. 47). In conjunction with the cover color filter, a set of cards show the textures/materials of covers that fall under the filtered dominant color. These cards can be clicked on as well to filter out the corresponding individual anthology (Fig. 48).

Figure 46: Using the time-span filter to select an individual story by clicking on the small squares on the timeline.

Figure 47: The cover color filter and cover texture view in the filter panel.
7.4 Interactive Filters

(a) Filtering by blue anthologies.

(b) Filtering by red and blue anthologies.

(c) Result of filtering by red and blue anthologies.

Figure 48: Effects of using the cover color filter.

7.4.3 Anthology Size Filter

The final filter explores the anthologies’ sizes in terms of their page dimensions and the number of stories included within them (Fig. 49). For anthology dimensions, the filter previously introduced in Chapter 6.2.2 was used. The number of stories filter visually shows three anthologies viewed from the side, with the heights representing the number of stories. Sounds play on hovering to represent various amounts of paper being flipped in order to enrich the experience further. Both filters dynamically change appearance when other filters are activated (white rectangles in the dimensions filter indicate that there are no anthologies with that cover color and dimension) (Fig. 50).
(a) The anthology dimensions and number of stories filters.

(b) Filtering result.

Figure 49: The anthology size filters.
(a) The size filters while filtering for red covers.  
(b) The size filters while filtering for blue covers.  
(c) Filtering result for red covers that are 26 x 20 cms.  

Figure 50: The size filters used with the cover color filter.

### 7.5 Sorting Anthologies

The final feature of the prototype is the ability to sort anthologies based on one of the three filter dimensions. Instead of eliminating anthologies, this feature sorts all the anthologies. It only works in the pile-based layout as it sorts them into smaller piles (Fig. 51) and can be accessed from the filter panel in each filter’s tab. Upon hovering over a pile, the anthologies within that pile fan out to show all the covers more clearly (Fig. 52). The fanning out is accompanied by a sound that differs depending on the number of anthologies in a pile, as discussed previously in Chapter 6.3.
This concludes the various visualizations, filters, and interactive features incorporated in the final prototype. The following chapter outlines the user study conducted to evaluate the prototype. It presents the results of the study and discusses their implications on the project’s goal-fulfilment.
8 Evaluation

One of the basic rules of the universe is that nothing is perfect. Perfection simply does not exist. Without imperfection, neither you nor I would exist.

Stephen Hawking

An online pilot study was conducted to evaluate how participants perceive the visualization-based prototype described in the previous chapter and whether it adds value to their explorations. The study aimed to collect data regarding technical stability and usability of the prototype (e.g., whether people ever need to refresh the page or could not understand the prototype) as well as qualitative data about participants’ experience with the prototype and further suggestions. In addition to participants’ evaluation of the prototype, a set of established heuristic metrics were compared against as a final evaluation step. This comparison was done to ensure that the prototype was as human-centric and usable as possible.

8.1 Study Design

The study was conducted under the umbrella of the Artifact Evaluation Ethics by the School of Computer Science (see Appendix A) and took the form of 15-minute sessions conducted in Microsoft Teams. Overall, 23 participants took part in the study. Participants were first given an introduction to the project and prototype. The researcher then shared their screen and walked participants through the different features of the prototype, giving participants the chance to control the researcher’s screen to try out features for themselves if they wanted to. After this practical session, participants were asked to fill in a questionnaire about their experience with the prototype. The full list of questions can be found in Appendix D.

The questionnaire was created using Qualtrics and the questions were a mix of open-ended and Likert scale questions inspired by several frameworks for evaluating interfaces. Research has found that the perceived ‘beauty’ and aesthetic attractiveness of interfaces, and especially web-based ones, can help prolong interest and engagement, improve people’s perception of other qualities such as performance and usability, and lead to an overall positive, enjoyable experience. To that end, the questionnaire was used to examine whether the desired emotional and experiential outcomes of the visualization were reached since the engagement and enjoyment levels, aesthetic satisfaction, and emotive evocations of the visualization are a crucial part of the experience. The aim was not to make generalizations about the prototype, but rather to find trends in people’s perceptions of it.

Since the information collected was mainly qualitative in nature, individual answers, comments and suggestions of interest were taken into account and presented. Additionally, answers were aggregated

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http://attrakdiff.de/index-en.html
http://visawi.uid.com/
based on the elements they reference (for example, comments about filters, comments about the page layout, etc.) in order to discern broader trends in people’s perception of different elements. Moreover, bar charts were created for questions that used Likert scales in order to visually understand whether users overall had more positive or negative sentiments towards different aspects of the prototype. Finally, participants were also asked to rate how they felt about the prototype using sets of terms representing opposites (e.g. ‘human’ vs ‘technical’) on a scale with five points. This technique is an adaptation of the Self-Assessment Manikin (SAM) [91] and aims to highlight the perceived aesthetic of the prototype and the emotions it invoked. While many of the terms do not necessarily hold an inherently positive or negative meaning, as part of the data analysis process they were coded as either positive or negative given the focus of this research.

8.2 Findings

The following section describes the findings from the pilot study outlined above, focusing in particular on participants’ reactions to the prototype and how these reflect the prototype’s faculty to fulfil its goals of emphasizing the collection’s physical and material properties, facilitating open-ended browsing and targeted searching, and providing an immersive and engaging experience. Participants’ answers to open-ended questions can be found in Appendix E.

8.2.1 Overall Impression

Participants were asked to describe the prototype to someone who has not seen it before in order to discover their main takeaways from their experience and to survey some of the terms they would use to describe it. It was evident from the responses that the majority found the prototype to be novel, with nine participants using words such as ‘new’, ‘unique’, ‘different’ and ‘unusual’. Participants also commented on how the prototype provided a richer experience than the one provided by the University of Calgary’s library interface for the Gibson Anthologies – which was shown to participants in the questionnaire (Fig. 55). One participant stated that the prototype ‘aims to focus on aspects of books that are not focused on by popular means of searching for publications’ [P 4], and another wrote that it ‘fill[s] the gap that other online library resources are missing’ [P 10]. Finally, it was clear that participants understood the main aim of the prototype with 11 participants referencing that they would describe the prototype as emphasizing books’ physical properties, characteristics, or designs (including specific ones such as colors, sounds, textures, etc.); one participant saying that the prototype provides ‘the feel of being in a library’ [P 3]; and another participant writing that it gives ‘a more real-life experience’ [P 2]. Three participants also mentioned using the prototype to explore or browse books. One participant’s answer particularly stood out as evidence that the prototype had achieved its goals:

“In contrast to the typically available purchasing or reviewing interfaces online for books, this interface gives one a more aesthetic and physical real-time experience, where it allows you to not just view a book in pictures, but experience the whole beauty of a book as it was intended by the creator. This is especially in the case of books that are handmade and unique with intricate details on them, like the collection used within this prototype.” [P 15].

When asked what they particularly liked about the prototype, participants gave a range of answers (Fig. 53). Ten participants mentioned the simplicity and effectiveness of the layouts, five mentioned how the prototype provoked their curiosity and invited them to engage with the anthologies and
explore them, and eight participants spoke about the prototype’s visual aesthetic and intuitive design. Additionally, eight people said the prototype allowed for an experience comparable to exploring books in a physical environment, with one participant writing that the experience felt more like “physically choosing” rather than “scanning” [P 3], indicating that the prototype invoked an analogue aesthetic (entailing physically choosing – engaging all the senses) more so than a digital aesthetic (entailing scanning – only using the eyes).

Eighteen respondents mentioned the interactive features and mainly the comprehensiveness of the filters as particularly positive features, and two referenced the use of sound as a positive aspect. Filters were well-received, with participants commenting on the novelty of the time-span filter design, but also on the usefulness of having cover color and size filters. One participant also commented on the use of the scale to find out anthology dimensions. Two participants who seemed to enjoy the prototype particularly wrote:

“The variety of ways to explore the books. Not just a normal search grid type view. Loved the pile that was interactive and reorganised depending on filters. Definitely gave a more playful aspect. For those who like a bit more organised the shelf gave that too. The filters gave a very unique and different view of searching for things.” [P 10].

“One) The overall feel of the interface actually made me feel closer to a real bookstore (much more than the currently available interfaces I’ve seen). 2) I really liked how every detail of aesthetics has been incorporated, including the bit of messiness that one usually finds in a cluttered pile of books. I found this even in the filter options, with irregularity in the colour tile choices and actual texture used for backgrounds, adding in to the overall experience. 3) The wide range of dimension options helped in giving a better idea of how a book actually looks.” [P 15].

![Figure 53: Aspects/features participants particularly enjoyed about the prototype.](image-url)

There was also a range of responses regarding what participants’ found lacking in the prototype (Fig. 54). Two participants mentioned that the interface was not suitable for someone in a hurry
or wanting to locate an anthology quickly, as opposed to openly exploring, and four people spoke about the lack of emphasis on content. These comments were not surprising since the main aim of the prototype was to focus on open-ended exploration and browsing based on items’ physical and material properties, rather than content-based, targeted searching, which is only partially supported through the search bar and for which many interfaces already exist. Additionally, three respondents felt that the overall layout of the prototype was overwhelming or complicated; two mentioned the use of sound to be disruptive or inconsistent; and five participants offered suggestions for improving the filters, all revolving around the idea that they might be un-intuitive to use without initial explanation or clearer indicators.

Figure 54: Aspects/features participants found lacking in prototype.

In order to further tease out how the prototype compared to a more typical, grid-based library interface with a nested filtering system, participants were shown such an interface for The Gibson Anthologies (from the University of Calgary’s Libraries and Cultural Resources Digital Collections) and asked to comment on what they felt was different (Fig. 55). Nine participants mentioned that the traditional interface was unappealing and uninviting, specifically referring to the ‘generic’ grid-based layout. Below are some comments regarding this point and how the prototype is perceived to add more value to the collection items:

“In short, the former system [the prototype] was an experience in itself.”

“There is a big difference. I think that this presentation here [in the traditional interface] is one we are so used to that we cannot even ‘feel’ books anymore. It does not come close to what it is to experience books in person and is an established digital library.” [P-19].

“Yes, it is different. This grid-view in the image gives no value to the uniqueness of the books. In real-life, a clothing store is very different from a bookstore. But putting them in a grid-view like this, wouldn’t show the difference in the experience you get when going to either store, but the prototype actually does bring us much closer to a real bookstore or library, in the way you see, perceive and feel books.” [P-15].
8.2 Findings

Figure 55: The grid-based interface shown to participants. The interface is from the University of Calgary’s Libraries and Cultural Resources Digital Collections.

“The digital library interface diminishes the value of these collections and does not give a clear depiction of how the collections feel. While this format might work for normal books the prototype augments their value.” [P-23].

Seven participants also spoke out about how complicated the filters in the traditional interface are, with one also mentioning the lack of a search bar. Most notably, 16 participants said that the prototype was much more engaging and inviting to explore because it was more similar to real-life experiences and felt less digital. One participant also mentioned that it “also encourages users to look at books which a user may not have come across otherwise” [P 14] hinting that the prototype can help serendipitous discoveries take place. Finally, six participants commented that while the traditional interface is more suited to searching quickly, they would not use it to browse or explore for more extended periods. Specifically, one participant mentioned that the prototype would likely lead to “people spending more time on the page and getting to know more about the collection” [P 7].

Overall, participants seemed to grasp the prototype’s aim of emphasizing the physical and material properties of the collection and appreciate the motivations behind this. They generally found the prototype aesthetic appealing and the synonymity to physical experiences beneficial. People also emphasized the novelty, usefulness, and comprehensiveness of the filters available. The main limitations of the prototype were the lack of emphasis on content and the lack of support for quicker, more targeted searches.

As described earlier, participants were also asked to rate the interface using sets of opposing terms which were classified as positive or negative based on the focuses of this project (Fig. 56). Adapting the SAM technique [91], different terms were categorized as Pleasant vs Unpleasant and Arousing vs Calm (or engaging vs passive). Numerical averages were computed for each participant’s answer (which ranged from 1-5) based on each rating they gave. For example, words that were categorized as Pleasant vs Unpleasant included ‘Motivating’, ‘Inviting’, and ‘Not Valuable’. Motivating and

http://contentdm.ucalgary.ca/digital/collection/gcsf

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Inviting were classified as pleasant, represented by the number 5, while Not Valuable was classified as not pleasant, represented by the number 1. If a participant chose a 4 towards motivating, a 5 towards inviting, and a 2 towards not valuable, their average would be 3.7 which would be neutral (neither pleasant or not pleasant). An average would also be computed for terms that are arousing vs calm. These two averages would then form x,y coordinates that were used to plot points on a 2X2 matrix, with each point representing a participants’ average sentiment, to show how the majority of participants felt about the prototype (Fig. 57).

Generally, participants associated the prototype with positive connotations in terms of aesthetic, value, engagement level, and straightforwardness. Negative associations mainly took the form of the prototype being too complicated or challenging to use, which aligns with the answers given in the previous section. These negative feelings, however, were not strong enough to drag any participant’s representative point down into the negative half of the matrix (indicating that the experience was unpleasant). The majority of participants were also mostly neutral in terms of being aroused vs calm.

![Figure 56: Participants’ experience of the prototype.](image)

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8.2 Findings

Figure 57: Participants’ levels of arousal and pleasure based on the keywords they selected. Each point represents a participant. The vertical position of the point represents the extent with which the participant felt the experience was pleasant vs unpleasant. The horizontal position of the point represents the extent with which the participant felt the experience was arousing/engaging vs calm/passive.

8.2.2 Enrichment of the Browsing Experience

The majority of participants assigned the prototype the word ‘valuable’ as opposed to ‘not valuable’ as shown in Figure 56. When asked about how the prototype had helped them to find suitable anthologies, participants again had mostly positive answers (Fig. 58). They found value in the prototype, and it had raised their curiosity in the collection and generally made them want to read the stories more. Finally, one participant mentioned that they “wouldn’t read this kind of books but the visualization got [them] interested” [P 11].

Figure 58: The suitability of the prototype for exploring the anthology collection and finding potentially interesting anthologies.
8.2.3 The Collection’s Visual Representation & Aesthetic

The overall prototype layout was well-received; however, some participants found it overwhelming or overly complicated, which was also indicated by previous answers (Fig. 59). Both anthology layouts were found to be promising by most participants, while very few found them too messy or complicated (Figs. 60 and 61). One participant elaborated further, writing:

“I certainly do not think that the representation was ‘visually overwhelming’. Rather, it allowed one to simply see the physical properties of the book. I do not feel visually overwhelmed when looking for books in a library and essentially this is no different. What was shown to me seems like a microcosm of being in an actual library. As said previously, it is an experience - it feels as if you can touch and appreciate the book in its physical form. The only other means to do this is physically being in library or archive.” [P 4].

![Participants' Thoughts on the Visual Representation of the Anthologies in the Prototype](image)

Figure 59: Participants’ thoughts on the visual representation of the anthologies in the prototype.

With regards to the pile layout, participants commented that they enjoyed getting an overview of the entire collection at the same time in a realistic representation rather than a list of books. Six participants said they enjoyed seeing the colors of the covers, while three also appreciated seeing the minute details of the covers in high fidelity. Four participants liked the messy/random nature of the pile and said it encouraged exploration, while four participants particularly enjoyed the drag and drop interaction. On the other hand, two participants found that it was not efficient when looking for a specific anthology, five participants found it confusing or overwhelming, and 13 participants said that the titles and details were too occluded in some instances, favoring the anthologies on the top while potentially hiding other anthologies – data providence issues could arise here with regards to selectively picking which anthologies should go on the top. A possible remedy is to have the ordering and layout be randomly generated whenever the page is refreshed in order to exclude human biases.
For the shelf layout, 11 participants appreciated the organized, structured nature of the layout, with seven people liking the similarity to physical bookshelves. Six participants enjoyed the fact that the sizes of the anthologies were accurate in terms of dimensions and were proportional to each other. Finally, two participants mentioned that having two different perspectives was beneficial. On the other hand, three participants complained that there was no particular ordering, two did not like that less details were shown compared to the pile layout, and five felt that the larger anthologies overshadowed smaller ones which were then more difficult to see.

All in all, both layouts were well received. The pile layout was thought to encourage more open-ended, playful exploration, while the shelf layout was an organized alternative capable of giving a quicker overview of the collection. Where some people found the pile to be too messy or overwhelming and preferred the shelf layout, others enjoyed the flexible interactivity offered by the pile layout more. When used together, the layouts catered to a broad audience in terms of preference and intention.
8.2.4 Simplifying the Search Experience

One of the main shortcomings of traditional browsing interfaces is the cryptic, keyword-dependent search bar offered. The proposed search bar was introduced as a more accessible alternative that worked using natural language and auto-complete. It was also supplemented with snippets of anthology titles to increase visual engagement. Overall, participants found the search bar intuitive and straightforward to understand and felt that it enriched their overall experience (Fig. 62). One participant expressed that the auto-complete feature was particularly useful. Five participants appreciated the snippets while one suggested that showing the entire cover would be more useful since currently both the snippets and text show the anthology title.

![Figure 62: Participants' thoughts on the search bar.](image)

8.2.5 Filters as Interactive Entry Points into the Collection

As previously reported, multiple participants enjoyed the filters and especially appreciated the variety of explorable dimensions. While some felt that they were un-intuitive without further instructions on how to use them (especially the time-span filter and cover color filter), most felt that they added value to the prototype and were enjoyable to explore (Fig. 63).

![Figure 63: Participants' thoughts on interacting and exploring the anthology collection using the prototype.](image)
The time-span filter was the most positively received (Fig. 64). Four participants felt it was well designed and aesthetically pleasing, with one participant commenting on how its cluttered, overlapping elements were an apt complement to the anthology pile’s aesthetic. One participant commented that the time-span filter was their favorite feature in the entire prototype. Conversely, two participants mentioned that it was difficult to understand how the filter worked without prior explanation.

![The Time-Span Filter](image)

**Figure 64: Participants’ thoughts on the time-span filter.**

The cover color filter also garnered generally positive reactions (Fig. 65). Participants particularly appreciated the ability to filter out more than one color at the same time. Four participants commented that it was again difficult to understand how to use the filter without some explanation and that there was nothing to indicate that more than one picker could be generated to filter multiple colors.

![The Cover Color Filter](image)

**Figure 65: Participants’ thoughts on the cover color filter.**

Lastly, the anthology size filter was perhaps the most intuitive for participants. Two participants also commented on how they liked the fact that the filter worked dynamically with other filters and changed appearance when another filter was active.
8.2 Findings

8.2.6 Usage of Sound

Participants generally either did not enjoy the usage of sound or did not notice it (Fig. 67). Five participants did not notice the use of sound at all, while one person felt it was unnecessary. Some participants did like the sound, with two emphasizing that it helped them differentiate between the anthologies and improved their overall experience. While the use of sound could simply be ineffective, the antagonism towards it could also be because sound is not homogeneously used throughout the prototype but only in two instances. This non-uniform usage could cause the sounds to be disorienting to people as they are not expecting them. Further experimentation is needed to determine whether that is the case.

To summarize, the prototype is an effective step in the right direction towards achieving the project’s goals. It provided a positive experience to most participants who understood that the goal was to emphasize physical and material properties in an interactive way and appreciated the alternative layouts based on their own inclinations and approaches. The search bar and filters successfully enhanced the experience, providing multiple entry points into the collection based on different physical features while also giving an overview of the collection in novel ways. The prototype was found to be overwhelming by some, mainly because the filters did not have enough instructions.
regarding how to use them. The use of sound was also found to contribute negatively to participants’ experience but requires further investigation to understand why that was the case. In conclusion, the prototype fulfilled its goals by encouraging exploration, putting people in an aesthetic attitude, showcasing the collection’s physical properties and overall aesthetic, and providing multiple entry points and perspectives to cater to different preferences and tasks.

8.3 Heuristic Evaluation

Nielsen (1994) developed a list of heuristic evaluation points which he extracted from widespread interface usability issues [90]. The list acts as a quick and practical checklist to ensure that an interface is as user-friendly and usable as possible [85]. It was used as a secondary form of evaluation for the prototype by checking it against the following heuristics:

1. **Visibility of System Status.** Users should always be aware of what is happening by receiving appropriately timed feedback.

2. **Match between System and the Real World.** The system should feel natural and non-technical, making use of real-life conventions.

3. **User Control and Freedom.** Users should be able to undo and redo actions freely and easily transition between different states.

4. **Consistency and Standards.** Users should be able to intuitively understand how the system will behave and what certain words and phrases mean.

5. **Error Prevention.** The system should protect against erroneous situations, preventing problems from occurring whenever possible.

6. **Recognition Rather Than Recall.** Users should have an overview of different possible actions they can perform instead of having to rely on their memories.

7. **Flexibility and Efficiency of Use.** The system should be easy enough for novice users to learn quickly, and efficient enough for expert users to accomplish tasks quickly.

8. **Aesthetic and Minimalist Design.** Any information displayed should be relevant, with the level of visibility correlating to the level of importance.

9. **Help Users Recognize, Diagnose, and Recover from Errors.** It should be clear to users exactly what went wrong and how to overcome it.

10. **Help and Documentation.** Users should be able to look up how to use the system or specific features. The information should be presented in a clear and concise way.

The comparison table for the prototype can be seen on the following page.
<table>
<thead>
<tr>
<th>Heuristic</th>
<th>Prototype Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visibility of System Status</td>
<td>The prototype shows the Venn Diagram breadcrumbs to let users know which filters are active. The fact that filters dynamically change in response to one another is also helpful.</td>
</tr>
<tr>
<td>Match between System and the Real World</td>
<td>Many item and interaction affordances are inspired by real-life (such as dragging books around). This parallelism helps people immediately understand how to interact with the system, and also offers an amalgamation of digital and analogue aesthetics to compliment physical experiences.</td>
</tr>
<tr>
<td>User Control and Freedom</td>
<td>It is quite easy for users to undo any action or remove any filter by clicking on the same item again.</td>
</tr>
<tr>
<td>Consistency and Standards</td>
<td>While not strictly adhering to browsing interface conventions, the prototype is consistent in its appearance and interaction modes.</td>
</tr>
<tr>
<td>Error Prevention</td>
<td>The way the filters and search bar are designed makes it impossible to get empty results, even without knowing exactly what to search for. This design, coupled with the high level of user control and freedom, offers a solid error prevention mechanism.</td>
</tr>
<tr>
<td>Recognition vs Recall</td>
<td>The prototype does not rely on recall but instead always explicitly shows all options/alternatives (such as the different filter tabs and visualization layouts). By also showing the filter breadcrumbs, users are always aware of what is happening and what their options are.</td>
</tr>
<tr>
<td>Aesthetic and Minimalist Design</td>
<td>The aesthetic of the prototype was inspired by the aesthetic of the collection itself and aimed not to look too ‘digital’. No redundant features or information were included, and the filter dimensions were chosen based on the fact that they represented aspects which users had found interesting or looked for in previous studies [5, 7, 89].</td>
</tr>
<tr>
<td>Help and Documentation</td>
<td>The prototype was designed with casual users in mind, ensuring that it was straightforward to use. An introduction is given to the collection and prototype, which can be viewed again as needed. Despite this, some participants did find the prototype overwhelming or required more help/explanation to use some features.</td>
</tr>
</tbody>
</table>

Table 1: Evaluating how the prototype addresses Nielsen’s heuristic metrics.
8.4 Summary

This chapter outlined the user study conducted to evaluate the prototype and the heuristics compared against to ensure usability. Participants were found to have enjoyed the prototype, finding it similar to physical experiences with books. They expressed an appreciation of both visualization layouts, acknowledging how each one was suitable to different tasks and preferences. The pile layout was found to appeal to participants who valued a no-pressure, highly interactive, casual exploration session, while the shelf layout suited participants who wanted a quicker, more organized overview. Participants also enjoyed the filters and commended their comprehensiveness and novelty, especially the time-span and cover color filters. The time-span filter was valued because of the various interactions it allowed and because of the similarity of its layered appearance to the aesthetic of the book pile layout. The cover color filter was appreciated for the playfulness of dragging the picker around and filtering in real time, as well as the supplementation of the cover textures. On the other hand, some participants felt that the interactive features needed more explanation as they were quite novel and therefore un-intuitive, especially the time-span filter. The use of sound was found to be disruptive to the experience, with only a minority of users rating it positively, however, the reasons behind this require further investigation to uncover. Overall, the prototype can be said to add value to participants’ experience with the anthologies. It also evidently facilitated open-ended exploration while also raising interest and curiosity in the anthologies through highlighting their unique physical properties.
9 Conclusion

A road need not be paved in gold to find treasures at its end.

Alan Brennert

9.1 Project Summary and Outcomes

Overall, the project’s goals have been largely accomplished (please refer back to Section 1.2):

1. An extensive review has been conducted, leading to the identification of two main weaknesses in existing literary collection browsing interfaces: the focus on content at the expense of physical properties, and the onerous nested, keyword-dependent search mechanisms. Several solutions for overcoming these issues were explored, and multiple existing works employing them were reviewed.

2. Based upon the insights gained, several alternative designs were created in various fidelity levels to explore possible interfaces that could offer a novel browsing experience.

3. After adapting, combining, and eliminating some designs, the emerging ones were fashioned into an interactive prototype. The prototype also incorporated several overview-giving filters oriented around the physical and material aspects of the collection. It additionally employed a natural language, auto-complete-based search bar supplemented visually with anthology snippets.

4. The prototype was evaluated through a pilot study where participants found it engaging and pleasant, especially appreciating the variety of perspectives offered by the alternative layouts and the comprehensiveness and novelty of the filters.

5. Several explorations took place regarding using sound to increase the richness of the experience.

The resulting prototype is a digital embodiment of the collection. It displays the anthologies from different perspectives while accommodating for different searching methods; from open-ended browsing and exploration (more supported by the pile-based layout and filters) to more targeted searches (more supported by the search bar and the shelf-based layout). It also provides smooth navigation between different layouts and filters \[2,9,10\] and visual breadcrumbs to guide visitors. It is clear enough to provide a quick overview, yet comprehensive and novel enough to merit and encourage a prolonged investigation. By drawing on existing techniques such as generous interfaces \[10\] or rich-prospect browsing \[63\] and utilizing the collection’s visual properties, as well as audio, it puts people in an ‘aesthetic attitude’ \[13,19,24\] thus maximizing their sensual receptiveness to the experience. By incorporating traditional interface elements such as filters and search bars, and imbuing them with the collection’s own physical characteristics and material properties, the resulting interface is personalized enough to faithfully represent the given collection, yet flexible enough to be extensible to various other collections. Such an interface is especially beneficial for special collections that are fragile or valuable which cannot be freely handled or moved around, allowing users to engage with them without physical constraints or a cautious attitude.
Additionally, the cognitive affordances within the prototype and the way the filters and search bar are designed to help prevent people from making inappropriate choices (e.g. leading to empty results which can cause frustration [89]). Additionally, it guides data entry (e.g. through auto-complete in the search bar), and provides visual (and in some cases acoustic) feedback [85]. Affordances between the visualization and filters (e.g. the layered book pile and layered timeline filter, dragging the books and dragging the color picker, the linear bookshelf layout and the linear size filter, etc.) also help to unify the prototype and establish consistency.

9.2 Limitations and Future Work

Since there is a plethora of grid-based, thumbnail-dependent, generic browsing interfaces for a variety of literary and print collections, the project aimed to develop a novel technique of visualizing a unique collection using its inherent physical and material properties. Such a visualization could also potentially supplement or be combined with more traditional layouts, to cater to a broader audience. Due to time constraints, however, the evaluation of the existing prototype can be considered a pilot study and is only the first step. An extensive study is required (including a comparative study with a ‘traditional’ interface), also preferably including in-depth interviews and having participants think-aloud [99,100] while using the prototype. Several design iterations should follow this extensive evaluation in order to further improve the design, which already shows great preliminary potential. More technical considerations should also be made, such as the fact that images are used for the anthologies and not vector graphics (which could cause quality loss as people zoom in or navigate).

The user study indicated that more explanation needs to be provided regarding the filters and features of the prototype, suggesting that if participants had not been explicitly guided through these features beforehand, the experience might have been more confusing/overwhelming and therefore negative. Further investigation is also needed regarding why the use of sound was found to be disruptive to the experience, despite a few people finding that it was a positive factor that increased their overall immersion. One suggestion could be that the irregular usage of audio throughout the website caused visitors to become jolted when they suddenly heard sounds in the middle of an otherwise silent prototype.

As with any interface that is custom-made to fit a specific collection, scalability and generalize-ability quickly become significant issues. Since most of the underlying data regarding physical appearance and material properties is collected manually, the time and effort needed to scale up to a larger number of books are incredible. It is also questionable whether the proposed layouts (for example the shelf layout) would still be practical and aesthetically pleasing when used for remarkably more books, mainly because this collection contains more than 800 anthologies. Research shows that excluding items from an overview can give a more positive experience [8,31,81], but it then introduces problems with biases and artificial data curating [87]. Scaling up might entail altering the layouts, or merely introducing scrolling or zooming techniques. While increasing the number of items may be problematic, the visual metaphors of the book pile and bookshelf, as well as the filter designs, can easily be applied to another set of hand-made or printed works, rendering the design generalize-able.

“Without materiality, the immateriality is destined to collapse” [33, p. 75].

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References


Appendix A  Ethics Form

UNIVERSITY OF ST ANDREWS
TEACHING AND RESEARCH ETHICS COMMITTEE (UTREC)
SCHOOL OF COMPUTER SCIENCE
ARTIFACT EVALUATION FORM

Title of project

Exploring Sensed Aesthetics in Digitized Print Collections through Visualization

Name of researcher(s)

Malak Foad Sadek

Name of supervisor

Uta Hinrichs

Self audit has been conducted YES ☑ NO ☐

This project is covered by the ethical application CS12476 (amended for 2019/20 due to COVID-19)

Signature Student or Researcher

Malak Sadek

Print Name

Malak Foad Sadek

Date

2/6/20

Signature Lead Researcher or Supervisor

[Signature]

Print Name

Uta Hinrichs

Date

05/06/2020
Appendix B  Additional Sketches of Visualization Designs

Sketches are shown on the following page.
Information on anthology DB comments → slanted if text slanted

- mis matching paper sizes or bad binding
- binding
- tape for damage
- ink color

- intensity weight
- thickness

- cover color & texture
- paper color & texture

- illustration or marks of interest
- draggable

↓ actual dimensions
- jagged edges represent level of damage or glitches

Title

* Connect & annotate elements
* Damage from interaction remains
* Dragging damages
* Sound for category, heartbeat, or intended audience
Title

1. 
2. 
3. 

ink

Damage

illustration

marks or notes

binding

Zoom ins

DB comment

Paper

texture

DB comment

width
layered books

Illustrations & marks

Info

Moving shadows

Process

Contents
can only take top one

* Rearrange based on properties

represent timeline

colors, thickness

random order, no names
Title

Books as pixels
* Arrange as color wheel

* Interactivity, swap around, reorder by property

- Outline weight dimensions
i.e.
ion
or video
binding

Title
Paper

Illustration

material

handwritten annotation

mark or stain

mismatch
tilt/flush

Dimensions
> All books of one material

> Title or drawing

> Colors of book

> Colors are not the same or compared to maximum

> Paper in blank space

> Heart beat idea
*Zoom in

- length
- width
- number of stories
- cover color
- thickness
- weight

Damage
Appendix C  Additional Filter Explorations

Figure 68: Exploring the possibility of having a supplemental view that shows illustrations (similar to the one showing cover textures).
c  ADDITIONAL FILTER EXPLORATIONS

Figure 69: Exploring the possibility of filtering by letters to showcase the title typographies.

Figure 70: Exploring the possibility of filtering illustrations by the basic shapes found within them.
Figure 71: Exploring the possibility of creating a color wheel using dominant cover colors.

Figure 72: Exploring alternative layouts for color/texture cards.
Appendix D  User Study Questionnaire

The questionnaire begins on the following page and was obtained by exporting the Qualtrics survey into a PDF.
Exploring Sensed Aesthetics in Digitized Print Collections through Visualization

Start of Block: Default Question Block

You are being invited to participate in a research study titled Exploring Sensed Aesthetics in Digitized Print Collections through Visualization. This study is being done by Malak Sadek from the School of Computer Science at the University of St Andrews. The goal behind the study is to explore different ways of representing print collections digitally with a focus on their aesthetic and physical properties, more so than their content. It has been found that aesthetic qualities such as cover colors and tactile properties of a play an important role in book exploration and reading. However, most digital libraries and book stores just offer generic list views on their collection that all look and feel the same.

This project aims at providing a digital experience with book collections that picks up on the aesthetic, physical and material properties books. As part of this, I have developed a prototype that I would like you to explore and then answer some questions in form of a survey about your experience with it. The survey should not take longer than 15 minutes to fill out. Survey questions focus on your experience of the prototype only; there will be no personal questions.

There is no potential risks associated with taking part in this study that exceed the risks of everyday life. Your participation is entirely voluntary, and you can withdraw at any time. You are free to omit any question.

It is important that you are able to give your informed consent before taking part in this study and will have a chance to do at the end of this page. This research is not funded. It is conducted as part Malak Sadek’s MSc Dissertation (CS5099). Answers are collected digitally and no identifying information about the participants will be collected. Your data will be stored in an anonymized form so that no-one can use any reasonably available means to identify your identity from the data. Only myself and my supervisor - Drs Uta Hinrichs and Loraine Clarke - will have access to this data. The analysis of the survey results will be finalized within a year and, will be written up as part of the my CS5099 project report and academic publications. Your data will be stored for a period of 1 year before being destroyed.

No matter their physical location, researchers are required to store and make use of personal data as if they were in the UK; University requirements and the provisions of the data protection law apply at all times. The University of St Andrews (the ‘Data Controller’) is bound by the UK 2018 Data Protection Act and the General Data Protection Regulation (GDPR), which require a lawful basis for all processing of personal data (in this case it is the ‘performance of a task carried out in the public interest’ – namely, for research purposes) and an additional lawful basis.
for processing personal data containing special characteristics (in this case it is ‘public interest research’). You have a range of rights under data protection legislation. For more information on data protection legislation and your rights visit https://www.st-andrews.ac.uk/terms/data-protection/rights/.

For any queries, email dataprot@st-andrews.ac.uk.

This research proposal has been scrutinized and subsequently granted ethical approval by the University of St Andrews Teaching and Research Ethics Committee. If you have concerns about the study, please contact the researcher at mfzs1@st-andrews.ac.uk. If you feel uncomfortable in doing so, please contact the Supervisor or the School Ethics Contact (contact details below). A full outline of the procedures governed by the University Teaching and Research Ethics Committee is available at https://www.st-andrews.ac.uk/research/integrity-ethics/humans/ethical-guidance/complaints/.

**Dissertation Supervisors:** Uta Hinrichs, Loraine Clarke

**Contact Details:** uh3@st-andrews.ac.uk, lec24@st-andrews.ac.uk

Please ensure you have read the above information and select the following before continuing:

- [ ] I agree to take part in this study
General Experience

How would you describe the prototype you have just explored to someone who hasn’t seen it before?

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

What are the things you liked best about this prototype?

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

What did you not like or felt was lacking about the prototype?

________________________________________________________________
________________________________________________________________
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________________________________________________________________
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________________________________________________________________
________________________________________________________________
This book collection is also available via a typical digital library interface, with a grid-based view of books to the right and filter keywords to the left (see below). Do you feel that there is a difference between this type of representation of the book collection and the prototype that has been shown to you? If so, can you describe the difference(s)?

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
Please read the following statements about the suitability of the prototype for exploring the anthology collection and finding potentially interesting anthologies. To what extent do you agree or disagree with the following statements?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree or Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I was able to find suitable anthologies for the given task.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. I am satisfied with the selection of anthologies I found as part of my exploration.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. The prototype overall raised my curiosity and interest in the collection.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. The prototype made me feel that I want to read some of the stories in the anthologies.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. I see value in this form of representation of unique book collections in digital space.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Once fully implemented, I would like to use the prototype for exploring the anthologies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
more. or recommend it to a friend

7. I would recommend this form of interface to explore collections such as the anthologies to a friend.

If you have any comments about the statements above about the suitability of the prototype for exploring the anthology collection and finding potentially interesting anthologies, please specify these below:

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
Please read the following statements about the visual representation of the anthologies in the prototype. To what extent do you agree or disagree with the following statements?

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neither agree or disagree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The design of the prototype helped me to gain an understanding how the collection of Gibson Anthologies looks like in real life.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2. I feel the representation of anthologies in this prototype is visually overwhelming.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>3. The visual aesthetics of the prototype make me want to explore the anthologies more.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>4. I feel the different visual filter options provide inspiring angles from which to explore the anthologies.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
If you have any comments about the statements above about **the visual representation of the anthology collection using the prototype**, please state them below:

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

Page 8 of 23
Please read the following statements about interacting and exploring the anthology collection using the prototype. To what extent do you agree or disagree with the following statements?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neither agree or disagree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I found the experience of interacting with the prototype satisfying.</td>
<td>☐</td>
<td>☐</td>
<td>☒</td>
<td>☒</td>
<td>☐</td>
</tr>
<tr>
<td>2. At some point I got lost in the different features of the prototype and needed to refresh the page or start over.</td>
<td>☐</td>
<td>☒</td>
<td>☐</td>
<td>☒</td>
<td>☐</td>
</tr>
<tr>
<td>3. I found the interface unnecessarily complicated.</td>
<td>☐</td>
<td>☐</td>
<td>☒</td>
<td>☒</td>
<td>☐</td>
</tr>
<tr>
<td>4. I found it easy to understand how the filters work.</td>
<td>☐</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☐</td>
</tr>
<tr>
<td>5. I was able to use the interface without instructions or asking for help.</td>
<td>☐</td>
<td>☐</td>
<td>☒</td>
<td>☒</td>
<td>☐</td>
</tr>
<tr>
<td>7. I felt was able to learn and understand how to use the interface quickly.</td>
<td>☐</td>
<td>☐</td>
<td>☒</td>
<td>☒</td>
<td>☐</td>
</tr>
</tbody>
</table>
8. I found the interface intuitive to use.

9. Interacting with the prototype was a fun experience.

If you have any comments about the statements above about interacting and exploring the anthology collection using the prototype, please state them below:

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

Visualization Layouts

1. Pile Layout

Please answer the following questions about the pile layout (see above):

<table>
<thead>
<tr>
<th>How would you describe the visualization's layout?</th>
<th>Too messy/random</th>
<th>Overwhelming/Confusing</th>
<th>Neutral</th>
<th>Promising</th>
<th>Very Suitable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Validated</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

What's one thing you liked most about this layout?
________________________________________________________________

What's one thing you felt did not work well in this layout?
________________________________________________________________
2. Shelf Layout

Did you get a chance to explore the alternative shelf layout for the visualization (see above)?

- Yes
- No

Please answer the following questions about the shelf layout:

<table>
<thead>
<tr>
<th>How would you describe the visualization’s layout?</th>
<th>Too Messy/Random</th>
<th>Overwhelming/Confusing</th>
<th>Neutral</th>
<th>Promising</th>
<th>Very Suitable</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What's one thing you liked most about this layout?

________________________________________________________________

What's one thing you felt did not work well in this layout?

________________________________________________________________
Interactivity

1. The Search Bar

Did you use the search bar (see above)?

- Yes
- No
To what extent do you agree or disagree with the following statements?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neither agree nor disagree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>The search bar was straightforward to understand.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The search bar was straightforward to use.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The search bar adds value to the interface.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The search bar gives information about the collection beyond simply filtering.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The appearance of the search bar is pleasant.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Please provide any additional comments about the statements above and/or your experience with the search bar:

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
2. The Story Dates Filter

Did you use the story dates filter?

- Yes
- No

To what extent do you agree or disagree with the following statements?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neither agree nor disagree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>The story dates filter was straightforward to understand.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The story dates filter was easy to use.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The story dates filter adds value to the overall prototype.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The story dates filter provides valuable information about the collection.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The story filter’s appearance is pleasant.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Please provide any additional comments about the statements above and/or your experience with the story filter:

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

3. The Cover Color Filter

Did you use the cover color filter?

☐ Yes
☐ No
To what extent do you agree or disagree with the following statements?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neither agree nor disagree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>The cover color filter was straightforward to understand.</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>The cover color filter was easy to use.</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>The cover color filter adds value to the interface.</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>The cover color filter provides valuable information about the collection.</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>The cover color filter's appearance is pleasant.</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

Please provide any additional comments about the statements above and/or your experience with the cover color filter:

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
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________________________________________________________________
4. The Anthology Size Filter

Did you use the anthology size filter?

- Yes
- No

To what extent do you agree or disagree with the following statements?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neither agree nor disagree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>The anthology size filter was straightforward to understand.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>The anthology size filter was easy to use.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>The anthology size filter adds value to the interface.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>The anthology size filter provides valuable information about the collection.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>The anthology size filter's appearance is pleasant.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
5. Sound

How did you feel about the usage of sound throughout the interface?

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>The use of sound enriched or improved my overall experience</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I didn't notice sounds being used</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>The sounds used were disturbing or disruptive to my experience</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I felt more immersed in the experience because of the use of sound</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
Please provide any additional comments about the statements above and/or your experience with the use of sound in the interface:

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

Page Break
Overall Impact
Lastly, please rate how the interface felt to you. Below you’ll find a list of words and their opposites, for each pair of words, select the mark closest to the word that you feel better reflects the interface and your experience with it.

Eg. I felt the interface was very human so I selected the leftmost mark on the first line, but I felt it was quite complicated but not incredibly so I selected the mark second from the right on the second line.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simple</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Practical</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Captivating</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valuable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unpleasant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conventional</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Straightforward</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Predictable</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Rejecting</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Challenging</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Motivating</td>
<td></td>
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<td></td>
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<tr>
<td>Technical</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complicated</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impractical</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dull</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not Valuable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pleasant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inventive</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Cumbersome</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unpredictable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inviting</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Undemanding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discouraging</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix E  User Study Questionnaire Open-Ended Answers

Below are all participant answers to open-ended questions asked in the questionnaire. Please note that they contain no identifying information. All the scaled and closed question answers were shown within the discussion chapter.
How would you describe the prototype you have just explored to someone who hasn’t seen it before?

- **Participant 1**: A new and digitalised way of experience books based on their physical properties

- **Participant 2**: I would describe it as an online library that provides an enhanced vision and presentation of books/articles in order to give a more real-life experience instead of just providing a list.

- **Participant 3**: A new way to explore books online, providing the feel of being in a library and helping people enjoy a search for a new book.

- **Participant 4**: Unprecedented and original. It aims to focus on aspects of books that are not focused on by popular means of searching for publications: Libraries, archives etc. Even though you can apply multiple filters at once, this does not affect the system’s simplicity. To its credit, the simplicity is maintained throughout.

- **Participant 5**: It is basically a platform of books that shows the characteristics of the design of the book cover, the texture of the pages and so on. You can choose different books to look more closely.

- **Participant 6**: Extraordinary, unusual, mesmerizing

- **Participant 7**: It is an interactive book store that offers to explore the Gibson collection. This collection can either be explored in a book shelf or on a table. It additionally offers plenty of opportunities to browse for book types by applying filters and sorts.

- **Participant 8**: A brand new way to explore books.

- **Participant 9**: Interesting and very unique, never seen anything like it

- **Participant 10**: So very playful, great interaction with the books and searching. Seems to fill the gap that other online library resources are missing.

- **Participant 11**: It’s interactive, cool, different, and makes me smell books:)

- **Participant 12**: I would describe it as an online library which focuses on the physical attributes of books.

- **Participant 13**: An interactive computer-based alternative of browsing a book shop.

- **Participant 14**: The prototype allows you to explore different anthologies by Gibson. It also allows you to experience sounds and colors while exploring similar to the sounds and colors you would experience while exploring with real books.
• **Participant 15:** In contrast to the typically available purchasing or reviewing interfaces online for books, this interface gives one a more aesthetic and physical real-time experience, where it allows you to not just view a book in pictures, but experience the whole beauty of a book as it was intended by the creator. This is especially in the case of books that are handmade and unique with intricate details on them, like the collection used within this prototype.

• **Participant 16:** I would describe it as a good way for sorting with a digital library interface and it can be helpful in categorising.

• **Participant 17:** The prototype provides a unique representation and perception of books in a digital space, allowing you to explore a book beyond its content and can also be defined by its physical properties such as texture, colour or size.

• **Participant 18:** A prototype which aimed to portray the physical aspects of literature, through an amalgamation of anthology books. Which aimed to take into account the physical aspects of reading through digital interaction. May it be through the size of the book on it’s side. Also being able to filter them by colors dates. There is also a way to explore the books through a pile or shelf, and the the pile allows you to drag the books around through a physics enabled interaction.

• **Participant 19:** The prototype presents books not only in terms of title, content, and author but also in terms of texture, colour and overall feeling.

• **Participant 20:** The prototype is useful website for displaying books in an alternative way that gives you more of a feel of the physical properties of the books.

• **Participant 21:** This prototype is based on physical appearance of the collections. You can choose the books that you like by viewing the visual elements. I will recommend it to friends who are interested in art.

• **Participant 22:** A tool to find books and stories within books based on their physical appearance (visual through colours, texture through touch, etc.)

• **Participant 23:** The prototype is a virtual collection of sci-fi books cleverly organised in such a way that the user gets an accurate feel of the anthologies. Each collection has it’s a tool tip attached that describes the material it’s written on. The collections can also be neatly organised in a shelf where they’re displayed proportionally to their dimensions. A timeline of the collections is also displayed which gives an overview of how old these collections are.
What are the things you liked best about this prototype?

- **Participant 1:** The design concentrates on only a few properties of the book that are important and leaves out unnecessary information which makes the experience pleasant and not too overwhelming as in usual online book stores on libraries.

- **Participant 2:** I liked the more casual style of presenting the books and the layout encourages higher engagement and curiosity of looking at them, their designs, etc. I think the prototype would be more likely to make people engage with all the books available, whereas in a typical digital library interface, people are unlikely to scroll through list after list of books.

- **Participant 3:** Visually, it was very appealing. I liked the feeling of finding a book to read - it felt more like physically choosing, rather than scanning. I liked that there are different ways to search. Also, it is so easy to use, and very intuitive.

- **Participant 4:** Personally, I liked how one can apply several filters at the same time, meaning you can become very specific in your search. When it comes to publications, there is certainly a link between the book’s content and its physical appearance and characteristics. It is rarely arbitrary. Thus, I certainly feel that a book’s physical appearance is a suitable focus area when searching for a publication.

- **Participant 5:** The pile layout - the sound of the sheets - filter for years but also that all three filters are working together.

- **Participant 6:** That’s it is so different to normal online bookstores, the interactivity and that it makes use of your senses.

- **Participant 7:** The thing I like best is the filtering mechanisms, that allow a great variety of options to interact with the collection.

- **Participant 8:** 1. The interface of piles. Feel like there is really a lot of books on the desk ready for exploring. 2. Colour filter and the combination of different filter conditions.

- **Participant 9:** Adding the visual elements to selecting books is a great idea.

- **Participant 10:** The variety of ways to explore the books. Not just a normal search grid type view. Loved the pile that was interactive and reorganised depending on filters. Definitely gave a more playful aspect. For those who like a bit more organised the shelf gave that too. The filters gave a very unique and different view of searching for things.
• **Participant 11:** I LOVE the visuals and how interactive it is. Unlike most websites, this one brings lots of senses alive than the visual sense. Not even by actually sensing, but by inducing the imagination of sensing. It's cool.

• **Participant 12:** The visualization of the website, the UI (it seemed easy to use and intuitive), the general design of the prototype. I liked how unique it was since I have never seen an online library where the users can filter books by their physical attributes. I believe that these physical attributes are important when I am looking for a book that I wish to read for pleasure.

• **Participant 13:** The ability to fine-grain search through literature by unique properties such as textures and cover colours.

• **Participant 14:** The different ways to explore the anthologies. The different ways to sort the available material in an interactive way. Also, the sound effects while exploring.

• **Participant 15:** 1) The overall feel of the interface actually made me feel closer to a real bookstore (much more than the currently available interfaces I've seen). 2) I really liked how every detail of aesthetics has been incorporated, including the bit of messiness that one usually finds in a cluttered pile of books. I found this even in the filter options, with irregularity in the colour tile choices and actual texture used for backgrounds, adding in to the overall experience. 3) The wide range of dimension options helped in giving a better idea of how a book actually looks.

• **Participant 16:** The user experience and the ease of use.

• **Participant 17:** All the detailed settings which allows you to explore the books (e.g. colours, drawing, dragging, size, texture etc.). It highlights the unique physical traits of the books in the collection. Very beautiful interface!

• **Participant 18:** Definitely the pile of books. Really felt like that enticed the physical aspects of reading. Also the filters in the way they are all varied was really good. Especially with the size aspects, which really helped to bring into play the physical notion of reading.

• **Participant 19:** I liked that I had so many options to filter through everything that exists (time, colour, texture, thickness, etc). I further liked that I could drag and drop and see exact book dimensions. That made it very real. Another noticable thing was the use of either a pile or a shelf.

• **Participant 20:** I liked the different kinds of filters for books, an interesting way of finding books with different properties other than the usual way of filtering.

• **Participant 21:** The filter is really impressive. I can explore the collections by different combinations of year, colours and sizes.
• **Participant 22:** The consistent look of the entire prototype (font, colours, style), the vast array of options for visualising the books, the adaptive interface depending on how many books are retrieved and the very intuitive and deep filtering/sorting system.

• **Participant 23:** The scale feature where you can measure the size of the collection. 2) The shelf feature which organises the books on a shelf like a traditional shelf of books.
What did you not like or felt was lacking about the prototype?

- **Participant 2**: I think this experience is more suited to people who are just browsing for a potential book to read for personal pleasure as opposed to academic/professional work. The layout, for me, is designed to draw the reader in and spend time browsing as opposed to quickly trying to find a source.

- **Participant 3**: A way to search by content, or explore content. That may be missing the point of it all - but practically, one might need that option.

- **Participant 4**: The current scale system seemed quite cumbersome, but this was pointed out as being due to the current system's status as a prototype. I think this is quite an important aspect of the website, as size can be a factor when looking or choosing a book/publication.

- **Participant 5**: I think it would have been nice to see at least one or two sentences describing briefly the collection shown here - so that any visitor gets a better understanding of what type of books he is looking at - is it science fiction or romance or thriller... Or what type of collection it is - gibson that he collected science fiction and printed/copied them on stuff in the house.

- **Participant 6**: In terms of experience I did not feel that it lacks much, maybe a bit overwhelming because it is so different but once I would get used to it. It’s a great experience

- **Participant 7**: On the one hand, I liked the sound, knowing what it meant. On the other hand, this could be confusing as it is not a 100% clear that those are pages flipping.

- **Participant 9**: Maybe a button to switch to a grid. I love the interaction but if i was needing to select a book in a hurry i would struggle

- **Participant 10**: 1. Filter menu background was a very similar colour to one of the collections of book covers. Maybe change this? 2. Add a tooltip to the colour wheel + symbol. Might not be that intuitive to people that you click there to add a colour filter. 3. Have the filtering transfer over to the shelf

- **Participant 11**: Can’t think of what’s lacking. The only thing I’d recommend more thinking about is the spread out of the book pile, given there’s significant white space in the corners. Also, the location of the Venn diagram when filtering for books appears on the bottom right hand corner when the filters are on the left side, so that was a bit disorienting.

- **Participant 12**: Not applicable
- **Participant 13:** Nothing immediate stood out, although, it would be interesting to see how the application would work on different screen sizes.

- **Participant 14:** It was not clear how a user can read the contents inside the anthology. The prototype focuses a lot on exploration by cover, but very little on exploration by content. Also, in the color picker filter, it was unclear how to clear the filter if a user does not want to filter by a particular color anymore.

- **Participant 15:** Although the filtering options gave an opportunity to search deeper into what one would be looking for, since it is quite different from the typical filtering options, at first glance, it might seem a bit complicated, but getting more familiar with the interface is definitely worth the slight complication.

- **Participant 16:** How the prototype isn't able to be used.

- **Participant 17:** Nothing really. I like it!

- **Participant 18:** Perhaps just the bug testing in regards to layers overlaying each other if some were toggled without un-toggling the other layer. Maybe aswell adding an indicator to the zoom feature to the right, and also on the colour filter, to add an indicator to the + so that the user knows they can add other colours

- **Participant 19:** I feel like the creation of a room would have been good. Maybe a bigger shelf or even a way to walk towards the shelf or pile of books to come closest to reality.

- **Participant 20:** - For the anthology size filter, it was difficult to know how the filter actually worked - Due to the fonts, it was also difficult to know what books were there at a glance - The filter button could be more pronounced so that the user can find it easily. Maybe have a panel on the left that is already expanded so the user doesn’t have to click on it. i.e Amazon - https://www.amazon.co.uk/s?rh=n%3A268062%2Cp_72%3A4-&pf_rd_i=268062&pf_rd_p=80d1d379-688d-5c9fa112-03d40f1a5717&pf_rd_r=JFEXX8XYXRVSVTW7242&pf_rd_s=merchandised-search-10&pf_rd_t=BROWSE&ref=Oct_s9_apbd_otopr_hd_bw_b17ja_S - More attributes for filtering - would having reviews of the anthologies be suitable?

- **Participant 21:** I think for the book shelf we can have more detailed view for one book when choosing it.

- **Participant 22:** Sound inconsistently used (at the very beginning, pages). Additionally, the search bar font is hard to read.

- **Participant 23:** More filtering options would make the user experience more personalised.
This book collection is also available via a typical digital library interface, with a grid-based view of books to the right and filter keywords to the left (see below). Do you feel that there is a difference between this type of representation of the book collection and the prototype that has been shown to you? If so, can you describe the difference(s)?

- **Participant 1:** While this view gives me more information, the amount of information available seems too much and sometimes unnecessary - Although I can now see the titles and not only the cover, I can only see part of it in some cases which doesn't help me - The date issued section is too much, the interface in the prototype was more appealing.

- **Participant 2:** Yes, I believe there is a difference. The prototype is a more casual and real-life type way of presenting a book collection, whereas the typical digital library interface is purely a list and is less likely to draw attention or higher engagement with the materials.

- **Participant 3:** This is boring to look at. The prototype is more engaging. I would not browse books shown like this. I would only use it if I had a particular book in mind. I would not use the grid if I was looking to read as a leisure activity. It gives me a headache just looking at it, and (without evidence) I assume it would be hard to use.

- **Participant 4:** Personally, I would argue that the key difference between the two representations of book collection is what type of factors they both consider and focus on when searching. The prototype that was shown to me focuses on the physical traits of the book, as well as any unique characteristics the book may have. The other focuses on the actual content - being the subject, author, date of publication. Also, the site shown to me was far more interactive. Searching in that manner did not feel as laboured or monotonous as the standard means of searching for a book. In short, the former system was an experience in itself.
• **Participant 5**: Yes, there definitely is. The prototype is a lot more creative which is reflected in the book collection. Also the filters are clearer to understand in the prototype. The digital library interface is boring, because it's nothing new. also the filters are not really well grouped. Furthermore I don't feel any inspiration to look more close to any of the books. Which is not the case in the prototype.

• **Participant 6**: The prototype is a lot more immersive and let's you rummage for books. However, when you quickly want to find a book the typical interface might be more convenient.

• **Participant 7**: Yes, there is a huge difference, as the static library has a different type of interaction. With the new library people are invited to explore more and enticed to browse the library. This will most probably end in people spending more time on the page and getting to know more about the collection.

• **Participant 8**: 1. Didn’t find any search text box inside the old interface. I think this is the basic need for me. 2. The old one is less aesthetic which would let me don’t want to explore this site unless I have to.

• **Participant 9**: Yes, the prototype makes you want to interact and explore what is on the page. The grid above is generic.

• **Participant 10**: The grid initially stands out as the main element here. It overpowers the purpose of the website which is to explore the collection. It does not feel as fun and feels very regimented in the exploration that can be had. I feel that with the prototype you can gain a greater understanding via the unregimented feeling. In addition, the prototype feels more approachable. As in, you want to approach it and play around with it to find something you were looking for or find new things you didn’t even know you wanted! I wouldn’t do that with the image above.

• **Participant 11**: oh my GOD. no no no. DEFINITELY like the prototype better. this is boring. the prototype got my senses activated!

• **Participant 12**: The grid based view is a more traditional representation among online libraries. However, the representation that was shown to me reminded me more of a physical book store or library. I could gather more accurate information about the physical appearance of the book.

• **Participant 13**: The prototype shown is far more interactive and personal - this makes the experience better (if we assume this is what users are after). Although, the above method does seem more efficient as filter and search options are immediately available on one page. The prototype might be excellent for a younger demographic who would prefer a better experience over efficiency.

• **Participant 14**: Yes, there is a difference because the prototype shown engages a user in a way that this grid-based view does not. It also encourages users to look at
books which a user may not have come across otherwise, whereas in the grid-based view the user is restricted in the number of books they can see at a time.

- **Participant 15**: Yes, it is different. This grid-view in the image gives no value to the uniqueness of the books. In real-life, a clothing store is very different from a bookstore. But putting them in a grid-view like this, wouldn’t show the difference in the experience you get when going to either store, but the prototype actually does bring us much closer to a real bookstore or library, in the way you see, perceive and feel books.

- **Participant 16**: This is merely sorted in alphabetical order and does not help me in getting any information.

- **Participant 17**: The prototype offers a more exciting and fun representation of the books, raising my curiosity and interest in exploring the collection.

- **Participant 18**: I think there is definitely a difference. This typical library interface feels far less user friendly and takes a more of a database approach then like in a library where you are exploring to find books or sifting through them. I think the prototype takes a far more explorative and playful approach, one that also seemingly seems to have a lower level of technical literacy.

- **Participant 19**: There is a big difference. I think that this presentation here is one we are so used to that we cannot even ‘feel’ books anymore. It does not come close to what it is to experience books in person and is an established digital library. The prototype presents something that does not exist perse and thus allows us very new ways of filtering and knowing what a book would be like in real life. Moreover, the prototype focuses on very different details (texture, colours, size) than this digital library.

- **Participant 20**: - The names of the books appear to be more clear and easier to know what books are there at a first glance. - There is also more information on the left pane about attributes of the book

- **Participant 21**: I think the filter in the prototype is much more intuitive, and easier to interactive with. You don't need to read much text and all is visual guided. The filter also use colour for filtering.

- **Participant 22**: Yes the main difference is the filtering options. The book collection once requires metadata about the book to be known (e.g. collections, dates, ...), whereas the other one requires visual cues to find the book.

- **Participant 23**: The digital library interface diminishes the value of these collections and does not give a clear depiction of how the collections feel. While this format might work for normal books the prototype augments their value.
If you have any comments about the statements above about the suitability of the prototype for exploring the anthology collection and finding potentially interesting anthologies, please specify these below:

- **Participant 3**: I am not sure how valuable exploring by colour or size is. It is fun, but maybe not very useful.

- **Participant 5**: It was the first time I have heard about anthology collections, so I am not familiar at all with this topic, but the prototype made me curious.

- **Participant 10**: I would definitely like to use this type of interface if looking for something completely new.

- **Participant 11**: Please show the libraries how they can do more of this and make our readings more interesting and fun!!

- **Participant 13**: As said in the previous section, I feel the suitability of the prototype might be extremely suitable for a younger target audience who seek a more personal experience.

- **Participant 20**: Would be great to understand more how the search functionality worked. - Was wondering, are there any user studies to decide the 3 filters; story dates, cover colour and anthology size? Would be interesting to know the usage percentage of each filter and other filters that might be useful.

- **Participant 21**: Perhaps a full view of the anthology is more helpful for choosing.
If you have any comments about the statements above about the visual representation of the anthology collection using the prototype, please state them below:

• **Participant 3:** It was pretty!

• **Participant 4:** Regarding question 2, I certainly do not think that the representation was 'visually overwhelming'. Rather, it allowed one to simply see the physical properties of the book. I do not feel visually overwhelmed when looking for books in a library and essentially this is no different. What was shown to me seems like a microcosm of being in an actual library. As said previously, it is an experience - it feels as if you can touch and appreciate the book in its physical form. The only other means to do this is physically being in library or archive.

• **Participant 5:** I assume overwhelming is meant in a negative context in the sense that the design is too much for an eye to focus on one thing or to know where to look next. From this assumption I can say that this is not the case, the design is really clear and the covers / books are in the center of the users attention.

• **Participant 7:** Like the filters most!

• **Participant 10:** Great representation! Very different and unique way of looking for things!

• **Participant 11:** I wouldn't read this kind of books but the visualization got me interested!

• **Participant 13:** The filter and sort methods were abstract and very interesting.

• **Participant 17:** Given all the filters and options to interact with the anthologies, the representation of the books are not overwhelming at all.

• **Participant 20:** The overall visual representation is good, the fonts need to be a bit clearer and would be helpful if we could know more information about the books like the grid format i.e author, creator, date issued, reviews possibly, formats (audio, cd, softcover, hardcover)

• **Participant 21:** They are really good, not only colours but the texture.
If you have any comments about the statements above about interacting and exploring the anthology collection using the prototype, please state them below:

• Participant 3: I like the animations (not sure if that is the right word). It is very interactive and fun to use.

• Participant 4: I would like to stress particular emphasis on questions 8 and 9. Such a method of searching for publications is unprecedented and being able to appreciate the physical qualities of books via a computer screen is most definitely intuitive as well as fun.

• Participant 10: Very well thought out interface with a lot of intricate options but due to the thought process and design behind is very simple and clear for the user. Been a bit harsh, question no.8 has been marked as agree due to the minor element of the + on the colour wheel discussed earlier! (Earlier: Add a tooltip to the colour wheel + symbol. Might not be that intuitive to people that you click there to add a colour filter.)

• Participant 11: This has made it more approachable for someone who would otherwise not thinking of exploring it.

• Participant 17: It looks amazing and is a great idea. Love it!

• Participant 19: I think all filters were very value-adding and interesting, however the only filter that I would need additional explanation on was the time filtering filter.

• Participant 20: Maybe some hints on how the filters work would be helpful for users that haven’t received an explanation.

• Participant 21: Generally, the interaction in the prototype is easy for me to understand.
**What's one thing you liked most about this layout? (Pile Layout)**

- **Participant 1:** It is more appealing than just a roster of books
- **Participant 2:** I think it's fun to play around and click on the different books/collections
- **Participant 3:** You physically can move books to find more books.
- **Participant 4:** The specific and unique detail that is evident on each cover.
- **Participant 5:** It represents the uniqueness and creativity of the way the books were produced - loved the drag and drop feature
- **Participant 6:** makes you want to explore things
- **Participant 7:** contrasts and colors as well as varying sizes.
- **Participant 8:** The fidelity of pile. Looks really real.
- **Participant 9:** colours!
- **Participant 10:** How different it is!
- **Participant 11:** Spread out:)
- **Participant 12:** it's randomness
- **Participant 13:** Visually pleasing and something that you wouldn't expect on a digital book-finder.
- **Participant 14:** It's easy to see the collection in one screen without having to scroll.
- **Participant 15:** the messiness bring life to the books.
- **Participant 16:** The colour spectrum
- **Participant 17:** Quick overview on the colour scheme and differences between the anthologies
- **Participant 18:** the explorative nature of it
- **Participant 19:** It's so customisable due to the drag and drop and very satisfying to see books in a pile. It makes the interaction very realistic.
- **Participant 20:** The different colours allowed you to separate the books
• **Participant 21:** seeing all of them at the same time and view.

• **Participant 22:** Realistic representation of what it feels like when searching a book from scratch

• **Participant 23:** The books are organised by hue and gives an overview of the number of collections.
What's one thing you felt did not work well in this layout? (Pile Layout)

- **Participant 1:** Books which are at the front of the pile get more recognition, while I felt that books on the back could be forgotten.

- **Participant 2:** If one was looking for a specific book/collection, it's probably not the most efficient way to find it.

- **Participant 3:** The white books on the left look boring compared to the others.

- **Participant 4:** Where it is deliberately cluttered, some people could find that as obstructive when trying to look for a specific publication. Nevertheless, it certainly delivers on an authentic appearance.

- **Participant 5:** People might overlook the one or other book in the pile when it's completely covered by others - users might not understand/find the drag&drop feature.

- **Participant 6:** A bit hard to read all covers.

- **Participant 7:** Nothing.

- **Participant 8:** Maybe would be hard to click one that at the very bottom.

- **Participant 9:** Finding a book under the pile.

- **Participant 10:** Nothing, with the interactions in place all are explorable.

- **Participant 11:** Love it.

- **Participant 12:** Sometimes books get covered too much.

- **Participant 13:** Some books hidden - how is it decided what books are shown?

- **Participant 14:** It can be a little overwhelming about where to begin, or how to find things.

- **Participant 15:** Some books are hidden, although it's part of the real-life visual aid.

- **Participant 16:** No order besides the spectrum.

- **Participant 17:** Cannot get a detailed view of the anthologies and some are hidden (if you would not have filters or dragging option).

- **Participant 18:** In my case, the internet connection was slow so this led to a slow and buggy interaction.
• **Participant 19:** I would feel like I may have to 'dig deep' to find the hidden books.

• **Participant 20:** Pile kind of obstructs the names of the books

• **Participant 21:** a little bit distracted

• **Participant 22:** Not all books are immediately visible

• **Participant 23:** A The number of collections might be confusing. Especially since the fonts in some collections are slightly muted.
What's one thing you liked most about this layout? (Shelf Layout)

• Participant 1: looks clean and organised and I can see the different sizes

• Participant 2: It looks like a normal library shelf

• Participant 3: It is easy to read.

• Participant 4: You can easily appreciate the size and dimensions of the books.

• Participant 5: The order - the user can see each book that belongs to the collection next to each other

• Participant 6: It’s engaging but still very clear

• Participant 7: Order in the books and the ability to easily compare length and size of the books

• Participant 8: The high fidelity.

• Participant 9: Easy to read

• Participant 10: Gives a more organised feel but still playful

• Participant 11: LOVE IT. So organized.

• Participant 12: I liked how I can see the differences among the books in terms of size

• Participant 13: The tooltip that lets you view onclick more information about the book - its like picking a book out of a shelf in real life.

• Participant 14: It's neater, and easier to see the collection of books similar to seeing a book in a library.

• Participant 15: The dimensions fit perfectly, helps so much better in understanding the real look of a book.

• Participant 16: Nothing

• Participant 17: More detailed structured view

• Participant 18: you got to see all the side by side views of the books much like you would in a library

• Participant 19: I liked that i could see it from a different angle. moreover, it's very realistic.
• **Participant 20:** Orderly nature of the books

• **Participant 21:** It’s more ordered

• **Participant 22:** Organised

• **Participant 23:** The shelf gives a personalised view. It’s like having a personal collection on your computer. The collections are represented in proportion to their physical size.
What's one thing you felt did not work well in this layout? (Shelf Layout)

- **Participant 1:** smaller books don’t catch the eye as much as bigger books do
- **Participant 2:** You don’t get to see the front covers of the book
- **Participant 3:** It feels unusual to scroll left to right rather than up and down.
- **Participant 4:** Perhaps an aerial view, coupled with the current shelf layout could enhance the experience even more.
- **Participant 5:** this zoom feature when hover over a book
- **Participant 6:** nothing
- **Participant 8:** some book covers have small font size and kind of vague, which would be hard for me to read
- **Participant 10:** Did not understand how they were initially organised left to right
- **Participant 11:** Nothing. It's beautiful. Do not change.
- **Participant 13:** Nothing.
- **Participant 15:** None.
- **Participant 16:** The size of books is not a relevant feature to me
- **Participant 17:** Focus is directed towards brighter colours and bigger books (tendency to explore might be limited)
- **Participant 18:** much like a shelf, the books in front of you hold more focus. it would be nice to have a slider to have them slide in front of you so that all the books have a chance of centered in the frame
- **Participant 19:** it could have been placed on a bigger shelf to make it even more realistic.
- **Participant 20:** The inconsistency of the fonts, if there was a way to also add a consistent font that would be great
- **Participant 21:** Can not see as many details as in the first one
- **Participant 22:** Appears to be random placing
- **Participant 23:** The ordering of the books does not seem helpful.
Please provide any additional comments about the statements above and/or your experience with the search bar:

- **Participant 3:** I am not sure about the text choice (in particular the white fill with the black outline).

- **Participant 4:** The search bar was very much straightforward and fully succeeded in what it is intended to do.

- **Participant 5:** I think the search bar provides the same value to the platform than any other feature since it basically gives you the same information. It’s another way of filter

- **Participant 7:** Search bar autocomplete is a great feature

- **Participant 8:** I think if the thumbnail of each search result is a book cover, that would make more sense to me. Now the image and the text seem to deliver the same information.

- **Participant 10:** N/A

- **Participant 13:** Superb implementation - it’s rare to see images on search options.

- **Participant 15:** I love that the books names show up along with a picture of it from the real book.

- **Participant 17:** I like the pictures given with the title, makes searching so much more pleasant and easier.

- **Participant 19:** The search bar’s design is great and serves its purpose.

- **Participant 20:** N/A

- **Participant 21:** it is really useful to have a preview of the anthologies below.

- **Participant 22:** Font was hard to read, a more traditional/solid font would have been easier to read
Please provide any additional comments about the statements above and/or your experience with the story filter:

- **Participant 4:** This was perhaps my personal favourite aspect of the overall system. It was easy to use and visually pleasant. Furthermore - and perhaps most importantly - its results were very easy to understand. It was really quite interesting to see the dates of each book all laid out simultaneously in the story dates filter. Crucially, it did not get too cluttered when doing this.

- **Participant 10:** As mentioned earlier, the background colour of the story dates filter slightly interacted with one of the colours of the collections.

- **Participant 13:** Again, another great implementation of a unique sort field. This type of sorting is hard to achieve in traditional forms and therefore provides good value to the prototype.

- **Participant 17:** Very aesthetically pleasing, love the many options to filter and the details included

- **Participant 18:** would have been nice to have a clear way to understand what the colour of the date pickers meant

- **Participant 19:** The filter was a little bit difficult to understand. I don’t know whether I would have understood what the little squares mean without instructions.

- **Participant 20:** good way for filtering the books by time

- **Participant 21:** it is really helpful and well designed!
Please provide any additional comments about the statements above and/or your experience with the cover color filter:

- **Participant 4:** I thought it was particularly useful how one could apply multiple colour filters at once.

- **Participant 5:** I think that users might find it difficult to understand that they have to click on the plus first before they can start the filter.

- **Participant 10:** Initially, the + symbol may not be too intuitive to some users. I just like to randomly click things anyway! But, a tool tip may be useful to explain the plus symbol adds a filter. Or, start with one filter on in the middle with the plus symbol on the outside of the colour wheel to add more colour filter boxes.

- **Participant 13:** Although well implemented, I’m unsure you would search for a book based on its colour.

- **Participant 18:** I only understood through Malak that I could add different colours to the color picker. Maybe heightening the fact that you can in fact get more information.

- **Participant 19:** It’s great that one can use multiple colours at the same time!

- **Participant 01:** N/A

- **Participant 21:** May be better if the colour filter is not in a continuous form, because now I feel a little bit like I can’t cover a similar colour at one time.

- **Participant 22:** Hard to tell you could add more colour filters and how they interact together.
Please provide any additional comments about the statements above and/or your experience with the anthology size filter:

- **Participant 4:** None.

- **Participant 10:** very simply and effectively done.

- **Participant 13:** Again, I'm unsure if this sort feature would be useful within a computer-based application.

- **Participant 15:** I really liked that filters could be used in combination of one another. Was extremely helpful.

- **Participant 16:** I like how you could combined the colours and size as well, and how the display of the squares change with the colour chosen :)

- **Participant 20:** Was a bit unclear with how the filter worked at the start

- **Participant 21:** It is intuitive to select and use.
Please provide any additional comments about the statements above and/or your experience with the use of sound in the interface:

- **Participant 3**: If I had been doing this on my computer I would have probably noticed and loved the sound.

- **Participant 4**: I particularly liked how sound was used to differentiate between dissimilar sized anthologies. Once again this added to the overall experience of using the system.

- **Participant 10**: LOVE the sounds! Very special and unique way of tackling how big a collection or book is.

- **Participant 11**: I don't remember any sounds being involved!

- **Participant 13**: I am aware that I am an outlier in this situation, but I tend to dislike sounds when browsing/interacting with applications. In general, I feel they are unnecessary.

- **Participant 17**: Was there sound? I did not notice, sorry!

- **Participant 18**: The connection wasn't good enough for the sounds to work on my device

- **Participant 20**: I didn't notice the sound

- **Participant 21**: In fact I did not really notice the sound during the presentation.