Character-Centric Literary Visualisation for Casual Discussion and Analysis

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Certificate of Original Authorship

I, Natalie House, declare that this thesis is submitted in fulfilment of the requirements for the award of Doctor of Philosophy, in the Faculty of Engineering and Information Technology at the University of Technology Sydney.

This thesis is wholly my own work unless otherwise referenced or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

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"Plot is no more than footprints left in the snow after your characters have run by on their way to incredible destinations. Plot is observed after the fact rather than before. It cannot precede action. It is the chart that remains when an action is through."

Ray Bradbury

Abstract

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Character-Centric Literary Visualisation
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Casual reading communities, like book clubs, can benefit from tools that facilitate character recall and narrative reflection. However, existing resources – such as wikis, social media, other text-based repositories, or even handwritten notes – can lack an integrated format that enables all participants to access a unified presentation of both overview and detailed information, during live discussions. Moreover, current literary visualisation techniques are often designed for expert workflows, and methods for abstracting and extracting data types from unstructured text are still in development. To address these gaps, this research describes the detailed design and evaluation stages of developing a character-centric literary visualisation technique aimed at enriching casual book discussions for non-expert readers. It relies on a custom pipeline that transforms unstructured literary text into appropriate data structures which are then mapped to suitable visual encodings. The resultant technique is a cohesive, singular layout, with an integrated menu system that supports end-users to navigate, analyse, and edit data.

The research was conducted across two studies. In Study I, an interview with a literary expert, and investigation of the relevant literature, helped identify essential textual features that support character and story understanding – particularly for non-experts in literary analysis. This led to the identification of three types of character dynamics – temporal, social, and personal – and to the creation of *Clover Connections*, a layered visualisation technique that integrates storylines, social networks, and unique clover-shaped glyphs to encode the character dynamics in a singular layout. Findings from a task-based evaluation demonstrated the visualisation's effectiveness in supporting non-expert participants to conduct a series of general character analysis tasks, while qualitative feedback indicated areas for further refinement.

Study II enhanced the visualisation by adding plot and genre markers to contextualise character journeys, along with new features for customising the layout, and exploring and editing the textual data. A new evaluation approach was developed to gain improved qualitative insights, coined a book-club scenario focus group methodology. This enabled the capture of multimodal data on non-expert participants' discussions of a pre-read novel and explorations

of unread novels with the support of four different visualisations created using the *Clover Connections* technique. A grounded theory analysis of the data led to the development of a theory on non-experts' integration of casual literary visualisations into casual book discussions.

Synthesising findings from both studies, alongside the insights gathered throughout the design and evaluation processes, has yielded a deeper understanding of the casual literary visualisation design pipeline. This work also articulates four key dimensions of interaction variability that influence the effectiveness and usefulness of casual literary visualisations for end-users. The major contribution of this thesis is a novel character-centric literary visualisation technique, tested with datasets constructed from six novels, while other key contributions include valuable insights into the development of a tool tailored for casual literary analysis, and broader implications for non-expert-targeted visualisation designs. Promising directions for future work include the exploration of genre-specific visualisations, enhanced character relationship encodings, and distributed approaches to casual literary analysis, paving the way for further innovation in this field.

Publication Based on This Work

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List of Abbreviations

ADR	**A**ction **D**esign **R**esearch
AI	**A**rtificial **I**ntelligence
ASiS	**A** **S**tudy **i**n **S**carlet
BERT	**B**idirectional **E**ncoder **R**epresentations from **T**ransformers
CSS	**C**ascading **S**tyle **S**heets
HCI	**H**uman **C**omputer **I**nteraction
HTML	**H**yper **T**ext **M**arkup **L**anguage
infovis	**info**rmation **Vis**ualisation
JS	**J**ava**S**cript
JSON	**J**ava**S**cript **O**bject **N**otation
ML	**M**achine **L**earning
NER	**N**amed **E**ntity **R**ecognition
NEUVis	**N**on **E**xpert **U**ser **vis**ualisation
NLP	**N**atural **L**anguage **P**rocessing
NOVIS	**NO**vice **VIS**ualisation
RtD	**R**esearch **t**hrough **D**esign
UCD	**U**ser **C**entred **D**esign
UI	**U**ser **I**nterface
XML	e**X**tensible **M**arkup **L**anguage

Chapter 1

Introduction

1.1 Introduction to the Thesis

This thesis explores the iterative design and evaluation of a visualisation technique aimed at supporting non-experts in literary analysis to engage with character-centric literary data. The research focuses on refining the technique through iterative studies to better align with the needs of casual readers. The goal of the project is to address a gap between traditional literary analysis methods – typically designed for experts – and the needs of casual readers, making unstructured text data from novels, such as character dynamics, more accessible and understandable via visualisation. Utilising AI-generated textual summaries, the visualisation simplifies character and other contextual information, with the aim of illuminating key characters and events in the novels that may be difficult to recall in context.

Study I focuses primarily on the intial design of the visualisation, documenting in detail how the complexities and challenges inherent in the visualisation pipeline for literary visualisation were overcome. The primary design output is the visualisation technique, called *Clover Connections*, which employs intuitive visual elements, such as clover-shaped glyphs and networks, to represent temporal, social, and personal character data. By examining individual interactions with the visualisation in the evaluation component, Study I provides insights into how the tool can enhance users' understanding of character information and their ability to complete general character analysis tasks.

Building on the findings from Study I, Study II expands the visualisation tool to explore character data alongside plot and genre elements, visualising four novels from the detective and science fiction genres. Study II assesses how the visualisation can support group discussions, using the specific scenario of a structured book club meeting, where participants discuss both read and unread novels. It also examines how well users can interpret both familiar and unfamiliar texts through the visualisation technique, and whether it supports collaborative exploration and discussion without significantly impacting the flow of conversation.

Through a detailed discussion and analysis of the Study I and II findings, contextualised by the existing literature and associated gaps in the research, a detailed overview of the literary visualisation design pipeline is described. Evaluation findings from Study I and Study II contribute to a deeper understanding of how non-experts approach literary visualisations, which

is articulated into a set of dimensions of visualisation interaction variability in casual literary analysis, for other designers to consider in their own projects.

This thesis makes significant contributions to the field of casual literary visualisation by addressing the translation of character-centric information from novels into data types, developing new and layered visual encoding techniques, and evaluating how visualisations can enhance book discussions for casual readers. The findings demonstrate how visualisation can serve as a valuable tool for both individual and group engagement with literature, fostering meaningful interactions with characters in fiction novels, and opens the door for multiple future research avenues.

1.2 Introduction to the Research Problem

Stories have been an integral part of human culture for millennia, serving as a means to share knowledge, express emotions, and build communities. Novels, in particular, offer rich narratives that allow readers to explore complex worlds and the characters within (Felski, 2011). However, recalling specific elements of these narratives when sharing insights in casual reading communities is not without challenges. Novels can feature intricate story elements that can be difficult to keep track of for even the most attentive readers.

A specific challenge casual readers can face is recalling the appearances, relationships and personal development of *all* of the characters within a story. For example, the science fiction novel *The Stainless Steel Rat* by Harry Harrison only contains approximately 140 pages, yet there are 35 total characters mentioned in the text (Harrison, 1957). Of course, the recollection of characters extends beyond their number and names. As narratives unfold, characters appear, disappear, and reappear with evolving traits. Keeping track of these details becomes even more complicated in novels with large casts where characters' journeys follow very different trajectories. For example, secondary or minor characters can often play pivotal roles in resolving key events (Forster, 1985), although their importance can be overlooked during initial engagement with the text. Difficulty recalling and recognising the impacts of different characters may be exacerbated in group discussion contexts, where the diversity of personal interpretations and textual memory among participants may lead to potential missed opportunities for deeper engagement with characters and the overall text (Clarke, Hookway, & Burgess, 2017; Sedo, 2011).

Online tools designed to aid narrative and character recollection, such as character lists on *SparkNotes* (SparkNotes, 2024b) or wikis such as *Fanlore* (Fanlore, 2023a), can be leveraged to address these challenges. However, these resources can be disjointed. *SparkNote*'s character lists, such as that for the novel *1984* by Geogre Orwell (Orwell, 1949; SparkNotes, 2024a), provide brief static summaries that do not capture the full evolution of a character. Furthermore, they typically only summarise the primary characters, and cater mostly to novels addressed by school curricula. Online wikis, often collaboratively written, can be inconsistent in their depth of character summarisation between characters in the same novel, and also lack visual connections that could support comparing characters' journeys to one another. For example, *Fanlore*'s list of Harry Potter characters is comprehensive but presented out of context of the novels in

which the characters appear (Fanlore, 2023b). Moreover, these tools are not designed to facilitate casual or collaborative discussions, leaving casual readers with few options to bridge the gap between their individual interpretations and group insights.

In educational settings, teachers may diagram character connections, using straightforward visual tools like mind maps (Buzan, Buzan, & Harrison, 2010) to help students better understand relationships. Similarly, in casual discussions, participants can resort to ad-hoc methods, such as scribbling notes, drawing diagrams, or relying on verbal explanations to clarify points of confusion. While these more visual approaches can be effective in highlighting connections in the text, they can also lack consistency. Therefore, a clear opportunity exists to design a more systematic, semantically linked and reproducible reference point for character-centric literary discussion.

Information visualisation offers a promising solution to address this gap. By translating data from novels into visual representations, visualisations can provide an intuitive overview of complex information, highlighting patterns and connections that might otherwise remain obscured (Card et al., 1999; Manovich, 2011). Specifically, character-centric literary visualisations can play an important role in bridging the comprehension gap for casual readers (Hinze, Timpany, Vanderschantz, & Thomson, 2018). By visually encoding and associating novel-text-derived data, visualisations can enable those interested in exploring character information to grasp different features of characters at a glance (Aparicio et al., 2023; Hinze et al., 2018; Hoque, Ghai, & Elmqvist, 2022; Hoque et al., 2023; John et al., 2016). Furthermore, visualisations tailored for casual end-users can alleviate cognitive load (Pousman, Stasko, & Mateas, 2007), making it easier to navigate dense narratives and engage in reflective analysis.

Despite the potential benefits of literary visualisations for non-experts, it is difficult to locate a study that has explored their role in supporting casual discussion, particularly in live collaborative settings, such as book clubs. This lack of research does not suggest an absence of need but rather highlights an opportunity to create tools that enhance access to information in these contexts. Additionally, casual book discussions, in contexts like book clubs, with their dynamic and conversational nature, offer a unique context for studying how to support and enhance the spontaneous exchange of ideas, the recall of narrative details, and the deeper exploration of characters and their relationships (Long, 2003). Unlike solitary reading experiences, book discussions require participants to synthesise their own interpretations with those of others, often highlighting gaps in memory or understanding (Clarke et al., 2017; Long, 2003). This makes them an ideal setting to explore the ways in which visualisations can bridge these gaps, providing participants with an accessible reference tool to ground their discussions in the text and encourage reflection. By addressing this underexplored area, the research aims not only to develop a practical solution for enhancing discussions but also to contribute to broader conversations about the role of visualisations in making complex information more accessible and engaging for non-expert users.

Most existing research on literary visualisation focuses on tools for experts in literary analysis who engage with texts in highly specialised ways (Abdul-Rahman et al., 2017; Fisher,

Hoff, Robertson, & Hurst, 2008; Hoque et al., 2023; Jacobs, 2018; Jänicke, Franzini, Cheema, & Scheuermann, 2017; Keim & Oelke, 2007; Silvia, Etemadpour, Abbas, Huskey, & Weaver, 2016). These tools often prioritise comprehensive data representation over accessibility, limiting their utility for non-expert audiences. The lack of user-friendly visualisation techniques designed specifically for casual readers represents a significant gap in the field of literary analysis and visualisation research.

More specific research efforts have focused their attention on catering to casual readers with visualisations. Visualisations designed to enhanced eReaders offer promising insights into how to design for non-experts in literary analysis (Coleman & Hinze, 2017; Hinze et al., 2018). These accommodate quick in-text referencing to search for character mentions in context. However, eBook visualisations are designed to support the act of reading, but not the discussion of a novel after the fact. Hence, they are specifically designed to prevent spoiling the plot and to be embedded within an eBook interface (Hinze et al., 2018).

Other research has addressed interest in character-centric literary visualisation (Aparicio et al., 2023; Hoque et al., 2022, 2023; John et al., 2016; N. W. Kim et al., 2018; S. Liu, Wu, Wei, Liu, & Liu, 2013; Qiang & Bingjie, 2016; Regan & Becker, 2010; Watson et al., 2019), but none of these provide the level of textual enrichment, such as that found on wikis, for those seeking to understand the journeys of the characters in more detail; while retaining a cohesive visual overview of all of the characters in the novel. Furthermore, these works are typically only evaluated for expert literary analysts or professional writers (Aparicio et al., 2023; Hoque et al., 2022, 2023), or not at all (John et al., 2016). Those that have been evaluated with casual end-users were designed to visualise film scripts (N. W. Kim et al., 2018; S. Liu et al., 2013; Qiang & Bingjie, 2016; Watson et al., 2019), which differs from the data abstraction and visual encoding design requirements of visualising characters in novels.

The abstraction and extraction of character data from text adds a layer of complexity to this work. Unlike structured data, text is inherently ambiguous and often subjective in its representation of events, traits, and relationships. Subtle nuances, such as a character's implied motivations or unspoken connections, are difficult to formalise into structured data without losing richness or misrepresenting the narrative (Koidaki & Tiktopoulou, 2021). Automated methods, such as natural language processing (NLP), can excel at certain text summarisation tasks (Jurafsky & Martin, 2000), but are limited by their reliance on predefined rules or use of non-fiction in their training data (John et al., 2016), which may fail to capture the subtleties of a fictional character's evolving nature.

Additionally, determining how to visually encode the data presents its own set of challenges. Visual encodings must strike a delicate balance between accuracy, complexity, and interpretability. Deciding how to represent character data in relation to the individual character and others in the narrative requires considerations for how to use geometric elements, size, colour, or position, all of which will affect how end-users perceive the visualisation (Manovich, 2011; Munzner, 2014). Adding to this, the encoding of text-based features requires translating subjective

and context-dependent elements into visual representations, often also requiring direct visualisation of the text, not just the use of abstract marks and geometric primitives (Manovich, 2011). These decisions are complicated by the fact that different users may interpret encodings in different ways, depending on their backgrounds, experiences, or familiarity with visualisation conventions (Lee et al., 2016; Munzner, 2014).

These challenges underscore the broader difficulty of text visualisation, where the inherent subjectivity of textual features creates obstacles at every stage of the process – from deciding what to visualise, to extracting and abstracting the data, to selecting encodings that make complex information accessible and meaningful. Addressing these issues requires not only iterative refinement of visualisation techniques but also a deeper exploration of the theoretical and practical foundations of character and story composition, comprehension and decomposition.

This research seeks to address the aforementioned gaps by investigating how a non-expert-targeted character-centric literary visualisation can enhance the casual discussion and analysis of characters in novels. By focusing on both the design and evaluation of a novel visualisation technique, this research aims to support casual readers in interpreting and discussing character data. The project explores how data on characters can be abstracted and encoded into a cohesive visual format that captures their connections to each other and the overarching story. It further examines how readers interact with and integrate such visualisations in group settings, providing insights into their potential to facilitate collaborative literary discussions.

1.3 Thesis Structure

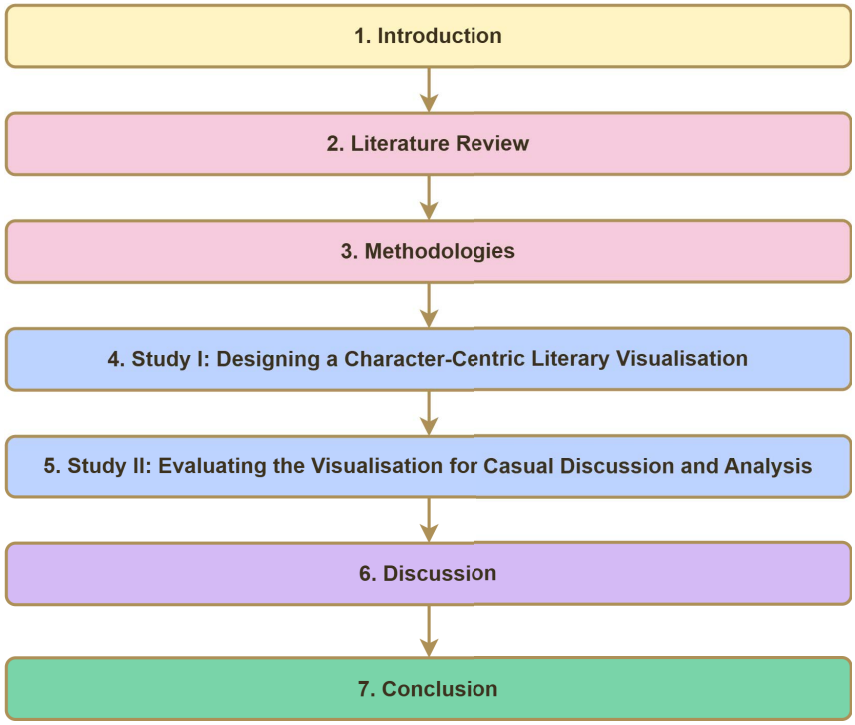

FIGURE 1.1: The structure of this thesis.

The thesis is organised into chapters that build upon one another, beginning with a theoretical and methodological foundation, followed by detailed design studies, and concluding with a discussion of the insights gained and future directions for research (Figure 1.1).

1. **Introduction:** Establishes the overall framework for the thesis, presenting the stakeholders, significance, and research questions for the research. The introduction guides the reader through the journey of the research, offering a preview of what will be explored in the thesis.

2. **Literature Review:** Presents a review of existing research related to information visualisation, non-expert end-users, and literary discussion and analysis. It critically examines prior work in visualising narrative elements and the challenges faced when designing for non-expert users, identifying gaps in the current literature that this thesis aims to address.

3. **Methodologies:** Describes the approach and processes employed throughout the research. This includes both the design of the visualisations and the evaluation methods used to test their effectiveness. The methodologies chosen combine techniques from information visualisation design and evaluation research with qualitative data analysis methods.

4. **Study I: Designing A Character-Centric Literary Visualisation:** Explores how characters can be represented visually to aid in literary analysis, focusing on their relationships, traits, and transformations throughout a novel. The chapter covers the process of extracting character data from novels, encoding it into a visual format, and the resulting visualisation technique, after which a task-based evaluation was conducted to determine the suitability of the visual encodings for performing general character analysis tasks.

5. **Study II: Evaluating the Visualisation for Casual Discussion and Analysis:** Builds on the findings of the Study I evaluation, making design enhancements to the visualisation technique. The chapter then covers an evaluation of integrating the visualisations into casual book discussions using a custom methodology of book-club scenario focus groups. Study II contributes insights into how non-experts use literary visualisations to discuss characters and plot in genre fiction.

6. **Discussion:** Synthesises the findings from both Study I and Study II, reflecting on how the research answered the research questions. This section delves into the contributions and limitations of the research, and areas for further investigation. It also explores broader implications for the fields of literary analysis and information visualisation, particularly how non-experts' engagement with literary visualisations can be characterised and considered by designers. A reflection on the literary visualisation design pipeline provides specific actionable insights into its navigation, and a set of dimensions of visualisation interaction variability are described to support casual literary visualisation design.

7. **Conclusion:** Provides a concise summary of the research project, highlighting its significance in advancing the understanding of how visualisations can support casual readers

in engaging with complex literary texts. It reflects on the research's impact and pathways for future exploration.

1.4 Research Aims

The overarching aim of this research is to determine whether a character-centric literary visualisation can enhance the casual discussion and analysis of characters in novels.

This research seeks to explore how data from literary texts, particularly popular genre fiction, can be abstracted, extracted, and transformed into visual representations that are accessible and engaging for non-experts in literary analysis. With the growing intersection of digital humanities and visualisation technologies, the study seeks to bridge the gap between literary analysis, which is often considered complex and specialist-driven, and non-expert audiences who engage with literature more casually. By focusing on character-centric visualisations, this research intends to develop methodologies that allow literary data, such as character personal traits, social relationships, and chapter appearances, to be mapped in ways that are both intuitive and insightful for non-expert readers.

A secondary aim of the research is to examine how non-expert users interpret and engage with these visualisations in the context of literary discussions. Understanding the ways in which non-experts navigate and interact with visualised literary data is crucial to creating tools that support deeper engagement and more meaningful discussions, whether in book clubs or other casual reader communities.

By synthesising insights from two design and evaluation studies, this research aims to provide a set of actionable design guidelines for creating future literary visualisations that effectively support non-expert users.

1.5 Research Questions

This research seeks to address one overarching research question – reflecting the overarching aim – by integrating insights from two study-specific research questions. Each study question is designed to explore a distinct but complementary aspect of the broader inquiry. The first study focuses on how data on characters in novels can be abstracted and visually encoded to capture meaningful connections, laying the foundation for the visualisation technique. The second study examines how non-experts interact with this visualisation in casual book discussions, providing insight into its practical application and impact. Together, these studies form a cohesive framework for evaluating the potential of character-centric literary visualisation for casual discussion and analysis.

Main Research Question: Can a non-expert targeted literary visualisation technique enhance the casual discussion and analysis of characters in novels?

> **Study I Research Question:** How can data on characters in novels be abstracted and visually encoded to represent their development and connections to each other?

Study II Research Question: How do non-experts in literary analysis integrate character-centric literary visualisations into casual book discussions?

1.6 Research Scope

This project focuses on visualisation design rather than natural language processing (NLP). As such, the methods employed for data extraction were chosen based on their accessibility and ease of use for the researcher, rather than aiming for advanced or custom NLP techniques. Prioritising the refinement of extraction methods would have significantly detracted from the primary objective of exploring and developing the visualisation itself. The emphasis remains on how the visualisation encodes and communicates character-related data effectively, rather than on the process of data extraction.

Additionally, the second study evaluates the visualisation in a group usage scenario conducted within a co-located setting, where participants interact in person. The exploration of distributed or online settings, while relevant to this work, falls outside the scope of this research. This choice allowed for a focused examination of real-time group dynamics and the visualisation's role in facilitating in-person discussions.

1.7 Stakeholders and Significance

Non-expert readers, typically comprising general audiences and literary consumers, are vital participants in the literary ecosystem. Their interpretations, preferences, critiques, and emotional engagement with books and characters significantly shape what becomes popularised and celebrated in the literary world. Encouraging diverse interpretations not only enriches the individual reading experience but also fosters a more nuanced, collective understanding of literary works. By supporting these non-expert communities through targeted visualisation tools, researchers have the potential to contribute to the development of critical analytical skills, such as empathy, narrative comprehension, and critical thinking, within the broader public.

The significance of this research lies in its contribution to the discourse on expanding the audience for literary visualisations. By focusing on the design and evaluation of a character-centric literary visualisation technique, this work addresses the underexplored needs of non-expert audiences. These audiences, characterised by their lack of formal training in literary analysis, often approach literature through the joy of exploring narratives and characters rather than through theoretical frameworks. This research proposes that incorporating the collaborative and casual nature of non-expert engagement into literary visualisations can create opportunities for broader discourse. By factoring in the diverse perspectives and interpretive approaches of non-experts, such visualisations can be designed to make complex literary data more accessible, interactive, and meaningful for casual literary analysis.

1.8 Personal Research Motivation

My personal motivation for this research arose from a casual conversation I had with a friend about the novel *Dune* by Frank Herbert (Herbert, 1965). As we discussed the characters and events, I realised that while we had both read the same book, our recollections of the story differed significantly in terms of the order and manner in which we remembered the characters, their roles, their motivations and the world around them. This discrepancy sparked the idea that having a visual summary would have greatly enhanced our discussion, with singular visual representations of multivariate data, such as Minard's map (Minard, 1869) (Figure 1.2), inspiring me to pursue this line of thinking. However, when I turned to online resources for casual readers, I found them disjointed, requiring me to piece together fragments of information scattered across different pages. This experience made me consider how difficult it can be for casual readers to engage with deeper literary analysis or even meaningful discussions without a clear and accessible reference.

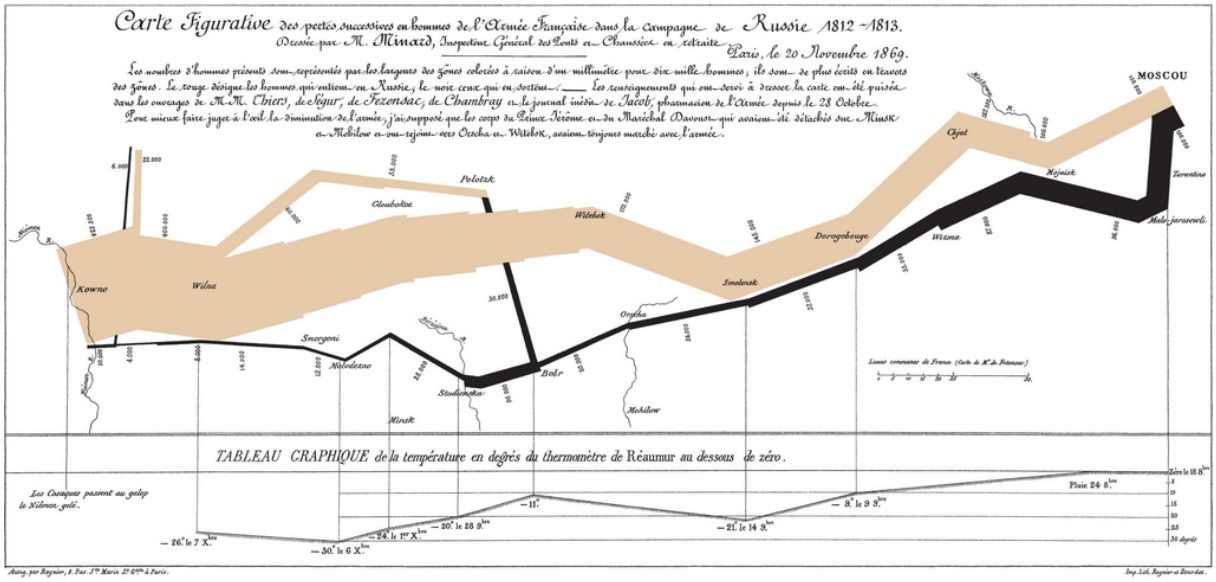

FIGURE 1.2: Charles Minard's map of Napoleon's Russian campaign of 1812 is renowned for its ability to convey six types of data in a two-dimensional format: troop numbers, distance, temperature, geographical coordinates, direction of movement, and key dates along the route (Minard, 1869).

This realisation led me to explore the potential of literary visualisation for casual readers as an accessible, social-oriented form of visual analytics. I wanted to create a tool that could help readers summarise and engage with novels in a way that was both cohesive and visually intuitive, bridging the gap between casual discussions and more structured literary analysis. By developing a visualisation that supports this kind of engagement, I aimed to provide readers with a means of accessing and exploring the complex dynamics of characters and narratives in an enjoyable and straightforward manner.

1.9 Definitions

In this section I provide the key definitions relevant to this research.

1.9.1 Novel

Although a pun that plays on research being new or original, the title of this thesis also points to a key goal – to provide insights into novels. In this thesis, the words novel and book are used interchangeably, hence a book refers specifically to a novel, unless otherwise noted in the context of its usage. The Cambridge dictionary defines a novel as "a long, printed story about imaginary characters and events" (Cambridge Dictionary, 2024d).

The novels used in this research are more specifically genre fiction novels, which are defined as "books or stories about imaginary characters and events that is written according to a particular model or style, for example crime fiction, romantic fiction, or science fiction" (Cambridge Dictionary, 2024b).

1.9.2 Visualising and Information Visualisation

The most basic definition of visualising in the context of computer science is to make something able to be seen (Card et al., 1999). Section 2.3 of the literature review provides an in-depth investigation into what constitutes an information visualisation.

The terms visualisation and information visualisation are used interchangeably throughout the thesis.

1.9.3 Character

There are diverse and conflicting theoretical perspectives on the concept of *character* in fictional media (Eder, Jannidis, & Schneider, 2010). A literary character is a subcategory of fictional character specifically found in literary works, such as novels and short stories. Literary characters are often more deeply explored, complex, and nuanced compared to characters in other forms of fiction. They serve as vehicles for exploring deeper themes, ideas, and human nature, and they often undergo significant development or transformation over the course of a literary work (Forster, 2023).

In this research, character is used to refer specifically to literary characters featured in novels, however, characters mentioned in other research may be from other media, such as film scripts, which is clarified in the context of the discussion of those works.

1.9.4 Non-Experts

In visualisation literature, non-experts may be referred to as novices, laypersons, the general public, or casual users (Burns, Lee, Chawla, Peck, & Mahyar, 2023). I prefer the term non-expert as it directly contrasts with the concept of an expert, emphasising a difference in how they may approach knowledge in a particular domain.

The terms casual reader and non-expert are used interchangeably throughout this work. These terms both capture that the users engaging with the visualisation tools are not specialists in literary or visualisation fields, but everyday readers engaging with fiction for personal enjoyment or discussion, such as within a book club.

1.9.5 Literary Analysis

The Cambridge dictionary defines literary as "relating to literature" (Cambridge Dictionary, 2024c), and analysis as "the act of studying or examining something in detail, in order to discover or understand more about it, or your opinion and judgment after doing this" (Cambridge Dictionary, 2024a). A general definition of literary analysis refers to the act of studying or examining literature in detail, with a specific purpose or goal in mind (Kusch, 2016).

1.10 Conclusion

The introduction chapter has established the foundational context and motivation for this thesis, which investigates how a character-centric literary visualisation can support casual readers in their discussion and analysis of novels. Grounded in the intersection of information visualisation and literary analysis, the study presents a unique opportunity to enhance the reading experience for non-expert audiences, offering them new ways to engage with and reflect on characters in popular genre fiction.

This chapter has also outlined the broader research problem, demonstrating the limitations of existing textual aids and visualisation tools for non-experts. Unlike static resources such as character lists or linear plot summaries, the proposed visualisation technique aims to provide a dynamic and interactive reference point for character-centric exploration.

The research scope, aims, and questions articulated here set the stage for a focused inquiry into the design and application of literary visualisation techniques. By framing the research within the context of casual book discussions, the thesis underscores its relevance to real-world scenarios where diverse perspectives and dynamic interactions are central to the reading experience. The subsequent chapters will delve deeper into the theoretical underpinnings, design methodologies, and empirical findings of the study, building a comprehensive case for how information visualisation can enhance access to literary insights for non-expert audiences.

Chapter 2

Literature Review

2.1 Introduction to the Literature Review Chapter

This literature review synthesises interdisciplinary research to support the research aims by identifying gaps and formulating research questions. It focuses on the intersection of visualisation design for non-experts and the analysis of literary characters in novels. The review examines key definitions of visualisation, highlighting its role in democratising insights and making complex, multidimensional datasets from literature accessible to non-experts. It addresses topics such as casual readers' engagement with literature, mental models, cognition, character-centric literary visualisations, casual visualisation, and collaborative visualisation. Figure 2.1 provides a succinct overview of the structure of the literature review chapter.

2.2 Casual Readers' Engagement with Literature

When casual readers engage in informal discussions to interpret and analyse literature, they are typically individuals without training in literary theory or formal methods of analysis, as they generally consist of members of the general public. This practice is commonly observed in settings such as book clubs, reading groups, online fan communities, and personal discussions among readers. Unlike expert literary analysis, which is systematic and grounded in established critical theories (Bennett & Royle, 2014; Kusch, 2016), casual interpretations of literature are less structured and more personal (Pianzola, Rebora, & Lauer, 2020; Rebora et al., 2021). Casual readers who discuss and analyse literature are often driven by their own experiences, emotional responses, and personal interpretations, creating a more conversational and relatable exploration of a text. Some researchers note that this informality encourages a more open and inclusive participation, fostering a sense of community and shared enjoyment among readers (Long, 2003; Pianzola et al., 2020; Rebora et al., 2021). Furthermore, informal literary discussions serve as important settings for casual readers to engage with literature in a collaborative way. These settings can offer freedom from the constraints of formal criticism, where participants may be more inclined to express their subjective interpretations or how they related to the characters. This suggests that when casual readers engage in literary analysis it may be a more inclusive and collaborative activity, contrasting with the often goal-directed and theory-driven approaches employed for expert literary analysis (Bennett & Royle, 2014).

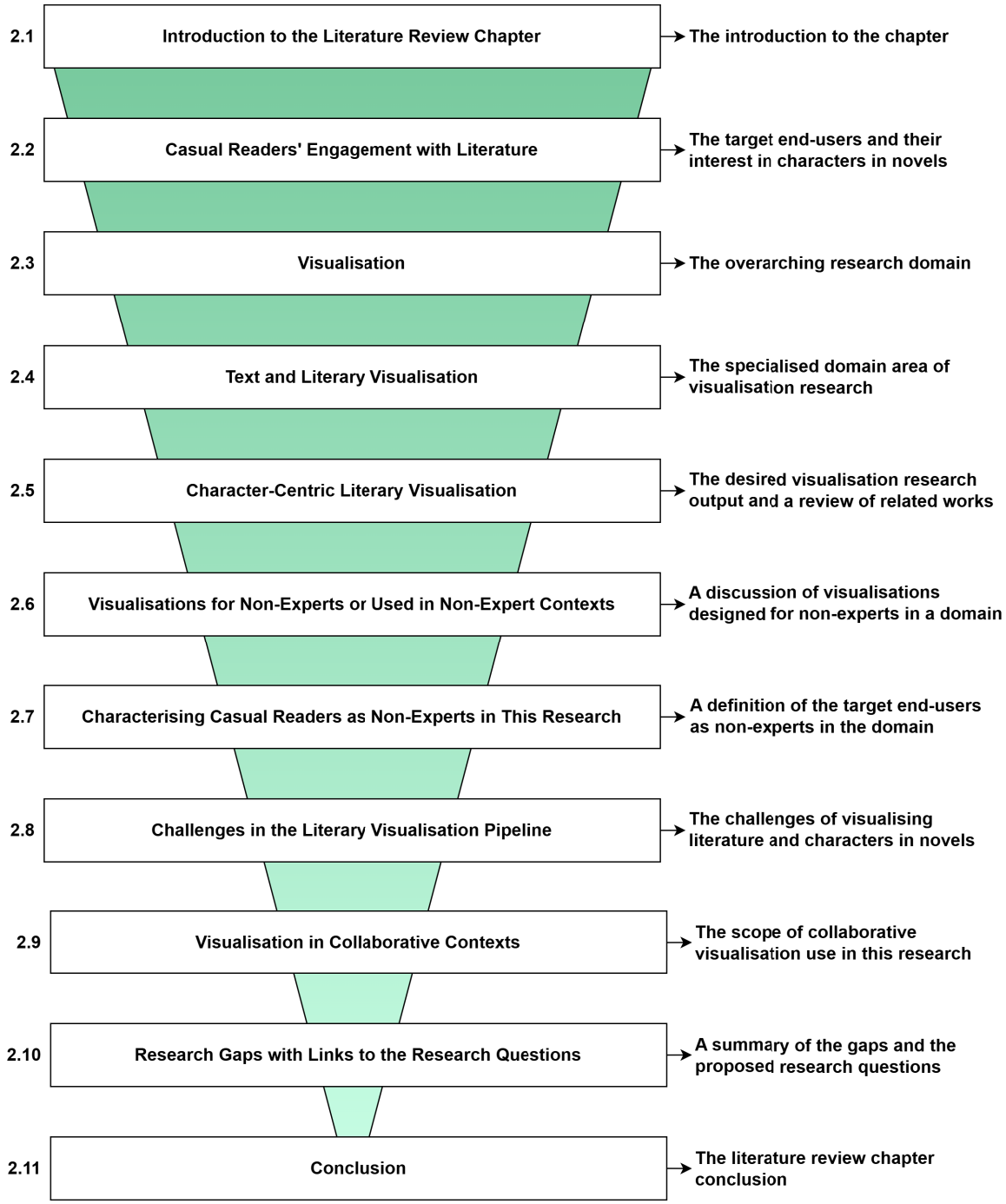

FIGURE 2.1: An explanation of the structure of the literature review chapter.

While casual readers might not be familiar with advanced theoretical frameworks like structuralism, postcolonialism, or feminist criticism, this does not diminish the depth or value of their discussions, nor the motivation to support this population in their discussions and analyses. Casual readers often focus on aspects of literature that resonate with them, such as character development, plot progression, or emotional impact (Hartley & Turvey, 2002; Pianzola et al., 2020). Their approach may lack the formal rigour found in academic discourse, but casual readers still engage critically by reflecting on personal experiences and discussing these insights with others as a form of collaborative meaning-making, as seen in the cultural practices of reading groups and book clubs (Long, 2003; Sedo, 2011). This distinction between literary scholars and consumers of books reflect differences in their uses of literature (Felski, 2011).

Fish's concept of interpretive communities highlights that readers' discussions often centre on the aspects of a narrative that are most accessible or compelling to them (Fish, 1980). Similarly, Rosenblatt's transactional theory emphasises the importance of emotional and imaginative engagement in reading, suggesting that readers naturally gravitate toward elements of a story that resonate with their personal experiences (Rosenblatt, 1994).

The surge in popularity of genre fiction book series has seen many enthusiastic casual readers also gather online to discuss and exchange theories about ongoing character and story development (Regan, 2011; Regan & Becker, 2010). Rebora et al. (2021) describe the activity of casual readers engaging collaboratively over the discussion and analysis of literature on digital platforms as digital social reading. The authors note that casual readers frequently interact with others through digital tools to:

- Enhance their understanding of texts
- Share insights and emotions with other readers
- Participate in the collective production of literary meaning

This concept of digital social reading has recently generated interest in its potential benefits in formal educational settings, where investigations into the integration of social annotation platforms, like *Hypothesis* (Hypothesis, Inc., 2024), show a fostered sense of community among students and increased engagement with reading materials (Zhu, Shui, & Chen, 2023). However, social annotation platforms are designed specifically for collective reading rather than visualisation. Additionally, casual readers in the general public are seen congregating on more publicly accessible online platforms to discuss literature.

For example, websites such as *Reddit* (Reddit, 2024b), *Goodreads* (Goodreads, 2024), and dedicated book-club forums (*The Book Club Forum*, 2023), have become popular spaces for discussing books and characters. Additionally, social media applications, such as *Instagram* (Instagram, 2024) and *TikTok* (TikTok, 2024) promote the casual engagement with and discussion of literature so much so that the discussions on these platforms regarding books are often tagged with either *Bookstagram* or *BookTok*.

For many, character-centric engagement with a text often manifests as a natural and intuitive mode of interpretation (Pianzola et al., 2020; Rebora et al., 2021). Readers frequently anchor

their understanding of a story in its characters – investing in their motivations, relationships, and challenges (Pianzola et al., 2020). Understanding characters' actions and their impact on the narrative can form a crucial role in text comprehension. By focusing on characters, casual readers can personalise their interpretations, reflecting on how individual character arcs resonate with their own experiences or values (Rebora et al., 2021).

As mentioned, readers may congregate online to discuss books in general, such as on the *Reddit* subreddit *r/books*, or create spaces for specific book series and characters, hosting the activities of a dedicated *fandom* – a community of people who share a passionate interest in a particular cultural phenomenon. The existence of fandoms has challenged traditional perceptions of passive media consumption among the general public (Jenkins, 2013). Members of a fandom engage deeply with the content of a TV show, or film or book series, often creating and sharing derivative works such as fan fiction, fan art, videos, and other creative expressions.

Oftentimes, fandoms for hugely popular works, such as the *Harry Potter* (Rowling, 1997) fandom, feature comparisons between the books and film adaptations. Fandoms are characterised by social interaction, and can vary in size and intensity, from small groups discussing shared interests to highly active communities with over one-hundred thousand members – which is the case for the *r/HarryPotterBooks* subreddit (Reddit, 2024a). Casual readers may participate in fandoms for a range of reasons, such as only occasionally to confirm understanding of a story and its characters, to more frequently to conduct in-depth analyses of characters and their defining traits, discussing and debating differing interpretations of character motivations. While the analysis of literature by its fans is considered distinct from its critique by professional writers and publishers (Regan, 2011), fans of popular series can influence the broader cultural perception of the books being discussed (Rebora et al., 2021).

2.2.1 Referencing Complex Character Information in Context

Characters in literature are dynamic and multifaceted, encompassing a wide array of traits, motivations, actions, and relationships that evolve across a narrative. As discussed, they can serve as pivotal anchors for readers, shaping their understanding and emotional connection to the story (Pianzola et al., 2020). Without external assistance or tools, casual readers need to rely on their memory when recalling details of characters to discuss. They may focus on memorable traits, significant interactions, or pivotal moments, but struggle to recall specific details or minor characters that contributed to the broader narrative context.

Some turn to online communities to seek practical advice for keeping track of characters in complex narratives, requesting advice on using bookmarks, sticky notes, or dedicated notebooks to jot down key characters. See Figure 2.2 for an example of a *Reddit* post detailing the trouble the original poster experienced keeping track of the large cast of characters in the novel *The Hunt for the Red October* (Clancy, 1992).

One solution to this problem are free-to-access online information respositories, such as *Fandom* (*Fandom*, 2023) or *Wikipedia* (Wikipedia, 2023b), which offer detailed descriptions of individual characters. However, these text-based resources rarely situate these details within the flow of

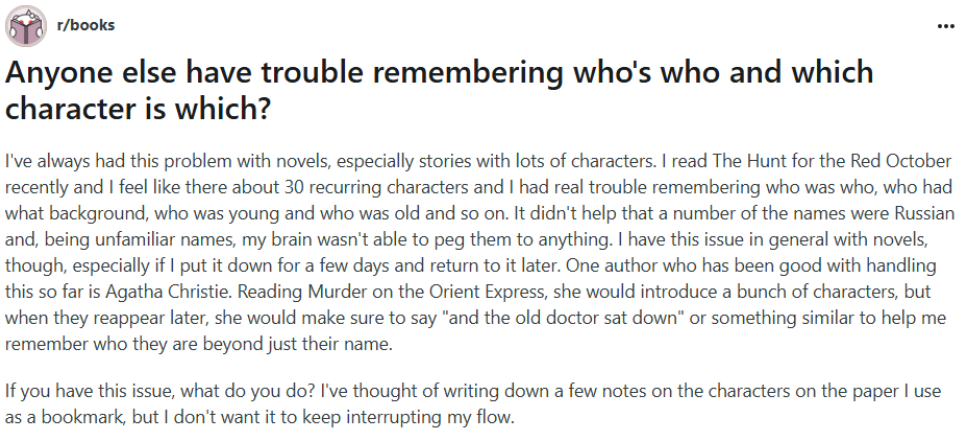

FIGURE 2.2: An anonymised post from the *r/books* subreddit on *Reddit* (Reddit, 2024b) that captures the frustration casual readers can experience when attempting to keep track of the many characters in a novel.

a novel's narrative. Figure 2.3 shows the *Wikipedia* page for the character Sherlock Holmes (Wikipedia, 2023a) – arguably one of the most famous characters in English literature. The article mostly summarises the character's overall development and impact on literature and pop culture. For lesser known or minor characters, wikis typically only offer brief summaries of their appearances in a work (if at all). Hence, there is a requirement to navigate disparate fragments of information to piece together character roles and relationships in a narrative.

One approach to addressing this gap is through tools like *Lensing Wikipedia* (Hoeber et al., 2017), which aim to bridge information fragmentation by providing structured and interactive interfaces for exploring relationships among entities in large text-based collections, such as *Wikipedia*. By employing techniques like semantic role labeling (SRL) and NLP, *Lensing Wikipedia* extracts relationships between entities and represents them visually through tabs that highlight timelines, spatial mappings, and storylines. This allows users to contextualise and navigate connections between historical figures, places, and events.

While this demonstrates an acknowledgment of the need to connect disparate details for end-users of information respositories, the design of *Lensing Wikipedia* (Hoeber et al., 2017) is ultimately tailored to datasets grounded in time-based events and geographic contexts. For characters in novels, however, such an approach would fall short. Unlike historical or encyclopedic entities, characters in literature require a different set of contextual markers to represent their appearances and relationships. For instance, a novel's characters are tied not to explicit timestamps or geographic locations but to the narrative's progression, such as their presence in specific chapters, their behaviours, emotions, or evolving relationships within the plot (Forster, 2023).

Other available text-based resources are structured for the specific purpose of assisting the recollection, or interpretation, of a novel. *SparkNotes* (SparkNotes, 2024b) is a resource typically used by students to access quick summaries of a novel's chapters and its main characters – hence most novels in the collection are those used in school curricula. However, these summaries are not exclusive to academia, providing a useful resource that benefits the casual

Sherlock Holmes

104 languages

Article Talk Read View source View history Tools

From Wikipedia, the free encyclopedia

For other uses, see Sherlock Holmes (disambiguation).

Sherlock Holmes (/ˈʃɜːrlɒk ˈhoʊmz/) is a fictional detective created by British author Arthur Conan Doyle. Referring to himself as a "consulting detective" in his stories, Holmes is known for his proficiency with observation, deduction, forensic science and logical reasoning that borders on the fantastic, which he employs when investigating cases for a wide variety of clients, including Scotland Yard.

The character Sherlock Holmes first appeared in print in 1887's *A Study in Scarlet*. His popularity became widespread with the first series of short stories in *The Strand Magazine*, beginning with "A Scandal in Bohemia" in 1891; additional tales appeared from then until 1927, eventually totalling four novels and 56 short stories. All but one[a] are set in the Victorian or Edwardian eras between 1880 and 1914. Most are narrated by the character of Holmes's friend and biographer, Dr. John H. Watson, who usually accompanies Holmes during his investigations and often shares quarters with him at the address of 221B Baker Street, London, where many of the stories begin.

Though not the first fictional detective, Sherlock Holmes is arguably the best-known.[1] By the 1990s, over 25,000 stage adaptations, films, television productions, and publications had featured the detective,[2] and *Guinness World Records* lists him as the most portrayed human literary character in film and television history.[3] Holmes's popularity and fame are such that many have believed him to be not a fictional character but an actual individual;[4][5][6] numerous literary and fan societies have been founded on this pretence. Avid readers of the Holmes stories helped create the modern practice of fandom.[7] The character and stories have had a profound and lasting effect on mystery writing and popular culture as a whole, with the original tales, as well as thousands written by authors other than Conan Doyle, being adapted into stage and radio plays, television, films, video games, and other media for over one hundred years.

Sherlock Holmes

Sherlock Holmes character

Sherlock Holmes in a 1904 illustration by Sidney Paget

First appearance	*A Study in Scarlet* (1887)
Last appearance	"The Adventure of Shoscombe Old Place" (1927, canon)
Created by	Sir Arthur Conan Doyle
In-universe information	
Occupation	Consulting private detective
Family	Mycroft Holmes (brother)
Nationality	British
Born	1854

FIGURE 2.3: The *Wikipedia* page for the character of Sherlock Holmes provides a high-level general overview of the character and its significance (Wikipedia, 2023a). Reproduction of the article here is licensed under ShareAlike 4.0 International License.

reader too. The summaries are, however, textual, and therefore key information, such as when characters appear in a novel, cannot be discerned at a glance.

SparkNote's more recent offering, *LitCharts* (LitCharts, 2024), uses AI to generate more detailed textual summaries, among other additions. One new feature is a theme wheel visualisation, available for some novels in the database. The theme wheel represents each chapter of a novel as a wedge on a radial layout. Each row of boxes extending from the centre of the wedge represent a part of that chapter, and the colours indicate different themes. These themes are made known to the end-user via a themes key.

There are several limitations to the theme wheel visualisation and *LitCharts* for casual readers. While characters are mentioned in the summaries, character entities are not represented in the visualisation, and despite the space-saving efficiency of the radial layout, it is less intuitive to those unfamiliar with the presentation than linear layouts (Watson et al., 2019). Additionally, the end-user is required to pay for full access to all the available tools and summaries on *LitCharts*, which may present a barrier to some.

Another method of visualising characters is through the use of mind maps. Mind maps are typically hand-drawn visual tools that represent information hierarchically, often radiating from

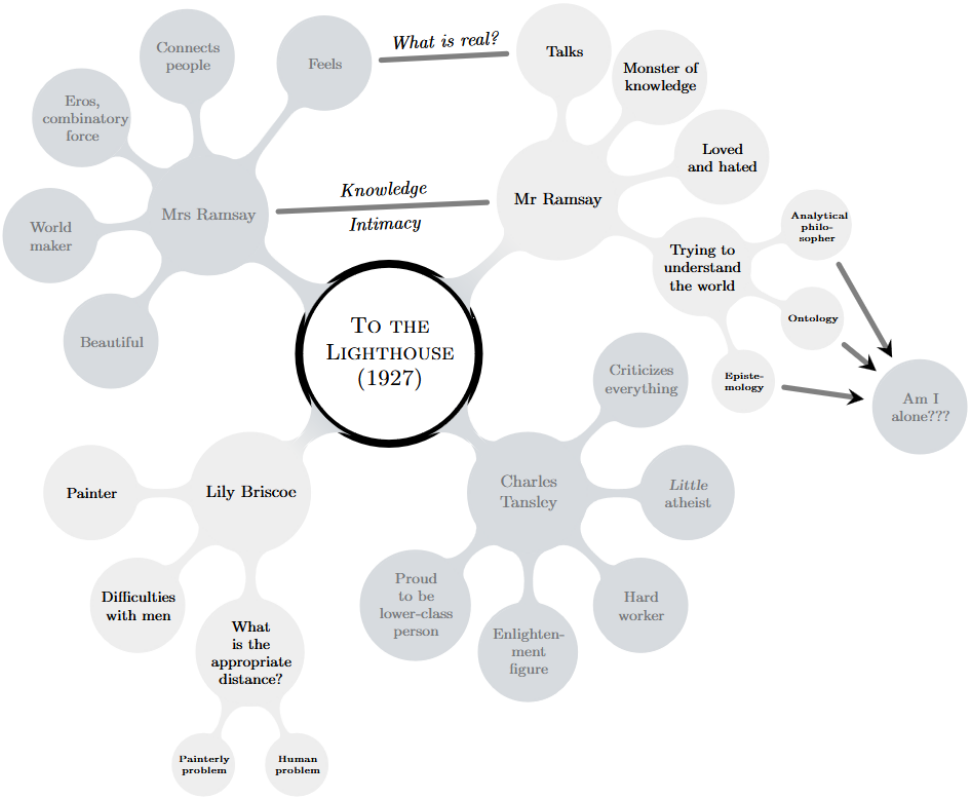

FIGURE 2.4: An example of a mind map of the main characters in Virginia Woolf's novel *To the Lighthouse*. Reproduction of the mind map here is licensed under ShareAlike 3.0 Unported License – Credit: Vitaly Repin, 2013.

a central concept, with branches connecting related ideas. They are designed to stimulate creative thinking, enhance memory, and improve understanding by visually organising information (Buzan et al., 2010). In the context of literary studies, mind maps are particularly useful for analysing texts, themes, characters, and relationships between these. For instance, students might create a mind map with the title of a novel at its centre, branching out to major themes, characters, and events. Further sub-branches can explore character motivations, plot developments, or thematic connections, helping to visualise the interplay between different elements of the text. When used in education, this encourages students to identify patterns and connections that might be overlooked when reading the novel. Figure 2.4 shows an example of a mind map drawn for the novel *To the Lighthouse* by Virgina Woolf (Woolf, 1927), focusing on four of the main characters.

While useful, a mind map is inherently limited by the creator's recollection of the text and the feasibility of capturing all characters in the narrative. Although they can be constructed collaboratively, this process would demand significant effort during a discussion to assemble a map that functions effectively as a central reference point. Furthermore, the personalised nature of mind maps makes them unsuitable as objective discussion resources that can be standardised or embedded online for broader use.

2.2.2 Summary

For casual readers, being able to reference each character's role within a story may enhance their ability to connect with the text. Characters are rarely static; their traits, motivations, and relationships often shift throughout the narrative, yet the existing resources and tools discussed in this section do not effectively portray the dynamic nature of characters. I argue that information visualisations can address this gap by framing characters and their relationships within the broader narrative structure, enabling a more accessible and accurate-to-the-text representation of a novel. Additionally, integrating visualisation tools into discussions – whether online or in-person – may enhance casual readers' social and interpretive practices. Informal literary analysis conducted by casual readers is characterised by its accessibility, relatability, and community-driven efforts. This underexplored area in visualisation research offers an interesting avenue for investigating appropriate literary visualisation designs to support casual readers.

A primary area for investigation is that current resources available to casual readers make it difficult to obtain a quick overview of *all* of the characters that appear in a novel in a manner that supports and entices further exploration of those characters. This is because most available resources are text-heavy, with a significant amount of additional reading required (in addition to having read the novel itself) to prompt recollection. Stone et al. (2005, p. 183) effectively summarise the overriding design principle of visualisations – they are "easy to comprehend and easy to make inferences from". Hence, with this design principle in mind, the next section of the literature review explores what a visualisation is and why they provide an effective solution for visually summarising and supporting the interpretation of complex data.

2.3 Visualisation

Card et al. (1999, p. 6) define information visualisation as "the use of computer-supported, interactive, visual representations of abstract data to amplify cognition". This is because traditionally visualisations were used to illustrate information that is inherently geometrical, derived from a physical space, such as the visualisation of weather patterns, ozone concentration, the human body, or molecules (Card et al., 1999). Hence, research in information visualisation predominantly focuses on how to visually represent abstract information, such as business data, in a manner comprehendible to humans.

2.3.1 Visualisation Vocabulary Influences Its Construction and Reception

Byrne, Angus, and Wiles (2019) note how the vocabulary of visualisation has influenced its construction, and that through modeling the content of a visualisation we can classify visualisations that use hybrid approaches. Initially, the term "information visualisation" was sufficient to describe any computer-based visualisation of abstract data (Card et al., 1999), however, wider adoption of visualisation practice has created a distinction between data visualisation and information visualisation in industry. Data visualisation has been used to refer to designs targeted at an audience familiar with the data or interested in examining it in more detail,

whereas, information visualisation has been used to refer to a process of making complex information more accessible to general audiences. These applications of the terms are not reflective of academic theory, as non-expert user visualisation refers to the latter (Gough et al., 2016). However, there are differences between information visualisation and scientific visualisation, because the former represents abstact, nonphysically based data, while the latter represents scientific data that is typically physically based (Card et al., 1999).

Regardless of one's stance on the terms, Kosara (2007, p. 2) provides the minimal set of requirements for what can be considered a visualisation:

- It is based on (non-visual) data. Data must come from outside the visualisation tool or program, and the tool or program should work for other data sets.
- It produces an image. The visualisation must be the primary means of communicating the data. Other media may be included, but the visualisation must stand alone as a communication medium.
- The result is readable and recognisable. Data can be transformed to any number of images, but most of these would not be understandable to the viewer in terms of interpreting the underlying data. A visualisation must be readable by a viewer, even if the viewer requires some training to do so. Visualisations can contain additional elements (such as embellishments), but these should not detract from the communication goals of the visualisation.

Another relevant distinction to make is that between information visualisation and information design. Manovich (Manovich, 2011) defines information visualisation as the process of mapping non-visual data into visual forms, primarily through reduction into graphical primitives like points, lines, or shapes, to uncover patterns or insights that were not immediately obvious. By contrast, information design presents pre-existing structures in a clear and accessible manner, often without the discovery of new relationships.

Gough (2017, p. 48) uses the example of the map of the London Underground by Harry Beck to illustrate what makes it information design and not information visualisation:

> Beck reduced the information shown to the user by removing geographical information; the lines between stations were always straight and at either 90 or 45 degrees ... since a bend in the actual rail line is irrelevant information once you are already on the train. These spatial cues were the primary source of information for the passenger, leaving secondary information (the different train lines) to be coded using color, a visual variable. However, the antecedent geographical structure of a rail network means that the rail map is not infoVis; there is no new structure being revealed to the user.

The major distinction between information visualisation and information design centres on the role of the antecedent structure (Gough, 2017; Manovich, 2011). In information design, the visualisation reformats existing structures for clarity or accessibility, as Gough evidenced with Beck's map through its simplification and encoding of the physical rail network for passenger

reference. In contrast, information visualisation aims to uncover new relationships or insights that were not immediately apparent in the original data.

When visualising characters in a novel, this distinction becomes nuanced. On one hand, the visualisation may benefit from leveraging the antecedent structure of the narrative – such as chapter order, character appearances, and indication of key events – to ensure it is accessible to non-experts, as these elements are familiar to the reader, helping to ground their understanding in the story's framework (Rand, 1984). These representations would draw directly from the novel's established structure, aligning closely with information design.

On the other hand, character data could be visualised to reveal insights that are not explicitly stated or readily apparent in the text, positioning a technique closer to information visualisation. For example, encoding a character's emotional trajectory across the story or analysing their prominence in terms of dialogue contributions can highlight patterns and dynamics that readers might not notice on their own. Similarly, a visualisation that tracks changes in social networks over time adds layers of meaning beyond the antecedent narrative structure.

Thus, it is worth clarifying that a character-centric literary visualisation may straddle the line between information design and information visualisation. By presenting familiar structures while also facilitating the discovery of less immediately recognisable textual patterns, it can serve as both a tool for comprehension and a medium for exploration.

Building on these distinctions, the concept of direct visualisation further blurs the lines between information design and information visualisation (Manovich, 2011). Unlike traditional information visualisation, direct visualisation represents the data in its original or minimally transformed form. This approach is particularly well-suited for textual and qualitative analyses, where the richness of the original material is integral to its interpretation (Manovich, 2011).

This is seen in techniques like *Phrase Nets*, which visualise text by connecting words based on their syntactic relationships in a document (van Ham, Wattenberg, & Viegas, 2009). These relationships are drawn directly from the structure of the text, creating an easily comprehensible network that makes linguistic patterns visible. Manovich (2011) describes the *Phrase Nets* technique as aligning with direct visualisation, where the data – in this case, the words and their relationships – retain their original form rather than being abstracted into graphical primitives. Unlike traditional information visualisation, *Phrase Nets* do not transform the underlying text into wholly new representations but instead reorganise it into an interpretable structure. Therefore, direct visualisation challenges traditional definitions of information visualisation by preserving the richness of the original data while uncovering new patterns.

Importantly, Manovich highlights how direct visualisation is particularly relevant in the humanities because of its emphasis on preserving the original structure of the data, aligning closely with the interpretive and textual nature of many humanities disciplines (Manovich, 2011). In the humanities, data often carries inherent meaning – texts, images, and other media are not merely repositories of information but also artefacts for analysis and reflection. Direct visualisation respects this complexity by prioritising the recognisability and integrity of the data. For example, rather than abstracting a text into purely statistical representations, a direct

visualisation might map linguistic patterns or relationships between words while retaining the original language. Manovich contrasts this with traditional information visualisation, which typically focuses on abstract, quantitative datasets and uses reduction to uncover hidden patterns or relationships (Manovich, 2011). While this abstraction is effective for numerical or highly structured data, it risks losing the nuanced interpretive potential that is central to the humanities. A dual approach that combines graphical primitives for quantitative data with direct representations of text could allow literary visualisations to function as hybrid techniques. These methods would simultaneously reflect the antecedent narrative structure while uncovering hidden dynamics, fostering both comprehension and exploration of the text.

2.4 Text and Literary Visualisation

Text visualisation is the visual representation of textual data to aid in understanding and extracting insights from large bodies of text. In general, text visualisation involves transforming textual information into graphical or interactive formats, making it more accessible and comprehensible to users. By visually displaying patterns, relationships, and trends within the text, it allows individuals to quickly grasp key information that might be challenging to discern through traditional reading alone. *Phrase Nets* by van Ham et al. (2009) – mentioned in the previous section – is one example of text visualisation.

Kucher and Kerren (2015) developed a taxonomy of text visualisation techniques to categorise the growing variety of methods available for representing text data visually. This taxonomy intends to aid researchers in navigating this complex field, providing clarity on which techniques might suit specific types of data or tasks. It is organised into several key categories: data, visualisation representation, visualisation tasks, analytic tasks, and domain.

The data category encompasses both the source and properties of the text data being visualised, and properties of the data, such as temporal or networked characteristics, which can significantly influence the choice of visualisation techniques. The visualisation representation category describes the graphical forms used to represent text data, ranging from pixel- or area-based displays and node-link diagrams to word clouds and maps. The visualisation tasks category focuses on the lower-level objectives supported by these techniques, while the analytic tasks category addresses the high-level goals of text visualisation, such as sentiment analysis, trend or pattern analysis, summarisation (condense lengthy texts into concise representations), and topic analysis or entity extraction (identify key themes or entities in the data). Lastly, the domain category identifies typical application areas for these techniques, such as social media, scientific literature, reviews, or editorial media. For this research project, the taxonomy by Kucher and Kerren (2015) offers a structured framework for understanding and building upon available text visualisation techniques.

When text visualisation is used to analyse literary works, it takes on a specialised role, referred to as literary visualisation (or sometimes, literature visualisation). Expert literary analysis often centres on the detailed interpretation of words and phrases within a text, considering both its historical and cultural context (Kusch, 2016). This form of close reading is a meticulous practice,

with scholars examining subtle nuances to draw insights from literature. Literary visualisations are typically designed to aid this process by either replicating or abstracting these interpretive practices. These visualisations support experts in literary analysis to manipulate and examine texts in ways that reflect their own analytical approaches.

Distant reading, for example, provides an abstract overview of large collections of text, focusing on global features rather than individual details. Such visual tools allow users to engage with broader trends across a body of work, identifying recurring themes or shifts in tone and style across multiple texts. In contrast, close-reading tools support the detailed examination of a single text, enabling a deeper analysis of language and structure. Visualisations such as narrative summarisations help to distil large unstructured texts, making it easier to identify recurring or prominent themes (Fisher et al., 2008; Jänicke et al., 2017). These approaches can be particularly valuable in literary analysis where scholars are dealing with large corpora of work and need to extract overarching insights.

Several visualisation techniques have been leveraged to assist with specific types of literary analysis. For instance, lexical dispersion plots allow scholars to compare the diversity and sentiment of texts (Hoque et al., 2023; Jacobs, 2018). Additionally, 2D pixelmaps help to visualise text similarities (Abdul-Rahman et al., 2017), while force-directed storyline visualisations are useful for illustrating textual variants between different versions of a work (Silvia et al., 2016). Other approaches, such as literature fingerprinting (Keim & Oelke, 2007), the aforementioned *Phrase Nets* (van Ham et al., 2009), and sonic topology visualisations (McCurdy, Lein, Coles, & Meyer, 2016), allow for the exploration of a text's structure, relationships, or even sound, in ways that enrich a literary scholar's interpretation.

However, while these tools offer valuable insights, they are often designed with formal literary analysis in mind, focusing on metrics such as lexical dispersion, diversity, and frequency. This prioritisation of academic workflows points to a larger trend typical for information visualisation, as Rogers, Sharp, and Preece (2011, p. 181) explain:

> Most interactive visualisations have been developed for use by experts to enable them to understand and make sense of vast amounts of dynamically changing domain data or information ... [a process that would] take much much longer to achieve if using only text-based information.

As a result, many tools and techniques are less accessible to casual readers in the general public, as they often require a certain level of familiarity with literary analysis approaches to fully engage with and interpret the visual data. Furthermore, characters are typically not visualised as distinct entities; instead, the words within the text, including those used to describe its characters, are presented for analysis. This highlights a gap between visualisation tools intended for scholarly use and those designed for broader audiences, indicating the need for techniques that cater to the interests and needs of casual readers.

2.5 Character-Centric Literary Visualisation

This research focuses on visually communicating data about characters in novels, particularly their appearances, traits, and interactions. Hence, related visualisation tools and techniques are evaluated in the section across multiple dimensions: the types of character data visualised, the visualisation techniques employed, and the evaluation methodologies used. Attention is given to the participants and contexts involved in the evaluations, offering insights into how visualisations are tested and applied for different audiences. Relevant studies published after this project began are also reviewed to illustrate how the field has evolved alongside this investigation, hence, each subsection is titled with the technique and year of publication.

2.5.1 Visualisations of Characters in Novels

As the primary focus of this research, novels provide a rich and complex medium for exploring fictional character representation. Visualisations of characters in novels play a central role in this investigation, offering opportunities to examine how text-based data can be effectively represented and interpreted visually.

Character Flowers (2010)

Character Flowers (Regan & Becker, 2010) provides abstract, flower-like representations of textual data, focusing on characters and their linguistic context in Philip Pullman's *His Dark Materials* trilogy. Data is extracted from the text to visualise the distribution of words around character mentions, with buds representing words frequently following a character's name, sized by occurrence frequency, and positioned by their contextual likelihood. An additional whole-text visualisation highlights character occurrences across the series, enabling analysis of their rhythm and prominence. The system was evaluated qualitatively through a workshop involving the author Philip Pullman, his agent, publisher, and collaborators, alongside in-depth interviews with five members of Pullman's fan community. The interviews are framed as qualitative explorations, and the paper hints at general insights rather than concrete findings. For example, it suggests that these visualisations may help fans and academics generate and test theories about the text, but no specific feedback or detailed results from the interviews are included. Additionally, the work does not include usability testing with a broader audience or direct application to other book series.

Web-Based Plot and Character Analysis System (2016)

John et al. (2016) created a web-based system that visualises characters and their relationships extracted from novels by accessing multiple views of different graph types. The aim was to support literary scholars (experts) in analysing plot structures and characters. Data is extracted using named entity recognition (NER) and co-occurrence analysis, applied to eBooks in EPUB or plain text formats. The visualisations include fingerprint timelines for tracking character appearances, force-directed graphs to represent relationships (see Figure 2.5), word clouds for

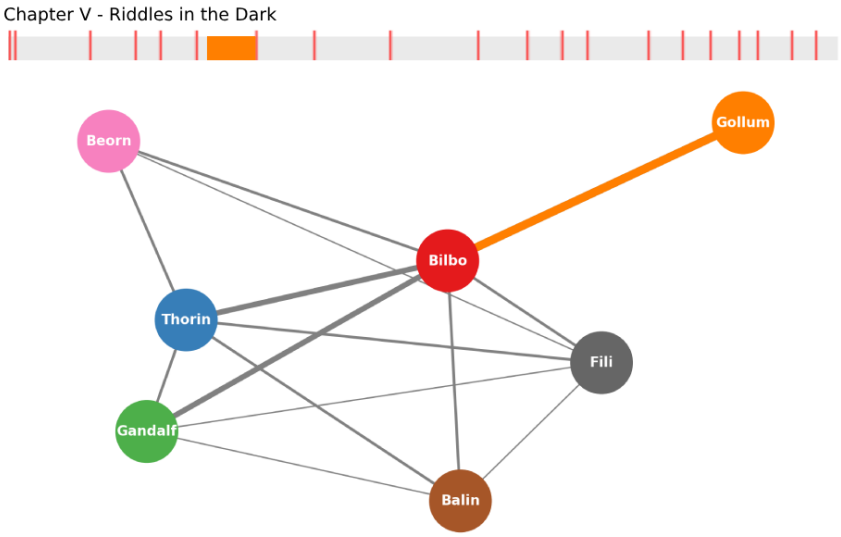

FIGURE 2.5: A redrawn representation of features from the web-based plot and character analysis system proposed by John et al. (2016). The fingerprint timeline highlights the character Gollum's appearances in orange, which is also used to represent Gollum in the force-directed co-occurrence network. This image is provided for illustrative purposes only.

contextual analysis, and plot views to outline interactions across chapters. The system incorporates multiple NLP tools, allowing flexibility in processing different types of texts. Their evaluation was conducted using fictional usage scenarios, involving hypothetical literary scholars analysing the novels *Harry Potter and the Half-Blood Prince* and *The Hobbit*. These scenarios were written to illustrate the system's utility in exploring and verifying narrative elements, although they do not involve actual participants. While the system effectively supports distant and close reading, limitations include dependency on NLP tools trained on non-fiction and scalability issues for lengthy novels.

Semantic-Enhanced eReader (2017)

Coleman and Hinze (2017) developed the *Semantic-Enhanced eReader* that integrates semantic visualisations into an eReader application to enhance the reading experience. Character-related data was extracted using a combination of NLP and book ontologies. The prototype included a range of character-centric literary visualisations presented as separate elements alongside the eBook text: a bar chart showing the frequency of character appearances, a line graph mapping where characters appeared in the text, proximity graphs highlighting relationships based on sentence co-occurrence, and word clouds displaying verbs and nouns associated with each character. The system was evaluated with 30 participants using *Alice's Adventures in Wonderland*, where participants rated their experiences on Likert scales and provided qualitative feedback in semi-structured interviews. Results indicated that participants found the graphs helpful for enhancing understanding of the text and revealing new information – notably, some participants were familiar with the novel, while others were not. Usability feedback suggested improvements such as linking visualisations back to the text for better integration.

***BookLine and CharacterChart* (2018)**

The *Who Was That?* study by Hinze et al. (2018) builds on the previous work by Coleman and Hinze (2017) to present an enhanced eReader prototype that visualises character appearances to assist readers in navigating complex narratives, making it highly relevant to the goals of this research. The system includes two main features: the *BookLine*, a line graph showing character frequency across the narrative, and the *CharacterChart*, an interactive sidebar listing characters mentioned on the current and previous pages. Data is extracted using NER and manually curated lists of alternate character names. The *BookLine* visualisation is smoothed to highlight trends while avoiding spoilers by limiting visible data to already-read sections. The system was evaluated in a user study with 13 participants, 10 of whom were students, who read *Through the Looking-Glass* using the eReader. Interviews and usage data revealed that participants found the *BookLine* and *CharacterChart* helpful for recalling characters and their relationships. The enhancements were praised for supporting navigation and improving reading flow. Areas noted for future refinement included improving colour differentiation and accessibility for users with dyslexia or colour blindness.

***DramatVis Personae* (2022)**

DramatVis Personae (Hoque et al., 2022) is for professional writers to mitigate biases regarding character representations in their own work. The data visualised in this study includes characters, their demographic attributes, and the nature of their interactions within the narrative. Characters were identified using NLP techniques such as NER and coreference resolution, enabling the extraction of character mentions and relationships. Demographic information, such as gender and ethnicity, was added by users through an interactive interface. The visualisation adopted a timeline-based approach to represent character appearances and interactions across the narrative, complemented by network graphs and word zones to highlight relational dynamics and descriptive language. The evaluation process involved two phases: think-aloud sessions with three writers to refine usability and identify potential use cases, and a larger user study with 11 participants to assess the effectiveness of the tool in identifying biases and character representations, with results highlighting the tool's potential to enhance narrative analysis and support bias mitigation.

***Portrayal* (2023)**

Portrayal (Hoque et al., 2023) integrates NLP and interactive visualisation to analyse fictional characters in narrative texts. It extracts character traits, including actions, emotions, speech, direct definitions, and contextual indicators, using an NLP pipeline enhanced with tools like coreference resolution and sentiment analysis. Visualisations are presented through modular card-based timelines, enabling users to explore single or multiple traits across chapters or scenes (see Figure 2.6 for an overview). The system was evaluated through a week-long qualitative study involving 12 participants comprising creative writers and literary scholars. Writers used *Portrayal* to revise their unpublished drafts, gaining insights into character arcs,

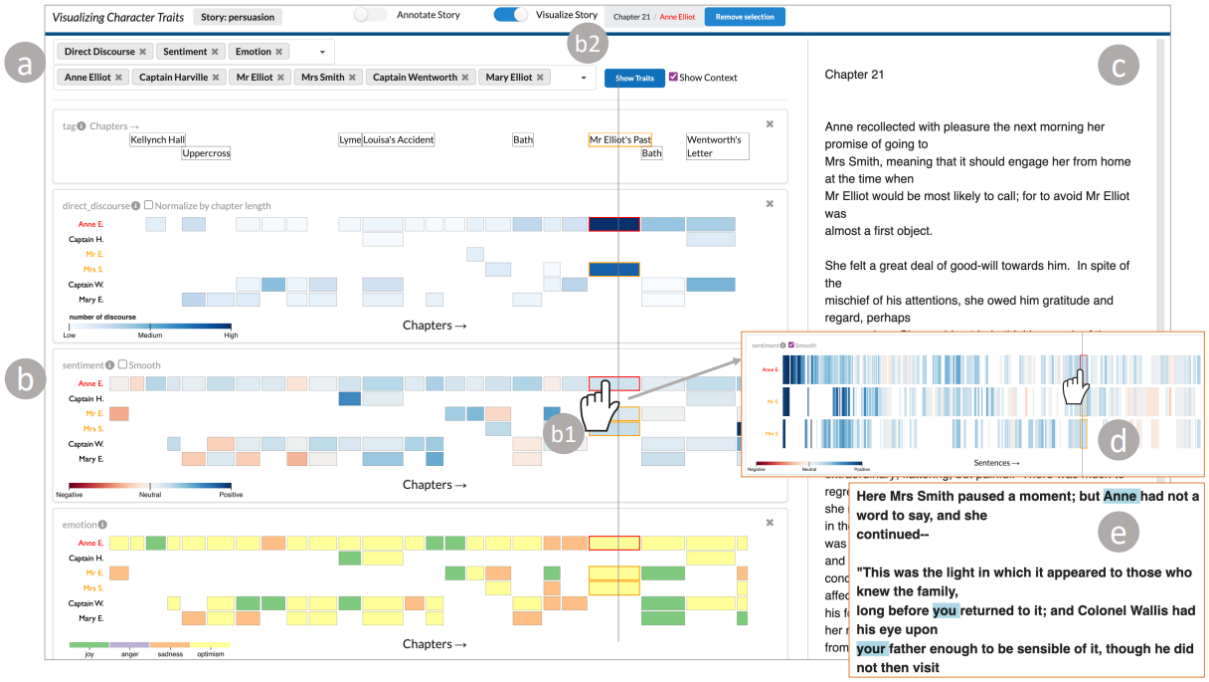

FIGURE 2.6: An overview of the Portrayal visualisation system by Hoque et al. (2023). (a) The control panel allows users to select characters and their associated traits. (b) The central panel displays these traits across chapters, with characters as rows and chapters as columns. Views are aligned and synchronised: hovering over a cell (b1) highlights the selected character (in red) and co-occurring characters (in orange), with chapter and character info shown above (b2). This interaction also scrolls the text editor to the relevant passage (c). Clicking a cell (b1) switches the view to a sentence-level layout (d), where each tile represents a sentence. Hovering over a sentence highlights it in the text editor and marks character mentions (e). This work is licensed under a Creative Commons Attribution International 4.0 License.

emotional dynamics, and biases, while scholars used it to support literary arguments with objective evidence, enhancing their analytical depth. The results highlighted the system's ability to augment creative writing and literary scholarship, though challenges such as over-reliance and limited contextual data were noted.

Story Charting Technique (2023)

Aparicio et al. (2023) propose a character-centric story charting technique. The data visualised includes characters, entities, and significant events extracted from a Portuguese book. As shown in Figure 2.7, the study began with a basic word cloud to represent word frequency. However, this was followed by more advanced forms of analysis.The visualisation employs a network-based approach, where nodes represent characters or key entities and edges signify their interactions or co-occurrences. This network is further enhanced by temporal visualisations of word frequency, allowing for the analysis of how references to key terms and events evolve throughout the narrative. The data was defined by identifying proper nouns and contextually important terms within the text. NER using a pre-trained BERT model for Portuguese was applied to categorise the text into meaningful entities. A key component of the technique

FIGURE 2.7: Aparicio et al. (2023) – like many interested in text analysis – first generated a word cloud to represent the frequency of words in the book used in their study. This work is licensed under a Creative Commons Attribution International 4.0 License.

is the use of correspondence analysis, shown in Figure 2.8, which reveals relational structure between entities. The focus was placed on characters, roles, and events pivotal to the narrative structure. The technique was evaluated through its ability to effectively uncover relationships, patterns, and key entities within the text. Network analysis metrics provided insights into the structural importance of entities, while clustering techniques revealed thematic groupings within the narrative. While the study did not include formal user testing, the technique was discussed in terms of its potential applications in literary studies and other domains, such as social network analysis and psychology.

2.5.2 Visualisations of Characters in Film

While not the focus of this research, film scripts are technically classified as literary works, and there are many parallels between fictional character representations in novels and film. Hence, I also investigated visualisations of characters built from film scripts.

StoryFlow (2013)

StoryFlow (S. Liu et al., 2013) visualises the evolution of narrative elements by mapping characters or entities to lines on a timeline, with proximity encoding interactions and hierarchical relationships. The system employs a hybrid optimisation strategy combining discrete and continuous methods to generate an efficient and legible storyline layout. Data is defined by an XML-based session table and location tree, capturing dynamic relationships and hierarchical structures. Visual encodings include bundling for large datasets, hierarchical colour-coded regions for contextual information, and user interactions such as straightening lines and reordering entities. The system was evaluated through comparisons with state-of-the-art methods, demonstrating significant improvements in computational efficiency and reduction of visual

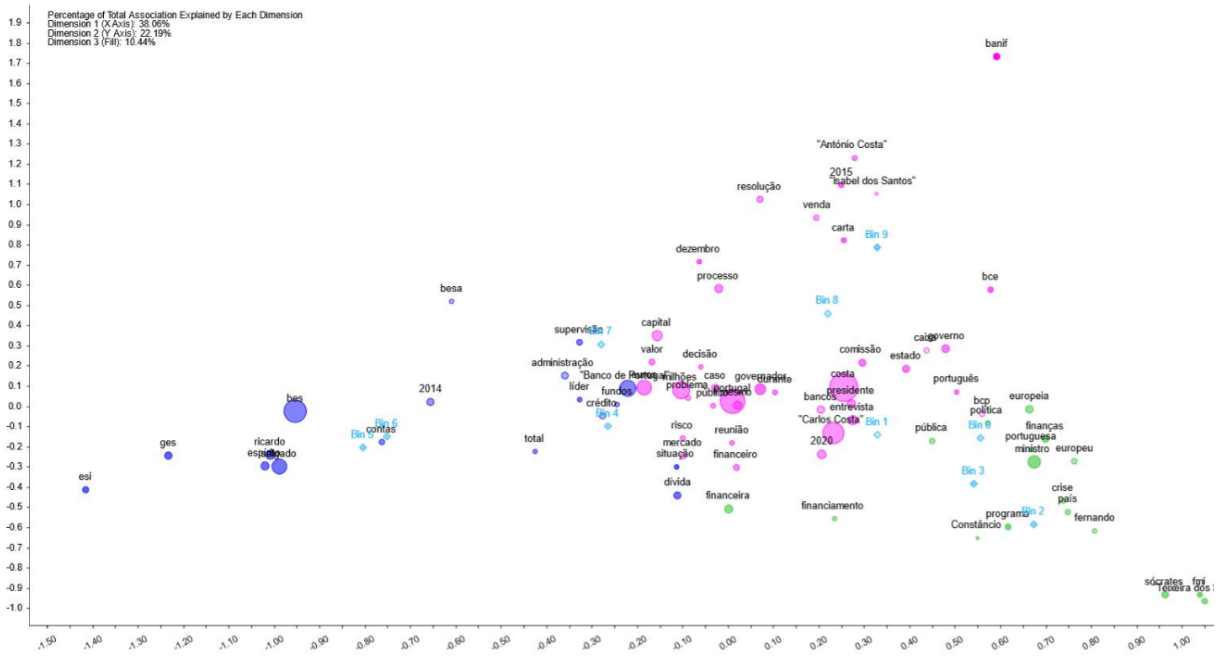

FIGURE 2.8: This correspondence analysis by Aparicio et al. (2023) is used as a story charting technique to reveal relational structure between textual entities. Those with similar contextual profiles are positioned closer together, enabling the interpretation of thematic clusters. This work is licensed under a Creative Commons Attribution International 4.0 License.

clutter. Expert interviews validated its utility for tasks such as film production planning and data-driven journalism.

StoryCake (2016)

StoryCake (Qiang & Bingjie, 2016) introduces a hierarchical plot visualisation method designed for non-linear and hierarchical narratives, using polar coordinates to enhance comprehension of dynamic relationships between characters and events. The system processes XML-based input to define characters, locations, and session interactions, creating a hierarchical tree that structures story elements across nested layers. Visual encodings represent entities as arcs, with the arc length indicating life cycles and bundled segments showing interactions, while layers and colour-coded fan-shaped blocks convey hierarchical relationships. Interactive features, such as folding session blocks and line integration, improve usability. The system was evaluated through a comparative user study with 27 participants recruited from within the university, contrasting *StoryCake* with *StoryFlow* (discussed above). Results showed improved performance with *StoryCake* in identifying hierarchical structures and plot dynamics, though challenges such as line crossings and limited interactivity were noted.

Story Explorer with Story Curves (2018)

The *Story Curves* (N. W. Kim et al., 2018) technique visualises nonlinear narratives by plotting events based on their narrative and story orders, creating curves to highlight deviations from chronological storytelling. It uses metadata such as character presence, locations, and times of

day, which are extracted from movie scripts using a custom parser and NLP techniques like sentiment analysis. Characters are represented as coloured segments on the curve, while locations and time periods are encoded as bands and backdrops, respectively. The tool, *Story Explorer*, allows users to rearrange scenes into chronological order and explore metadata. The technique was evaluated through two methods: generating story curves for 10 nonlinear films to analyse patterns, and a user study with 13 participants who performed pattern reading tasks and reconstructed story curves. Results showed high usability, with participants successfully identifying patterns, although some struggled with interpreting axes and differentiating between temporal concepts. Expert interviews highlighted potential applications in screenplay writing, film analysis, and education.

StoryPrint (2019)

StoryPrint (Watson et al., 2019) is an interactive visualisation tool for analysing script-based narratives, such as films and television shows, by mapping settings, character presence, character prominence, and character emotions around a radial timeline. The tool employs automated metadata extraction from scripts, including sentiment analysis to determine emotional arcs, and represents this data through concentric rings, each corresponding to a narrative element. Users can toggle overlays to compare original and revised scripts or different narratives, with changes in settings, characters, and emotions visually highlighted. The evaluation involved a large-scale 15-minute study with 100 non-expert users recruited through Amazon's Mechanical Turk (Buhrmester, Kwang, & Gosling, 2011), focusing on usability and intuitiveness. Later, they conducted a small-scale qualitative study with five expert screenwriters, assessing its usefulness in writing and comparative analysis. Results showed that non-expert users found the tool effective for visualising narrative elements, while experts valued it for identifying structural patterns and supporting the creative process. However, limitations such as dependency on standardised script formats and the visual distortion inherent in radial diagrams were noted.

2.5.3 Text-to-Image Generation of Characters

These works, though distinct from traditional information visualisations, are included here to illustrate the evolving landscape of text-to-image technologies for character and contextual data. While these systems do not align with the overall goals of this research, they demonstrate ongoing interest in translating text from fictional narratives into character-centric visuals.

Make-A-Story (2023)

Make-A-Story (Rahman et al., 2023) focuses on maintaining character and scene consistency across multiple frames in a narrative. By incorporating visual memory modules, the system ensures alignment between textual descriptions and the generated visuals (see an example in Figure 2.9). The authors extended existing datasets to include referential text – textual descriptions that include references or coreferences to previously mentioned entities, such as characters or objects, rather than explicitly naming them. Their work demonstrated improvements in visual quality and actor consistency.

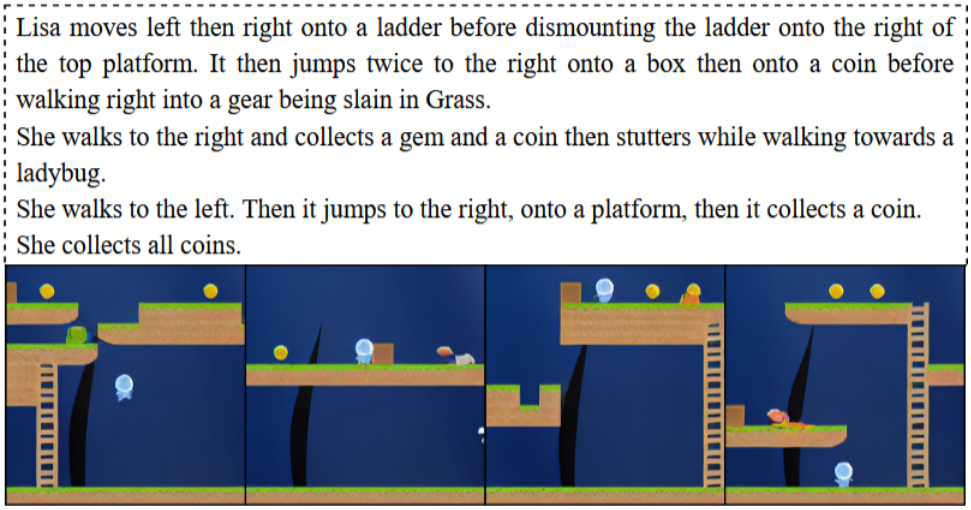

FIGURE 2.9: An example of the input text and story generation result from *Make-A-Story* by Rahman et al. (2023). This work is distributed under CC0 1.0 Universal (Public Domain Dedication).

TaleCrafter (2023)

TaleCrafter (Y. Gong et al., 2023) introduces interactive components that allow users to refine visual layouts and local structures dynamically. Its ability to maintain identity consistency across multiple characters while supporting user-driven adjustments ensures the outputs remain both accurate to the narrative and adaptable to personal preferences. User studies conducted to evaluate *TaleCrafter* demonstrated its effectiveness in creating engaging visuals.

LeMon (2024)

LeMon (Kou, Pei, & Zhang, 2024) addresses automating the generation of character portraits. The system eliminates the need for manually collected images by employing large language models and text-to-image diffusion methods to generate distinctive and compatible visuals for characters. Designed to address inefficiencies in earlier approaches, *LeMon* iteratively refines character representations and evaluates its effectiveness in creating high-quality images for multi-character scenarios. This highlights its role in advancing automated techniques for visualising textual narratives.

2.5.4 Summary

The tools and techniques reviewed in this section demonstrate significant advancements in visualising character-centric data, ranging from abstract linguistic representations like *Character Flowers* (Regan & Becker, 2010) to sophisticated narrative exploration tools like *Portrayal* (Hoque et al., 2023). These works employ a diverse array of methodologies, including NLP, sentiment analysis, and network-based visualisations, to extract and communicate character appearances, interactions, and traits.

Despite their strengths, these tools predominantly focus on supporting expert literary analysis or creative writing tasks (Hoque et al., 2022, 2023; John et al., 2016). Additionally, many tools

present multiple, disconnected views – such as networks visualised independently from word clouds – which, while useful for specific analyses, lack the cohesive overview of characters and their contextual appearances that this research aims to achieve (Aparicio et al., 2023; Hoque et al., 2022, 2023; John et al., 2016).

eReader and eBook studies offer promising insights into visualisations for casual readers (Coleman & Hinze, 2017; Hinze et al., 2018); however, their designs are primarily intended for individual use within the context of an eBook, rather than supporting group discussions. Furthermore, none of the existing techniques for visualising characters in novels appear to provide a unified, cohesive overview of *all* characters in the story while simultaneously enriching their textual appearances with relevant narrative context.

Film script visualisations demonstrate creative solutions for presenting an overview of character journeys but similarly lack textual enrichment to support investigations beyond character appearances and sentiments (N. W. Kim et al., 2018; Qiang & Bingjie, 2016; Watson et al., 2019). This gap becomes particularly evident when considering evaluation methodologies: few studies explore the role of visualisations in collaborative, discussion-based scenarios – settings that aim to reflect real-world online or in-person casual reader interactions with both the text and each other.

2.6 Visualisations for Non-Experts or Used in Non-Expert Contexts

The design of visualisations for casual readers presents a challenge, as they will likely lack both literary domain expertise needed for specific analyses, and familiarity with interpreting complex visual data. While expert analysts benefit from tools tailored to support exploratory and analytical tasks within their field, visualisations for non-experts in a domain must prioritise clarity, accessibility, and engagement. These designs should effectively guide users through data, presenting it in a logical and intuitive format that fosters understanding without requiring prior specialised knowledge (Gough, Ho, Dunn, & Bednarz, 2014).

Understanding how non-expert audiences interact with visualisations in varied contexts is essential to creating relevant designs. In non-expert settings – ranging from public education and casual forums to artistic and cultural experiences – visualisations are often expected to communicate complex information in a manner that is both informative and approachable. As this section explores, different approaches to non-expert user visualisation (NEUVis) (Gough et al., 2016; Gough, de Berigny Wall, & Bednarz, 2014; Gough, Ho, et al., 2014) and casual information visualisation (Pousman et al., 2007; Solis, Rajabiyazdi, & Chevalier, 2019) provide insights into how to address these challenges, while a study on public reactions to visualisations reveals how users interpret, personalise, and emotionally engage with the data (Kauer, Dörk, Ridley, & Bach, 2021).

2.6.1 Non-Expert User Visualisation

Non-expert user visualisation – referred to simply as NEUVis – is a design approach that prioritises accessibility and engagement for individuals without specialised expertise in the subject matter or data representation (Gough et al., 2016; Gough, Ho, et al., 2014). Unlike traditional visualisation techniques aimed at domain experts (such as many of those in literary visualisation), NEUVis focuses on simplifying complex information while maintaining its accuracy and relevance, enabling a broader audience to interact meaningfully with the data. This approach is particularly valuable in contexts where data needs to be presented intuitively.

Gough, Ho, et al. (2014) provide a set of guidelines for creative practitioners developing visualisations for non-expert users, emphasising the importance of balancing data accuracy, design intent, and audience engagement. They argue that accurate data is fundamental, as credibility cannot be compromised by embellishments or stylistic choices that distort the underlying information. Instead, these elements should be used thoughtfully to enhance the presentation and draw the viewer's attention without undermining the visualisation's integrity.

The authors stress the importance of design consciousness, highlighting how decisions about symbols, colours, and layout significantly influence the user's understanding. Designers are encouraged to adopt user-centric approaches, leveraging recognisable and intuitive visual elements to facilitate accessibility. Clarity of intent is equally critical, as practitioners need to define whether the visualisation aims to deliver precise data or provide an abstract, artistic representation to engage a broader audience. In this research, the intent is for the data to be accurate, yet the nature of textual data extracted from literature adds a layer of subjectivity that needs to be considered in the design process.

Understanding the intended audience and the context of use is another essential guideline. Visualisations should be tailored to the needs of the users and the environment in which they will interact with the work. For instance, an audience in an art gallery may interpret a visualisation differently from one at a scientific conference. Gough, Ho, et al. (2014) also advocate for recognising that visualisations can resonate on an affective level, which is particularly important for audiences who rely on intuitive and emotional decision-making processes.

Several studies have explicitly or indirectly applied principles of non-expert user visualisation design across different contexts. *DebateVis*, proposed by South et al. (2020), addressed the complexity of making political debate transcripts accessible to whom the authors describe as "casual users" – the viewers of political debates. Traditional debate coverage often relies on summaries or highlights, leaving viewers with limited engagement with the full content. *DebateVis* provides a novel solution by linking visual summaries, speaker interactions, and an annotated transcript to allow for exploratory analysis. The tool targeted non-expert users by providing multiple layers of interaction, including a timeline that visualised speaker exchanges and topic mentions. Users could quickly navigate dense information, fostering engagement and comprehension without requiring expertise in politics or data visualisation. The study highlighted the need for balance between simplification and depth, ensuring that users can both grasp the broader context and delve into specifics as needed.

J. Roberts and Gough (2016) explored the issue of integrating statistical uncertainty into visualisations for non-expert users. Statistical uncertainty presents as a concern in domains such as public health, science communication and policy making. An interactive disease mapping tool was contrasted with traditional static representations like the Queensland Cancer Atlas. The research highlights that while visualising uncertainty is often avoided for fear of overwhelming non-experts, doing so effectively enables them to appreciate the limitations of the data, fostering more cautious and informed interpretations.

2.6.2 Casual Information Visualisation

Casual information visualisation aims to lower the barrier to entry for non-experts by employing design features that simplify complex data. Traditionally, information visualisation often assumes the user has a certain level of expertise, whereas casual information visualisation caters to a broader audience, presenting information in an intuitive and visually appealing manner that does not require users to be "information analysts" (Pousman et al., 2007). In this context, casual information visualisation is not just about making information easy to digest but also about facilitating contemplation and reflection. The design can support non-expert users by providing them with new perspectives on the subject matter, even in the absence of explicit tasks or directed queries (Pousman et al., 2007). When applied to literary analysis, this means creating visual tools that allow non-experts to explore complex literary data without needing formal training in literary theory, making the experience accessible and enjoyable.

The development of visual guides for casual listeners of live orchestral music serves as an example of creating visual support for casual end-users of a subject matter by enhancing their understanding and engagement through carefully designed visual aids (Solis et al., 2019). The goal of the visual guides was to help non-expert listeners, or casual audiences, engage more deeply with orchestral performances. These guides presented information in a simplified, intuitive, and visually appealing way, aligning with the principles of casual information visualisation, which prioritises ease of access and understanding without requiring specialised knowledge or expertise in music theory. Their method included user studies to evaluate how casual listeners interacted with these visual aids during live orchestral performances, assessing both the effectiveness of the visual design and the overall listening experience (Solis et al., 2019). Findings demonstrated that these visual guides enhanced participants' enjoyment and understanding of the music by presenting high-level information, such as the instruments and movements, in an easily interpretable format.

2.6.3 Reactions to Visualisations in Non-Expert Contexts

Kauer et al. (2021) examined public reactions to data visualisations shared on *Reddit* (Reddit, 2024b), particularly focusing on the community of the subreddit *r/dataisbeautiful*. Their findings provide valuable insights into how the general public interacts with visualisations in non-expert contexts, such as online forums. This study differs from those discussed in previous sections, as the visualisations themselves were not necessarily designed for a non-expert audience.

Kauer et al. (2021) identified ten distinct types of user reactions that illustrate the varied ways people in a non-expert context engage with visual data. One reaction is observations, which often highlight specific data points or trends, while another reaction, opinions, see users express personal views, feelings or judgements. This diversity demonstrates that visualisations in a non-expert context do more than simply convey information; they provoke a wide range of cognitive, emotional, and social responses. The personalisation of data interpretation is also discussed. Many of the users related the visualisations to their own experiences, knowledge, or emotions. For instance, critiques are frequently motivated by a desire to correct perceived inaccuracies or challenge misleading representations. Similarly, personal testimonies bring in personal anecdotes that contextualise the data in a relatable manner. This suggests that visualisations should anticipate and accommodate the occurrence of personalised interpretations, if multiple interpretations are accurate – such as in literary visualisation. Additionally, their findings offer compelling support for using visualisations in collaborative contexts to both instigate and support discussions.

Another significant finding in is the role of emotional engagement in shaping public discourse around visualisations. While data is often perceived as objective and rational, many reactions reveal underlying emotional responses, such as surprise, frustration, or amusement (Kauer et al., 2021). These emotions can amplify user engagement and participation, suggesting that designers should consider how visual elements might evoke emotional connections with their audience, which is echoed in non-expert user visualisation research (Gough, de Berigny Wall, & Bednarz, 2014; Gough, Ho, et al., 2014).

While Kauer et al.'s study provides an example of how the general public react to visualisations in online spaces, other researchers have explored using information visualisations in physical co-located spaces, such as museums. Hinrichs, Schmidt, and Carpendale (2008) explored the reactions of museum visitors to a large-scale interactive visualisation designed to enhance an art exhibition centred on the Canadian artist Emily Carr. The visualisation, *EMDialog*, featured interlinked representations of temporal and contextual dimensions, encouraging visitors to explore relationships and discourse about Carr's life and works. This study provides valuable insights into how non-expert users engage with visualisations in public, non-expert contexts.

Visitors interacted with the visualisation in diverse ways, influenced by age, group dynamics, and interest levels. Younger audiences were drawn to the interactive display's novelty and tactile elements. In contrast, adults approached more cautiously, often engaging after observing others interact. This highlights the importance of designing visualisations that attract attention visually and encourage intuitive entry points to interaction for casual users. The study also revealed varied exploration patterns. While some users engaged briefly, appreciating high-level summaries, others delved into deeper layers of content, spending extended periods navigating linked data. These findings underscore the necessity of designing visualisations for non-experts that reward both short-term and long-term interaction. Group interactions played a significant role, as visitors often explored the visualisation collaboratively, pointing out elements or discussing their findings.

However, the study also identified challenges. Some visitors were overwhelmed by the amount of textual information and found the visualisation complex or confusing. Others felt self-conscious about interacting publicly, especially when the display was prominently visible to other visitors. These findings emphasise the importance of balancing visual and textual elements.

Similarly, Ma, Liao, Ma, and Frazier (2012) explored how interactive visualisation tools like *Living Liquid* can engage museum visitors in informal learning environments. Designed to visualise global phytoplankton distributions, the tool provided museum visitors with an accessible means of interacting with complex datasets. Their iterative design process revealed the importance of layering information to match varying levels of expertise, embedding context to facilitate understanding, and avoiding distractions that detract from inquiry. As shown in the *EMDialog* study (Hinrichs et al., 2008), the study by Ma et al. (2012) also demonstrated how visualisations in casual settings must balance accuracy with accessibility, offering entry points for novices while still engaging those with prior knowledge of the domain.

2.6.4 The Problem of Characterising Non-Expertise

A recent study by Burns et al. (2023) examined the complexity of defining non-experts (or novices) in visualisation research, particularly in terms of domain, user ability, and context of use. The authors conducted a qualitative analysis of 79 visualisation papers to understand how researchers describe novices and evaluate visualisations designed for them.

The findings reveal significant ambiguity in how non-experts are defined across the literature. While non-experts are broadly categorised by their lack of expertise and contrasted with experts, there is inconsistency in specifying the domains or skills relevant to these terms. For instance, one study might define novices as individuals without programming experience, while another might target users unfamiliar with data analysis or visualisation techniques. This lack of standardisation creates challenges for generalising findings and applying guidelines across different contexts.

The study also highlights that participants used to evaluate visualisations published in the visualisation research literature often represent a narrow demographic – predominantly young, educated individuals from Western countries. This limits the applicability of results to a broader, more diverse audience, as factors such as cultural background, education level, and familiarity with technology can also influence how visualisations are interpreted and used. The authors argue for a more inclusive approach that accounts for varied perspectives and experiences.

Additionally, the research emphasises the importance of understanding the context in which visualisations are used. For non-experts, the ability to make sense of a visualisation depends not only on their personal skills or knowledge but also on the design choices made by the creators, the tasks expected of users, and the social or cultural setting in which the visualisation is encountered. This interplay suggests that the term "non-expert" (or "novice") must be contextualised rather than treated as a fixed, universal category.

The findings from Burns et al. (2023) demonstrate the need for precise, inclusive definitions of non-experts, diverse participant recruitment for evaluations, and context-aware design practices. These findings confirms insights from some non-expert studies, while challenging assumptions made in others.

2.6.5 Summary

Visualisations for non-experts need to prioritise clarity, engagement, and contextual relevance while maintaining data integrity (Gough et al., 2016; Gough, Ho, et al., 2014). NEUVis and casual information visualisation approaches both emphasise intuitive design and emotional resonance to make complex data accessible (Pousman et al., 2007; Solis et al., 2019). Studies show that such visualisations can enhance understanding and enjoyment across diverse contexts, including political discourse (South et al., 2020), orchestral performances (Solis et al., 2019), museum exhibitions (Hinrichs et al., 2008; Ma et al., 2012), and online communities (Kauer et al., 2021).

However, significant challenges remain. One major gap is the lack of standardisation in defining "non-experts", which complicates the generalisation of design principles and research findings (Burns et al., 2023). Another is the overreliance on narrow participant pools – typically young, educated, Western users – which limits the broader applicability of user study findings (Burns et al., 2023). Furthermore, while affective and social responses are shown to be central to user engagement (Gough, de Berigny Wall, & Bednarz, 2014; Kauer et al., 2021), they are often under-explored in design processes and user studies. These insights call for more inclusive and contextually relevant visualisation designs that move beyond generic assumptions about the needs of non-expert users (Burns et al., 2023; Gough, Ho, et al., 2014).

2.7 Characterising Casual Readers as Non-Experts in This Research

In non-expert user visualisation research, the characterisation of end-users often hinges on their domain expertise, familiarity with the underlying data, and the data representations (Burns et al., 2023; Gough et al., 2016; Gough, Ho, et al., 2014). Earlier in the literature review, character-centric literary visualisations were discussed, and for multiple studies the intended target end-users were identified often in terms that indicated a level of expertise. Additionally, some of the studies included non-experts in literary analysis in the evaluation process, referred to as book fans or readers (Coleman & Hinze, 2017; Hinze et al., 2018; Regan, 2011). From the literature on non-expert user visualisation, literary visualisation and casual readers, I posit that a casual reader engaging with a literary visualisation fits the definition of a non-expert end-user due to the following reasons:

- **Potentially Limited Literary Domain Expertise:** They can be anyone in the general public, so it can be assumed that most casual readers lack formal training in literary analysis or the methodologies used to systematically interpret texts. Therefore, they are unlikley to be familiar with the workflows embedded in expert literary analysis tools.

- **Personal Purpose for Interaction:** They are more likely than experts to engage with literary visualisations to support activities like understanding characters, confirming their recollection of a story, or exploring a story to learn more about its contents. Their goals are likely to be more practical and informal, focusing on improving their experience as casual readers and enjoyment of literature, rather than contributing to the academic discourse surrounding the text (Pianzola et al., 2020; Rebora et al., 2021; Regan, 2011).
- **Potentially Limited Visualisation Exposure:** They may have had limited exposure to – or experience in interpreting – complex visual encodings or extracting insights from abstract representations of data, particularly if they have not encountered advanced visualisation techniques designed for specialised contexts (Burns et al., 2023; Gough et al., 2016).
- **Potentially Limited Technical Skill:** They may approach literary visualisations with varying levels of technical proficiency (Gough et al., 2016; Lee et al., 2016), or avoid them if they require specific configurations or additional software to use.
- **Focus on Enjoyment:** They prioritise enjoyment of characters and stories over rigorous analytical insights (Pianzola et al., 2020). Their interaction with a text tends to be exploratory and conversational (Rebora et al., 2021), potentially shaped by immediate questions such as "Who was this character?" or "What happened in this chapter?". This behaviour is characteristic of casual readers described in other studies, where the goal was to engage them with the text and activate their recollection, rather than have them perform detailed analysis to answer hypotheses (Hinze et al., 2018).

The contextual nature of non-expertise emphasises that no single definition or approach can fully encapsulate the varied experiences and capabilities of non-expert users. For non-expert targeted literary visualisations, this complexity poses both challenges and opportunities. Designers need to account for the diverse backgrounds, skills, and expectations of casual readers while also tailoring visualisation designs to support intuitive exploration and engagement. The findings of Burns et al. (2023) reinforce the importance of adopting a context-aware approach, recognising that casual readers may interact with literary visualisations in ways that differ from more traditional expert audiences. As limited studies in the literature design for and evaluate with casual readers (Coleman & Hinze, 2017; Hinze et al., 2018) – and none have designed specifically for the casual discussion and analysis of characters in a read novel – this research presents a significant step towards defining non-experts in the specific context of casual readers using literary visualisations.

2.8 Challenges in the Literary Visualisation Pipeline

The information visualisation pipeline provides a structured framework for transforming raw data into meaningful visual representations that are accessible and interpretable for users (Card et al., 1999; Munzner, 2009, 2014). This pipeline comprises multiple stages, from data extraction and processing to encoding information into visual structures. Each stage requires justified decision-making and making considerations for potential threats to the success of the

technique, as choices made at one stage directly influence the effectiveness, usability, and interpretability of the final visualisation (Munzner, 2009, 2014).

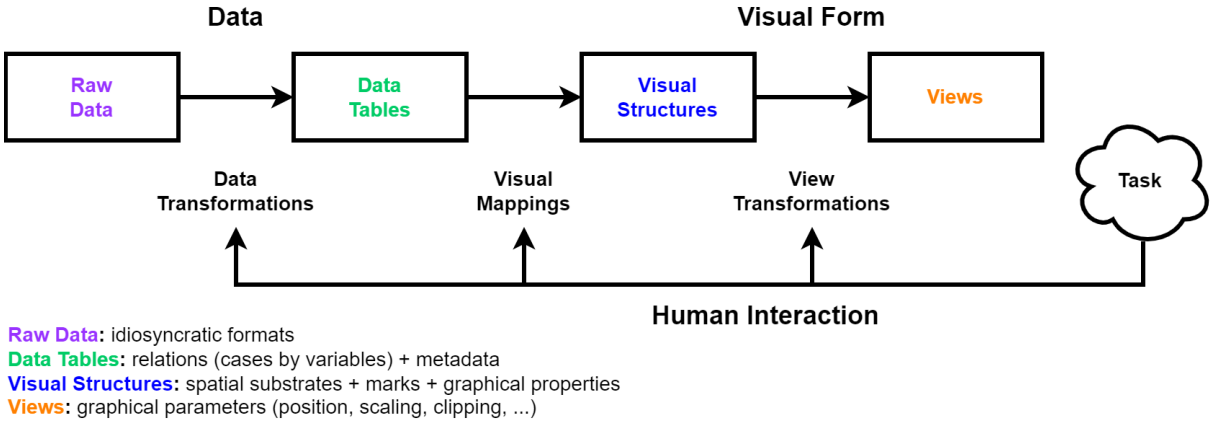

FIGURE 2.10: Adapted reference model for visualisation developed by Card et al. (1999). This model outlines the process of mapping data to visual forms that support human interaction within a visual sense-making context.

In the context of literary data, the complexity of this pipeline increases. Novels are rich, multifaceted texts with intricate narratives, characters, and thematic layers. The first stage of the pipeline involves extracting relevant data from the text, which requires careful consideration of what to include – whether character appearances, relationships, goals, or other elements that capture the essence of the story. Once extracted, this data must be transformed into visual encodings that represent key aspects of the novel while maintaining clarity and usability. The encodings should align not only with the structure of the data but also with the cognitive processes of users, ensuring they can intuitively engage with and interpret the visualisation.

Finally, the resulting encodings are assembled into visual formats for end-users to explore. This stage introduces additional challenges, particularly for literary visualisation. Unlike numerical data, which often adheres to established conventions like bar charts or line graphs, literary data demands innovative design approaches to communicate narrative elements effectively. For example, encoding character interactions or plot progression require visualisation techniques that balance complexity with accessibility. Additionally, visualising textual data can require the use of direct visualisation (Manovich, 2011).

The visualisation pipeline's adaptability (Figure 2.10) underpins its relevance for diverse data types. Numerical data, for example, often benefits from line graphs or heatmaps, while categorical data is well-suited to bar charts or stacked visualisations (Munzner, 2014). However, literary data introduces unique demands, as it intertwines character-driven narratives and thematic depth with temporal and relational complexity. This necessitates a rethinking of conventional approaches, aligning visualisation techniques with both the intricacies of the data and the interpretative needs of the audience.

This research investigates how to approach the visualisation design pipeline through the lens of character-centric literary visualisation. While the existing techniques, discussed in Section 2.5, help to understand aspects of character data extraction and visual encoding, it is also important

to understand the theoretical foundations of how stories are interpreted and communicated visually.

2.8.1 Visual Communication of Story Meaning

The most basic definition of meaningful is having a purpose. In a communication system, such as visualisation, something can be considered meaningful if it has an assigned function that conveys meaning in a way that is consistent with human understanding (Heath, Norton, & Ventura, 2014). Semantics in the context of visualisation has been explored (Cruz, 2015; Irani & Ware, 2003), with perceptual semantics used to describe how perceptual processes are mapped to entities and relations to take on a meaning (Irani & Ware, 2003).

On a conceptual level, imparting the meaning of a story involves (Gervás, 2016, p. 23):

> A speaker, who tells the story, and an audience, who listens to the story. The audience may be made up of one or several listeners, and these may be specific people or a generic public. In all cases, the process as a whole is governed by a number of implicit assumptions that help speakers and listeners to optimise the processing required of them to take part.

In the context of this research, the speaker can be considered the designer of the visualisation, the visualisation is the storytelling medium, and the listener is the end-user. The implicit assumptions that govern the process and help optimise the processing of story content may be uncovered through the study of how users comprehend the stories they are told.

2.8.2 Mental Models

Our exposure to other visual narrative systems greatly influences the developmental trajectory of our visual narrative comprehension capabilities (Cohn, 2019). This concept is echoed in research into mental models, which states that most users do not come to a new system devoid of any capability, even if the system is unfamiliar to them (Stone et al., 2005). This is because each of us have mental models that allow us to negotiate somewhat familiar situations. While it is possible to form new mental models through training and instruction, most are developed through experience (Norman, 1988). A user's knowledge on how to interact with a system is dependent on whether or not the domain of the system or its possible uses are already contained within a mental model (Rieman, Lewis, Young, & Polson, 1994). Therefore, if the domain is not at all familiar, mental models may provide little to no help (Stone et al., 2005). The closer the situations in a domain are to a user's mental model, the easier they become to manage to the point that it may become intuitive; conversely, if the differences are vast, a system can be very difficult to navigate (D. Roberts, Berry, Isensee, & Mullaly, 1997).

This poses the consideration of the mental models at play when engaging with a character-centric literary visualisation. In information visualisation, the mental model is activated as "a functional analogue representation to an external interactive visualisation system" with preserved "structural and behavioural properties of external systems", and "schematic, semantic

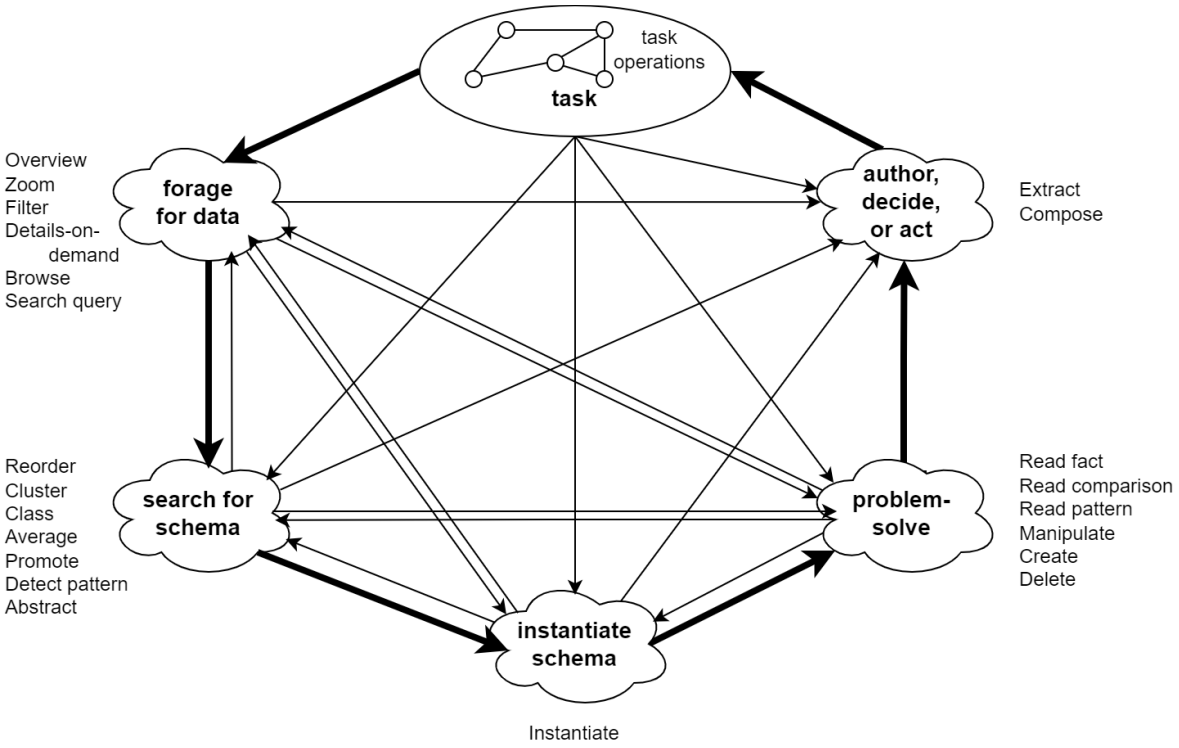

FIGURE 2.11: A visual summary of the elements typical of knowledge crystallisation, redrawn from the original diagram by Card et al. (1999).

or item-specific information about the underlying data", which when given a problem "can be constructed and simulated in working memory for reasoning" (Z. Liu & Stasko, 2010, p. 1001).

Typically, the aforementioned problem is the need to quickly assimilate information about data through a graphical display, but not necessarily to perceive an intended narrative construction or message about what the data implies. In other words, some cognition and perception models help to explain how visualisations support user mental models, but these typically do not account for the visual interpretation of a specific domain of data. In addition to this, for expert analysts the mental models to which they refer when engaging with a visualisation may contain more information than those held by non-expert users, as mental models are developed through experience (Norman, 1988). When users of a visualisation will be predominantly non-experts, it makes sense to consider what else may be referenced during the reasoning process.

2.8.3 Knowledge Crystallisation

Knowledge crystallisation as a task describes the process of gathering information for a purpose, and making sense of it (Russell, Stefik, Pirolli, & Card, 1993), aided by the construction of a *schema*, that is, a representational framework for understanding the information (Card et al., 1999). In the broadest sense, a schema describes a pattern of thought, or even behaviours or actions, that organise categories of, and relationships among, information. Schemata are personal, and research in psychology shows that they can both influence and impede human ability to integrate new information, especially when biases or preconceived ideas about the information are at play (Tuckey & Brewer, 2003).

The elements typical of knowledge crystallisation are summarised in Figure 2.11. When mapping graphical attributes to data attributes, whether for a large or small-scale implementation, "successful visualisation depends on a viewer decoding the visual scene into a message about the underlying data" (Byrne, Angus, & Wiles, 2015, p. 509), which activates the viewer's schema.

2.8.4 The Story Schema

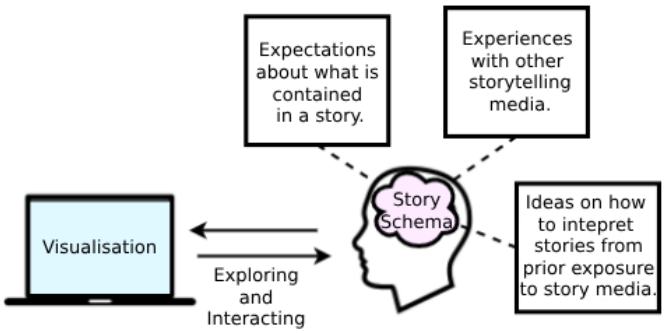

FIGURE 2.12: The potential impact of the story schema on visualisation interpretation.

People have expectations regarding the internal structure of stories which are referred to when decoding a story, making both comprehension of a new story, and recall of already heard or read stories, more efficient (Rand, 1984). The traditional art of storytelling has been a favoured method of communication since ancient times, meaning humans have developed strong expectations for what is contained in story content through consistent experiences of telling and being told stories. Psychologists and experts in cognition refer to these expectations as the basis of the story schema (Rand, 1984; Stein & Glenn, 1979), which may be considered the mental model activated when interpreting a story.

Figure 2.12 provides an illustrated concept of what I propose may be the potential impact of a user's story schema on their ability to comprehend a visualisation claiming to depict the characters and other contextual elements of a novel – that is, a story.

The theory of a story schema works on the assumption that story material has internal representations (Stein & Glenn, 1979), which can be communicated through the chosen storytelling medium. It guides the encoding and retrieval of stories in our brains and explains why we are sensitive to the manner in which stories are structured (Mandler & Johnson, 1977). This means that when visualising a novel, both visualisation cognition and story cognition must be considered in the design. Furthermore, in this research, there is the more specific requirement of structuring the visualisation to reflect stories contained in novels.

2.8.5 Fictional Characters

Aspects of the Novel by Forster (2023) is a pivotal text in understanding novels. Of particular importance to this research is Forster's exploration of the construction of characters in novels,

focusing on how fictional characters differ from real people and the unique role they play in literature. Forster distinguishes between *Homo Sapiens* (real people) and *Homo Fictus* (fictional characters), highlighting several key points and differences (Forster, 2023, pp. 69-124):

- **The Author's Power:** Unlike real life, where humans remain unknowable, the author has the power to reveal the "hidden life" of their characters – their thoughts, dreams, and emotions – making them more comprehensible and definite than real people.
- **Fictional Life vs. Real Life:** Forster discusses how novels exaggerate or minimise fundamental human experiences – birth, death, food, sleep, and love.
- **Birth and Death:** These are described by Forster as "strange" because they are unknowable, yet fiction simplifies or dramatises them to serve narrative needs. Death is particularly congenial to novelists because it provides a neat ending.
- **Food and Sleep:** Often underrepresented in novels, these experiences are treated as uninteresting or as social occasions. Characters rarely eat or sleep realistically; they exist mostly in "daylight", awake and conscious.
- **Flat and Round Characters:** Forster introduces the distinction between flat and round characters. Flat characters are simple, one-dimensional, and built around a single idea. They are (according to Forster) easy to remember and function well in minor roles. In contrast, round characters are complex, capable of growth, and can surprise the reader convincingly.
- **Characters in Relation to Art:** Characters in novels are not bound by the constraints of real life. That is, they belong to an artistic world where their hidden lives can be made visible. The author's omniscience allows characters to be explicable, even if not fully explained.
- **The Illusion of Permanence:** Novels offer a sense of comfort and permanence through their characters. While real people are elusive and unknowable, fictional characters provide an illusion of understanding and stability.

In summary, Forster argues that the strength of fiction lies in its ability to reveal the hidden lives of characters, creating a world where people are knowable and their emotions more manageable. He distinguishes between the simplicity of flat characters and the depth of round ones, and critiques the ways fiction simplifies or exaggerates human experiences, to suit narrative purposes. These insights provide an important foundation for developing an understanding of how to decompose the elements of, and represent, fictional characters.

2.8.6 Book Navigation

In their research on orientation cues in books, Vanderschantz, Timpany, Hinze, and Du (2017) investigated how orientation cues in both physical and eBooks help readers navigate and orient themselves within texts. The research compared traditional cues in physical books, such as

page numbers and the physicality of the book, with their digital counterparts typical to eBooks, like progress bars and digital bookmarks.

Their work highlighted the importance of orientation cues in books to assist readers in determining their location and progress when actively reading, providing insights for this research into the important structural properties of novels. Key findings indicate that while physical books rely on tangible cues like page thickness and chapter headings, eBooks use features such as progress bars and headers displaying titles or chapter information. Their study findings revealed that chapter headings and progress bars are particularly effective in aiding orientation across both physical and digital formats, while also identifying challenges in eBooks, such as the loss of spatial memory due to text reflow when fonts are resized, which can disrupt the alignment of page numbers.

The study by Vanderschantz et al. (2017) provides insights that can inform the design of a literary visualisation that aims to activate the end user's mental model for navigating a novel – activating a sense of familiarity with their navigation of the original text. By understanding how readers navigate and orient themselves in books, I propose that designers can develop visualisations that align with readers' existing mental models and story schemas. For instance, incorporating persistent chapter markers and spatial organisation could make visualisations more intuitive and reflective of readers' cognitive models for storytelling.

2.8.7 Visual Narrative Theory

Visual narrative theory is a new and emerging field in cognitive science research (Cohn & Magliano, 2020). The field focuses on understanding the effective construction and interpretation of visual storytelling media, such as film and visual novels or comic books. The field challenges the common misconception is that it is an effortless task to understand image-based narratives (Cohn, 2019). Work into the visual language of comics, and the architecture of visual narrative comprehension and cognition, provides insights into understanding the complex tasks of perceiving and making sense of stories presented through images (Cohn, 2013, 2014, 2019, 2020; Cohn & Magliano, 2020). In such works, scientific attention is turning towards "investigating just how readers comprehend complex graphic displays of sequential images" (Cohn, 2014, p. 1). They also explore the role of narrative grammar in organising conceptual information into categorical roles for effective narration, showing that comics employ their own visual language (Cohn, 2013). Bach et al. (2016) developed data comics, which utilise the comic book grammars from Cohn's work in their design. These comics represent dynamic data – in that it evolves over time – in a static presentation that utilises a sequence of frames. In each frame, a social network is displayed and its representation and members change from one frame to the next.

Loschky, Larson, Smith, and Magliano (2020) propose the Scene Perception and Event Comprehension Theory (SPECT) that captures the interplay of theories that describe the perceptual processing of complex visual scenes to process the changes between them. Their theory guides understanding on how the attention and visual information extraction abilities of the audience

impact their comprehension of a visual narrative. In this work, the researchers describe the shifting between each event boundary that occurs when a viewer is interpreting a visual narrative. Hutson, Magliano, and Loschky (2018) call the inferences that connect story elements, such as characters and events, bridging inferences, acknowledging the role that visual scene construction plays in impacting the ability of the viewer to comprehend the story's meaning. When visualising the contents of a novel, I consider how a bridging inference may be semantically implied through event sequencing or structurally established through chapter-based delineation.

Visual narrative theories, such as SPECT (Loschky et al., 2020) and those discussed in the work of Cohn (2013, 2014, 2019, 2020), acknowledge the role of grammars in constructing effective and comprehendible visual narratives. Hence, core to this work will be the development of functional visual representations of characters in the story. Functional refers to them being effective in aiding the encoding and decoding of character-relevant information in a visualisation. This requires an understanding of the roles of different data types and character-relevant information. Narrative theory describes a similar concept: The two defining features of a narrative text are its textual unity and semantic unity (Zahoor & Janjua, 2013). In a visually told story, the audience may observe its visual unity and its semantic unity. The surface visual features contribute to its visual unity and their unified meanings, generated through visualisation, form its semantic unity. In this research, I propose that the meaning of the character representation elements may be derived from the surface features, which should function to impart the character-relevant content onto the visualisation through communicative graphics.

2.8.8 Extracting Data from Novels

Data extraction from novels for visualisation can be accomplished through both automatic and manual approaches. As discussed in Section 2.5, automatic methods often involve leveraging NLP algorithms to automatically identify and extract relevant information from the text, such as key themes, sentiments, or character interactions. On the other hand, manual extraction entails human readers meticulously analysing the text to identify and record specific data points. The choice between these approaches depends on factors such as the complexity of the desired data to be recorded, the precision required, and the balance between efficiency and the nuanced understanding that human interpretation can provide.

NLP algorithms excel at tasks like sentiment analysis, topic modelling, and text summarisation (Jurafsky & Martin, 2000). Sentiment analysis can discern the emotional tone of a literary work, and has been used to track characters' changing emotions in character-centric literary visualisations (Watson et al., 2019). Topic modelling helps in identifying recurring themes and motifs within a body of literature, shedding light on the underlying messages and narratives. Text summarisation algorithms can condense lengthy texts into concise summaries, facilitating quick overviews of complex literary works. ML plays a pivotal role in automating and enhancing literary analysis, but its implementation typically requires expertise in programming and data science. ML-driven recommendation systems use literary analysis to suggest books to readers based on their preferences and reading history (Alpaydin, 2010).

When determining what to extract from a novel, a key challenge is to develop an understanding of the distinction between textual entities and semantic entities in a text. These two complementary concepts form a foundation for how narratives can be represented and explored visually (John et al., 2016). Textual entities refer to the explicit, directly observable components of a text. These entities are tied to the surface structure of the narrative and include elements such as character names, places, recurring phrases, or significant objects mentioned explicitly in the text. For example, a textual entity might be the name "Sherlock Holmes," the location "Baker Street," or a frequently used term like "murder". Textual entities are often straightforward to identify and extract through automated methods, such as NER or frequency analysis (used in a number of techniques discussed in Section 2.5). As such, they provide a concrete foundation for initial visualisations, mapping the *what* of a text – the people, places, and words that populate its surface.

In contrast, semantic entities represent the deeper meanings, relationships, and abstract concepts that emerge from interpreting a text (Coleman & Hinze, 2017). These entities are not always directly stated but are inferred from the context, interactions, and narrative structure. Encoding relationships between semantic entities in literary texts is considered almost as difficult as their definition and identification (Koidaki & Tiktopoulou, 2021). Semantic entities might include themes, the emotional arcs of characters, or the social dynamics between key figures in a story. For instance, while the textual entity "Sherlock Holmes" identifies a character, the semantic entity might explore Holmes' role as a mentor to Watson or his function as a symbol of deductive reasoning within the narrative. Semantic entities require more nuanced methods for identification, often involving natural language processing, semantic analysis, or human interpretation. They illuminate the *why* and *how* of a text.

Character-centric literary visualisations often use textual entities to map structural features, such as linear and nonlinear narratives, character appearances, or frequent terms displayed as word clouds (Aparicio et al., 2023; Coleman & Hinze, 2017; John et al., 2016; N. W. Kim et al., 2018; S. Liu et al., 2013; Watson et al., 2019). These approaches are effective for providing overviews or navigating large texts but can struggle to capture the richness of narrative meaning. Some visualisations incorporate semantic entities to enable deeper exploration of concepts like characters' relationships and emotional trajectories (Coleman & Hinze, 2017; Hoque et al., 2023; Watson et al., 2019).

For literary visualisation, the interplay between textual and semantic entities impacts the relevance and usefulness of the technique. Literature often demands engagement with both the explicit details of the narrative and its interpretive layers. Casual readers not only track which characters appear but also reflect on how those characters interact, evolve, and contribute to the overal meaning of the story.

2.8.9 Visual Grammars

While visualisations provide a means to convey the insights garnered from the described data extraction techniques, the question of how to represent their outputs – particularly if they are

textual – poses more challenges regarding data representation design.

The application of visual grammars to literary visualisation should draw on foundational frameworks from data visualisation to represent complex character data in a meaningful and interpretable manner. Jacques Bertin's widely referenced *Semiology of Graphics*, first published in 1967, and referenced here as a later edition (Bertin & Berg, 2011), provides the basis for this work, defining seven key visual variables: position, size, shape, value, colour, orientation, and texture. These variables serve as the building blocks for encoding data visually, each with specific strengths depending on the type of data and the interpretative tasks required.

Bertin's principles have significant implications for information visualisation, and therefore, also literary visualisation. For example, position could be used to represent when characters appear across chapters, leveraging spatial layouts to convey narrative progression. Size could be used to reflect a character's prominence in a scene, while colour could be used to distinguish between character identities. Variables like value (lightness or darkness) and texture can add further nuance.

Subsequent work expanded on Bertin's ideas, refining their application in diverse contexts. Cleveland and McGill's research on graphical perception tested the effectiveness of various visual encodings, establishing a hierarchy based on how accurately people interpret these elements (Cleveland & McGill, 1984). Their findings reinforce Bertin's emphasis on position as a highly effective encoding for quantitative comparisons, while variables like colour and shape are more suited for distinguishing categories. These insights are particularly relevant for designing visualisations that aim to balance interpretability with the complexity of literary data.

Building on these foundations, *The Grammar of Graphics* (Wilkinson, Wills, Rope, Norton, & Dubbs, 2005) formalised visual grammars into a computational framework, which has since influenced tools like ggplot2 (Wickham, 2016). This approach integrates the encoding of data relationships, scales, and transformations into a cohesive structure, enabling systematic and flexible visualisation design. By leveraging established principles of visual grammar, this research is situated within the broader tradition of visualisation research, while addressing the unique challenges of encoding literary character data.

These firmly established grammars should be leveraged in the visual encodings design phase of any literary visualisation technique, however, investigation into specific techniques appropriate to the data types is needed.

2.8.10 Data Representation Design

Visualisation techniques draw upon cognition research to map data parameters to graphical representations that maximise interpretability (L. Nowell, Schulman, & Hix, 2002). Choosing the graphical representations to use for data attributes was considered a difficult task (L. Nowell et al., 2002), however, established methods and design guides help to improve this process (Munzner, 2014). Questions still remain regarding the inclusion of non-data graphics in visualisations, which has been a topic of ongoing discussion in the information visualisation field for some time. Tufte (2001) highlighted the potential risks of overusing decorative elements,

which he referred to as "chartjunk," cautioning that such additions might detract from clarity and dilute the communication of core data. This perspective has profoundly influenced traditional visualisation practices, with an emphasis on minimising extraneous elements to preserve accuracy.

However, later research suggests that non-data graphics can play a supportive role in certain contexts. For instance, Byrne et al. (2019) argue that incorporating images into visualisations can enhance the overall communication of information, making it more accessible and engaging for diverse audiences. The researchers found that pictorial elements significantly improve retention of presented content. This perspective broadens the conversation around visualisation design, recognising the value of thoughtful imagery in augmenting user comprehension.

Defined by Byrne et al. (2015) as representations where meaning derives from the resemblance of graphical forms to external objects, figurative visualisations can cater to a broad audience. Their exploratory and contemplative nature makes them particularly effective for communicating complex concepts in intuitive ways. Figurative visualisations employ semantic metaphors to convey data through relatable, often emotive imagery (Cruz & Machado, 2016). By drawing parallels between data and familiar objects or concepts, these visualisations can evoke emotional responses and enhance user understanding. For instance, the use of a blood vessel metaphor to depict traffic congestion exemplifies the potential of figurative representation (Cruz & Machado, 2016).

The design process for figurative visualisations involves two key steps: adapting structural metaphors and introducing visual cues (Cruz & Machado, 2016). For a character-centric literary visualisation, this introduces considerations for how to represent the structure of a novel with enough abstraction to provide a clear overview of its component parts.

Less traditional visualisation designs still need to balance artistic expression and scientific precision, while exploring new avenues for data representation. However, while figurative visualisations can transform traditional scientific tools into exploratory art pieces (Moere & Purchase, 2011), these types of approaches must be employed with good judgement. Overly artistic metaphors may distort spatial awareness or introduce slight informational inaccuracies (Cruz & Machado, 2016). These potential drawbacks highlight the importance of aligning design choices with user needs and ensuring that visual elements serve a clear communicative purpose.

Nielsen (2005) highlighted the issue that designers can make assumptions about user requirements rather than grounding their choices in evidence. This tendency highlights the necessity of introducing rigour, objectivity and iterative user testing into graphical design processes, particularly for visualisations intended for diverse and non-expert audiences. Empirical and qualitative studies provide a foundation for designing and evaluating graphical attributes, mitigating personal preference being the sole basis for design decisions (Carpendale, 2008; Elmqvist & Yi, 2012; L. Nowell et al., 2002).

2.8.11 Summary

Designing effective character-centric literary visualisations presents several key challenges. First, visual narrative theory highlights that interpreting sequential images is not effortless, as previously assumed (Cohn, 2013, 2014, 2019; Cohn & Magliano, 2020). Viewers rely on narrative grammars and perceptual-cognitive processes to make sense of stories that are communicated visually (Loschky et al., 2020), which must be considered when structuring visual encodings of literary data. A second challenge lies in the extraction of meaningful information from novels. While textual entities (such as character names or locations) can be identified through automated methods like NER (John et al., 2016), the identification and encoding of semantic entities (such as the nature of relationships) remains a highly complex, often manual task requiring interpretative insight (Coleman & Hinze, 2017; Koidaki & Tiktopoulou, 2021).

Translating this extracted information into visualisations introduces further complications. Foundational frameworks in data visualisation, such as Bertin's visual variables (Bertin & Berg, 2011) and Cleveland and McGill's perceptual hierarchies (Cleveland & McGill, 1984), provide guidance for encoding different data types. However, their application to literary data – which is often qualitative and subject to interpretation – poses a challenge when applying these principles to narrative-driven, character-centric data in ways that remain both comprehensible and analytically useful. Figurative visualisations offer creative opportunities to use metaphors and recognisable imagery to convey meaning (Byrne et al., 2015; Cruz & Machado, 2016), but their use risks compromising clarity, spatial accuracy, or analytical depth if not grounded in user needs and empirical testing (Moere & Purchase, 2011; Nielsen, 2005; Tufte, 2001).

In summary: visual narrative comprehension is a cognitively complex process that requires thoughtful design; distinguishing between textual and semantic entities is essential for meaningful visualisation; existing visual grammar frameworks offer useful guidance but need adaptation for literary contexts; and empirical, user-centred design practices help ensure that visualisations are both informative and accessible (Carpendale, 2008; Elmqvist & Yi, 2012; L. Nowell et al., 2002). These gaps point towards a need for design approaches that bridge literary analysis, cognitive science, and information visualisation.

2.9 Visualisation in Collaborative Contexts

This section explores considerations for using character-centric literary visualisations in collaborative contexts, distinguishing between co-located and distributed settings.

Collaborative visualisation, as broadly defined by Isenberg et al. (2011, p. 3), involves "the shared use of computer-supported, interactive, visual representations of data by more than one person with the common goal of contribution to joint information processing activities". This definition highlights the interactive nature of collaborative visualisation, where participants engage with and interpret shared data representations to achieve a common goal (Isenberg et al., 2011; Wood, Wright, & Brodlie, 1997).

FIGURE 2.13: A photographic representation of two people using a laptop together in a co-located environment, where their insights can be communicated in real time to each other without the support of the technology as a communication device.

In co-located settings (see Figure 2.13), participants share the same physical space, such as a meeting room or classroom. This arrangement enables real-time, face-to-face interactions that can enhance communication and decision-making. For instance, León, Isenberg, and Breiter (2023) found that vertical displays in co-located settings improve group awareness and facilitate immersive collaboration by making data visible to all participants. Shared displays – ranging from large screens to more commonly accessible devices like laptops or tablets – serve as focal points for interaction and discussion, fostering active engagement (Isenberg et al., 2011; León et al., 2023).

Maintaining awareness of others' contributions is crucial in these settings to prevent conflicts and improve collaborative flow. Systems incorporating visual or auditory feedback can assist in keeping participants informed about others' actions, supporting smoother transitions between tasks (Isenberg et al., 2011; Y. Liu et al., 2023; Wood et al., 1997). Flexibility in interaction styles also plays an essential role, allowing participants to switch between closely coupled collaboration – working together on a task – and loosely coupled collaboration, where they explore different elements independently (Isenberg et al., 2011; Y. Liu et al., 2023). Additionally, multimodal interaction methods, such as touch, speech, or gestures, can make the collaborative process more intuitive and dynamic, though they may introduce technical complexity (Isenberg et al., 2011).

Distributed collaboration occurs when participants are geographically separated and rely on networked tools to access shared data (see Figure 2.14). While it lacks the immediacy of face-to-face interaction, it offers flexibility by supporting both synchronous (real-time) and asynchronous (delayed) collaboration. Synchronous tools, such as video conferencing and real-time chats, facilitate immediate communication, whereas asynchronous tools, like threaded discussions or version control systems, ensure continuity for participants working at different times (Marchese, Mercado, & Pan, 2003; Wood et al., 1997).

FIGURE 2.14: A photographic representation of three people using laptops to collaborate in a distributed environment, where each person is located in a different place to the others, and so interaction occurs within the bounds of the technology.

Creating a shared virtual workspace is vital in distributed settings. Tools that incorporate features such as shared cursors and real-time updates help establish a sense of presence, enabling participants to collaborate effectively despite physical separation (Isenberg et al., 2011; León et al., 2023). Marchese et al. (2003) demonstrate how single-user tools, such as *Jmol*, can be adapted for collaborative use through peer-to-peer networking, showcasing the scalability of distributed interactions.

This research primarily focuses on co-located collaboration, evaluating for face-to-face discussion in a shared physical space to explore the potential of character-centric literary visualisations. Co-located settings allow for immediate communication, spontaneous exchanges, and enhanced group dynamics. However, to ensure future applicability and maintain relevance to how casual readers often refer to online resources, the visualisation technique is also designed for embedding in online environments.

2.10 Research Gaps with Links to the Research Questions

In reviewing the literature, clear gaps have emerged concerning the design, evaluation, and usage scenarios of literary visualisations aimed at non-experts, or casual readers. In the following subsections, I outline these gaps and explain how the research questions were formulated to address them.

2.10.1 A Literary Visualisation Technique Designed for Casual Discussion and Analysis of Characters

The representation of characters in literary visualisations has been explored through diverse techniques; however, significant gaps remain in both the data visualised and the intended audiences for these tools.

Character-centric literary visualisation techniques have predominantly been designed to meet the needs of professional domains. For instance, systems like *DramatVis Personae* (Hoque et al., 2022) and *StoryPrint* (Watson et al., 2019) cater specifically to professional writers and filmmakers.

The *BookLine* and *CharacterChart* designs by Hinze et al. (2018) show the potential for character-centric literary visualisations to enrich the reading experiences of casual readers. However, these designs have not been evaluated in contexts that involve group discussion and analysis. Furthermore, evaluations of literary visualisations often overlook the social and interpretive contexts in which casual readers interact with narratives. While *Character Flowers* was informally assessed with fans of *His Dark Materials* (Regan & Becker, 2010), and studies involving eBooks have included casual readers in their evaluations (Coleman & Hinze, 2017; Hinze et al., 2018), these investigations offer limited insight into collaborative settings where discussions about characters take place.

A notable gap exists in the design of visualisations tailored for casual readers, particularly in supporting the informal discussion and analysis of characters. This challenge is compounded by the traditional focus of information visualisation design, which typically targets experts in specific domains to facilitate professional tasks (Elmqvist & Yi, 2012; Gough et al., 2016; Pousman et al., 2007). In the case of literary visualisations, the primary audience has often been literary scholars, resulting in features such as annotation tools and evidence-gathering functionalities that align with professional workflows (Bellandi, Bellusci, Cappelli, & Giovannetti, 2014; Hoque et al., 2023).

In contrast, research on casual information visualisations – those aimed at non-expert users – indicates that less formal, task-oriented visualisations are not only accessible but also appreciated by the general public (Pousman et al., 2007). Public-facing tools, such as *EMDialog*, have been shown to provoke and inform discussion effectively (Hinrichs et al., 2008), highlighting the potential for casual visualisations to enhance discussions.

For casual readers who gather in book enthusiast communities, discussion plays an integral role in literary analysis. It fosters collaborative meaning-making and allows participants to explore personal and collective interpretations of texts (Long, 2003; Pianzola et al., 2020; Rebora et al., 2021). By designing a character-centric literary visualisation and evaluating it in such a context, this research seeks to address the gap of determining whether literary visualisations can enhance the informal discussion and analysis of characters in novels.

This led to the formulation of the **Main Research Question:** Can a non-expert targeted literary visualisation technique enhance the casual discussion and analysis of characters in novels?

To address this question, the research identifies specific gaps in both the design and evaluation of character-centric literary visualisation techniques for non-experts in literary analysis. These gaps are explored in the following two sections, accompanied by the formulation of study-specific research questions.

2.10.2 Designer Perspectives on Navigating the Pipeline for Literary Visualisation: From Data to Design Outputs

Designing character-centric literary visualisations involves addressing both technical and conceptual challenges, particularly when targeting non-expert users. Unlike tools for experts, which emphasise professional tasks, those for casual readers must align with how users naturally interpret and engage with stories.

Transforming unstructured literary data into meaningful visual representations is inherently complex. Characters in novels are defined by layered attributes – personal, relational, contextual, and narrative – which makes data abstraction and encoding a multifaceted task. Yet, existing literature offers limited guidance on the complete pipeline from data to design.

While prior studies demonstrate the potential of character-centric literary visualisations to aid story comprehension (see Section 2.5), they often lack the textual enrichment needed to summarise complex character journeys effectively. Resources like wikis provide such enrichment, yet their representation of character information is fragmented. Enriching a cohesive representation of *all* characters in a novel remains underexplored in literary visualisation design. A possible reason is the traditional focus in information visualisation on graphical over textual representation (Manovich, 2011; Tufte, 2001), despite evidence that including substantial text does not hinder cognitive processing (Stokes, Setlur, Cogley, Satyanarayan, & Hearst, 2023).

This research addresses a critical gap in designing visualisations that transform rich, unstructured literary descriptions into intuitive and engaging formats for casual readers. To advance understanding and articulation of this area, I formulated the **Study I Research Question:** How can data on characters in novels be abstracted and visually encoded to represent their development and connections to each other?

2.10.3 Scenario-Specific Evaluations that Address How Non-Experts Integrate Literary Visualisations

While studies that incorporate visual character analysis are growing in number, many are either not evaluated or do not provide complete insights into their evaluation findings (John et al., 2016; Regan & Becker, 2010; L. Shi et al., 2010). Others are assessed only for expert usage scenarios (Hoque et al., 2022, 2023; S. Liu et al., 2013). This creates a significant gap in understanding how non-experts interact with these tools. In the rare case where both non-expert and expert evaluations are conducted, the tool was still designed with experts in mind, limiting its wider applicability (Silvia et al., 2016; Watson et al., 2019). This is a common occurrence in information visualisation research, as Elmqvist and Yi (2012, p.11) explain:

> Many visualisation systems are designed for a particular expert user population, but getting access to this population for evaluation purposes is often very diffcult ... finding a good number of actual analysts that are willing to invest the time to help evaluate the system is diffcult.

The authors go on to say that to solve this, the researcher can (Elmqvist & Yi, 2012, p.12):

> Run two versions of the evaluation: a smaller version with a small number of expert analysts, and a larger version with non-expert participants selected from the general population. The tasks and datasets for the two versions can be radically different ... the few expert participants allow for retaining ecological validity and may be able to offer deep insights on the visualisation, whereas the larger pool of general participants provide internal validity and information on human motor, perceptual, and cognitive abilities not specific to experts.

In this research, it is the deep insights of the non-expert users that I seek to uncover, not just their ability to perceive the visual encodings.

One study had fans of a novel conduct an evaluation through interviews, but how the data were collected and analysed is unclear (Regan, 2011). Only one study targeted at non-experts had non-expert participants conduct their evaluation in the context of a scenario relevant to their use of the visualisation. This was Hinze's eBook study (Hinze et al., 2018), and the authors do explain the data collection and analysis procedures. However, the goals and context of this study differ to this research. Their visualisation does not provide a comprehensive overview of the entire narrative, instead providing page-based visualisations of characters in order to remove the potential for spoiling later chapters.

This gap highlights the challenges of not only designing for non-experts, but also in evaluating the designs with appropriate end-users and in appropriate settings. As Byrne et al. (2015, p. 509), "understanding how a visualisation creates meaning is a key task for visualisation research", as "socially constructed meaning is an overlooked factor and an untapped resource" in visualisation design. Therefore, there remains a gap in the research on how non-expert users can effectively engage with visual character analysis tools, particularly in the social context of literary discussions. Addressing this gap requires administering a user evaluation study that embeds use of the visualisation in a casual reader discussion scenario.

Therefore, I formulated the **Study II Research Question:** How do non-experts in literary analysis integrate character-centric literary visualisations into casual book discussions?

2.11 Conclusion

In summary, this literature review examined key works across information visualisation, literary visualisation, character-centric literary visualisation, casual visualisation, and collaborative visualisation. It established how casual readers engage with literature, including their common practices both online and in person, and highlighted the distinctions between these approaches

and expert literary engagement. The review also explored theoretical foundations for understanding how readers decompose and comprehend characters in novels and narratives more broadly.

Existing research highlights a growing demand for accessible visualisation methods tailored to non-expert users, particularly in contexts of casual literary engagement. Such methods have the potential to enhance the literary enjoyment of casual readers by making complex narrative data more intuitive and engaging. Despite progress, significant gaps remain in addressing the challenges of transforming intricate story elements into visual forms that resonate with non-expert audiences.

This review established the main research question and two study-specific research questions, which set the foundation for the subsequent stages of this work. These questions guide the design of a character-centric literary visualisation technique tailored for non-expert readers, its evaluation in a discussion scenario, and the determination of whether this approach successfully enhances casual discussions and analyses of characters in novels using visualisation. Building on the insights and gaps identified in the literature, this research aims to contribute novel methods and findings to the field of literary visualisation.

Chapter 3

Methodologies

3.1 Introduction to the Methodologies Chapter

This chapter introduces the methodologies that underpin the design and evaluation of the proposed character-centric literary visualisation technique. It begins by exploring the philosophical foundations that guide the research approach, followed by a description of the multi-study framework employed to iteratively develop and assess the visualisation. Key design frameworks, such as Munzner's nested model (Munzner, 2009) and non-expert user visualisation design supports (Gough et al., 2016; Lee et al., 2016), are highlighted as central to the design process. The chapter also details the evaluation methods, which integrate task-based and focus group techniques, combining quantitative and qualitative data collection. Analytical approaches, including thematic analysis, grounded theory (Charmaz, 2006), and statistical methods, are presented as tools to examine user engagement and behaviours.

By outlining these methodologies, this chapter provides a foundational framework for the research journey, establishing how the design and evaluation processes align with the study's philosophical and practical goals. It aims to offer readers a clear understanding of how the methods were selected and applied, ensuring the rigour and coherence of the research. This chapter serves as a blueprint for the research project, providing a foundational reference for subsequent chapters that discuss the application and outcomes of the methodologies.

3.2 Ontological and Epistemological Stance

In conducting this research, I adopt a constructivist ontological stance, which aligns with the view that reality is not a singular, fixed entity but rather is subjective and multifaceted, emerging from individuals' experiences and interactions (Crotty, 1998; Piaget, 1950). Within the context of designing and using literary visualisations, reality is understood as being constructed through the social and cultural processes that shape the perspectives of both researchers and participants. This perspective acknowledges that the ways in which individuals perceive and interpret the world are inherently context-dependent, and these constructions are valid within their specific social and cultural frameworks.

Epistemologically, the research draws on both constructivist and constructionist perspectives to address the different contexts of knowledge creation present in the two studies. As Crotty (1998) emphasises, constructivist epistemology views knowledge as emerging from the interplay between individuals and their environments, shaped by prior experiences and current contexts. On the other hand, constructionism foregrounds the collective nature of knowledge creation, recognising that meaning is socially co-constructed through interactions within cultural and social settings.

I believe that in the context of this research, knowledge is not simply a fixed entity to be transmitted but is developed through the experiences, interpretations, and interactions of existing literature findings, myself (as researcher), participants in this research, and the potential end-users. The two studies within this research reflect these distinct but complementary epistemological stances. Study I centres on constructivism, focusing on individual knowledge acquisition as participants interact with the interface to perform specific tasks and confirm the usability of the tool. This aligns with Piaget (1950), who emphasised the individual's role in constructing knowledge through active engagement and interaction with their environment. In contrast, Study II aligns with constructionism, as focus group participants co-construct knowledge through collaborative discussions, collectively interpreting the visualisation and negotiating shared understanding.

Although Study II participants engage in knowledge creation through a constructionist process, I employ a constructivist approach to analyse the data. This aligns with the constructivist grounded theory approach outlined by Charmaz (2006), which emphasises the researcher's role in interpreting data through their own lens, informed by participants' individual experiences and interactions. By using this constructivist framework, I focus on understanding how individual contributions and perspectives shape the collective meaning-making process observed in the focus groups.

By integrating these perspectives, this research acknowledges the evolving and socially situated nature of knowledge creation, affirming that both individual and collective interpretations are integral to understanding how literary visualisations function in practice. These principles guide the research design, data collection, and analysis.

3.3 Introduction to the Multi-Study Approach

This research adopts a multi-study approach to comprehensively investigate how non-expert users engage with a literary visualisation tool, both individually and in group settings. By conducting two distinct studies – one focused on individual usability and interaction (Study I), and the other on collaborative discussion and knowledge co-construction (Study II) – I aim to provide a holistic understanding of the tool's effectiveness in supporting casual literary analysis. Each study explores a different dimension of non-expert engagement, with the goal of informing a design that caters to both individual interpretation and social integration.

User-centred design (UCD) is a framework for design that prioritises the goals, needs, environment, and tasks of the intended user of the product – in this case, visualisation – throughout each stage of the design process. Rogers et al. (2011) emphasise that UCD is an iterative process, grounded in understanding users from the commencement of the work through to its evaluation. Unlike other design approaches, UCD aims to optimise interface features to align with the users' expectations (mental models) and behaviours, reducing cognitive load and enhancing usability. Instead of requiring users to adapt to the system, the design evolves to meet their needs. Hence, outputs of Study I indicate what to improve upon in Study II.

Given that this research seeks to make visual representations of character-centric novel data that are suitable for a target user group (non-experts), adopting a UCD approach aligns well with the principles outlined by Rogers et al. (2011), ensuring that the design remains focused on the users' goals and context of use. This approach enables the iterative refinement of the visualisation through direct feedback, fostering an inclusive and accessible design that resonates with its audience.

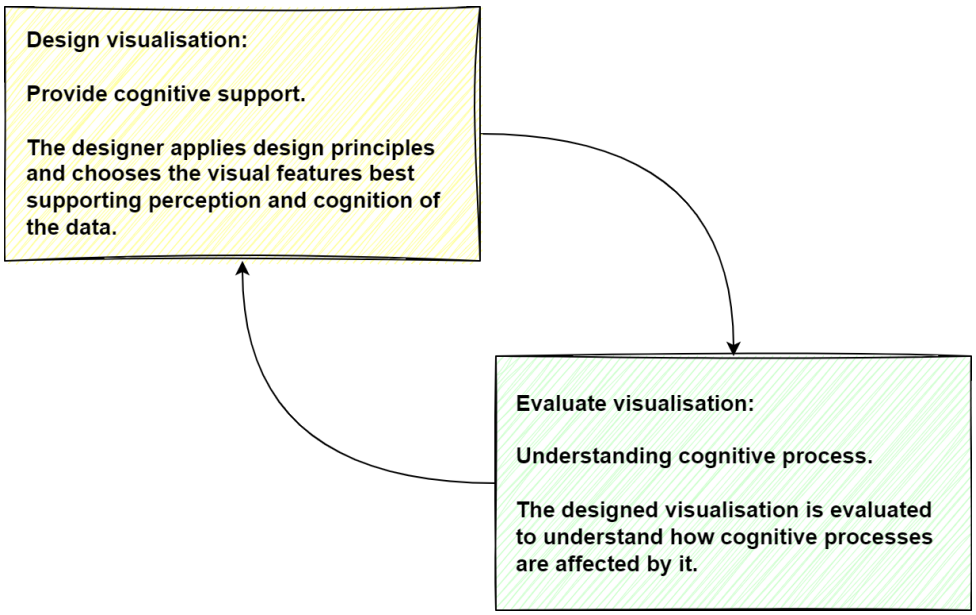

FIGURE 3.1: The two-stage visualisation design and evaluation assessment cycle (Huang & Bednarz, 2014).

Huang and Bednarz (2014) developed the two-stage visualisation assessment cycle, which captures the overarching design and evaluation stages of UCD in information visualisation research. This framework emphasises the dual objectives of providing cognitive support to users through the thoughtful design of visualisation elements and evaluating how these design choices influence cognitive processes, with evaluation findings guiding iterative improvements to the design (Figure 3.1). To adhere to this cycle, both robust design and evaluation methodologies must be established.

The decision to adopt a multi-study approach stems from the need to address the diverse ways non-experts engage with data visualisation tools. The two-stage design and evaluation cycle inherently requires multiple iterations (studies) to ensure evaluation outputs inform and

enhance the design. A single study focused exclusively on either individual usability or collaborative discussion would provide only a limited understanding of the visualisation's potential. By examining both the usability of the interface in isolation (Study I) and its integration into group discussions (Study II), I aim to capture the full spectrum of user experiences. This comprehensive approach ensures that the findings are applicable across varied contexts in which literary visualisations may be used.

Study I initiates the cycle by focusing on the design and usability of the visualisation technique, with an emphasis on testing the clarity and flexibility of the visual encodings. This study evaluated character-centric data in an anonymised form to avoid bias, producing foundational insights into the strengths and weaknesses of the initial layout. These insights informed the design refinements tested in Study II, which shifted the emphasis towards evaluating the visualisation in a collaborative discussion setting.

Study II offered deeper insights into the practical application of the visualisations, examining how group dynamics, narrative interpretation, and participant interactions influenced their effectiveness. By embedding the visualisations into a group discussion context, this study revealed how the tool supported collaborative engagement while also highlighting areas for further refinement.

The iterative nature of this two-stage approach underscores the importance of continuous design improvement, where findings from one study directly inform the next. Together, these studies provide a holistic understanding of the tool's capabilities, balancing cognitive and social dimensions of user engagement.

3.4 Visualisation Design

In this section, I describe and justify the visualisation design research theories and methodologies I adopted to guide my understanding and thinking of how to approach a visualisation design problem in the context of conducting this research – particularly as an individual.

3.4.1 Research Through Design

Research through design (RtD) is a methodology that employs "methods and approaches from design as a mode of inquiry," emerging in recent years as "a prominent research approach within the design-oriented communities" of human-computer interaction (Dalsgaard, 2016, p. 4991). This approach acknowledges design as a form of knowledge creation, enabling researchers to explore and address complex problems through iterative and reflective practices.

Moere and Purchase (2011) highlight the value of the RtD approach in its ability to benefit other developers and researchers by offering a detailed description of the design rationale. This transparency enables others to replicate or adapt the methodology for similar projects, thereby contributing to a growing body of knowledge in the field. By documenting the decisions, constraints, and compromises involved in the process, RtD projects provide a rich foundation for further exploration and application.

One of the distinctive features of RtD is its dynamic and evolving nature. As Dalsgaard (2016, p. 4992) note, RtD projects often "cannot in advance be fully articulated and demarcated," as the design itself evolves alongside the research questions, which are refined through iterative cycles of inquiry and reflection. This evolution typically involves an extensive review of the current and historical state of the field, ensuring the design is both informed and responsive. To capture this process, discussions of RtD must present the pivotal insights and revelations that emerge during the design journey, shedding light on how challenges were navigated and how new opportunities were identified.

A cornerstone of the RtD methodology is the need to justify each design choice with clear and detailed reasoning, which this thesis aims to do. As Zimmerman, Forlizzi, and Evenson (2007) emphasise, the value of RtD lies in the selection, application, and rationale of the methods employed. For the research to be reproducible and valuable to others, sufficient detail must be provided to allow others to follow or adapt the process. This commitment to transparency not only strengthens the credibility of the research but also ensures that its contributions are accessible and meaningful to the broader design and human-computer interaction communities.

3.4.2 Action Design Research

Action Design Research (ADR) is a research methodology commonly used in the fields of information systems, information technology, and design. It focuses on solving practical problems through the iterative development and evaluation of one or more design artefacts, such as an information visualisation. ADR is particularly useful when dealing with complex and ill-defined problems where traditional research methods may not be as effective. Designing for non-experts can be considered a wicked problem (Gough, de Berigny Wall, & Bednarz, 2014), and in addition to this, the unstructured nature of text data makes its abstraction both ill-defined and complex (Jänicke et al., 2017; Kucher et al., 2022).

McCurdy, Dykes, and Meyer (2016) were the first to explore the utility of ADR in increasing the reliability of applied visualisation design research. The authors explain that in the field of applied visualisation research, the creation of artefacts is influenced by a series of minor design choices, a significant portion of which are assessed swiftly and informally. These assessments are frequently left unreported and unconfirmed, typically considered a part of the design decision-making process, which are shaped not only by principles of visualisation theory but also by the individuals involved and the specific research context. When relevant, I endeavour to report on moments of ad-hoc testing to demonstrate this occurrence. ADR also acknowledges the impact of the research context on the final design outcomes, including any produced design artefacts, such as visualisation pipelines and techniques. The design artefacts produced in this research are shaped not only by theoretical frameworks and design principles but also by the specific needs of the research context and the iterative feedback gathered throughout the process. These artefacts, such as the proposed character-centric literary visualisation technique, embody the interplay between practical problem-solving and scholarly inquiry.

3.4.3 The Researcher / Designer Perspective

The context of the researcher/designer is an essential consideration in ADR (McCurdy, Dykes, & Meyer, 2016). ADR acknowledges that researchers and designers bring their perspectives, expertise, and experiences to the research process, and these factors can significantly influence the design and development of solutions. I – as the researcher conducting this research – am a non-expert in literary analysis, and a casual reader, whom enjoys discussing novels with others. This influences and shapes the perspective from which this research is conducted, perhaps even providing a better understanding of the questions and challenges non-expert users may face when navigating literary data.

3.4.4 Engaging a Domain Expert

It is common practice for information visualisation designers and researchers to begin the visualisation design process by first gaining a comprehensive understanding of the design context. This understanding is typically achieved through a combination of reviewing relevant literature, studying design guidelines, and investigating prior work in the field. In addition, designers frequently engage in both informal and formal discussions with domain experts who possess specialised knowledge of the data. These experts provide critical insights that help the designers identify key challenges, user requirements, and domain-specific nuances that might influence the visualisation's effectiveness. This collaborative approach ensures that the final design is not only theoretically grounded but also practically relevant to the needs of the target audience and the specific data being represented (Isenberg, Zuk, Collins, & Carpendale, 2008).

In practice, the ideal approach lies in balancing domain expertise and a fresh perspective. Collaboration between a non-expert-in-the-domain designer and domain experts can be highly effective. Domain experts can provide guidance on the accuracy and relevance of the data, while the designer can focus on creating a user-friendly interface and visualisation.

Additionally, it is important for the designer to invest time in understanding the domain, not to become an expert, but to have a basic understanding of the data and its context to communicate effectively with domain experts. Hence, the application of principles of both ADR and RtD can support this endeavour. This perspective was the underpinning motivation to engage a domain expert in literary analysis to support Design Stage I (Section 4.3.2).

3.5 Visualisation Design Models, Frameworks and Guides

With the theoretical underpinnings of my work established, I now describe and justify the practical design models and guides that structured the design portion of my research.

3.5.1 Nested Model for Visualisation Design and Validation

In the late 90s, multiple models of the visualisation creation process were proposed (Card & Mackinlay, 1997; Card et al., 1999; Chi & Riedl, 1998), but none contain explicit instructions on when to complete each step and how to evaluate such a system, hence the nested model

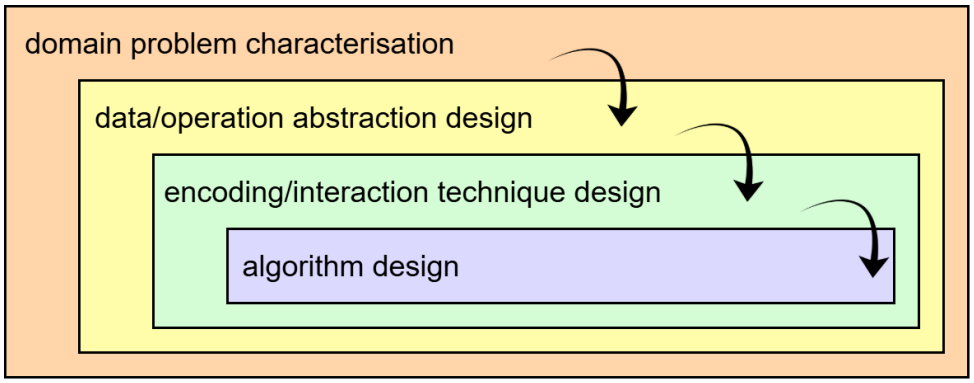

FIGURE 3.2: Munzner's nested model of visualisation creation consists of four nested layers, as redrawn from the original diagram by Munzner (2009).

for visualisation design and validation was developed by Munzner in response to growing frustrations with the lack of practically applicable frameworks to guide the visualisation design process (Munzner, 2009).

While previous models aimed to articulate the visualisation pipeline, the nested model guides the visualisation designer to go one step further and validate their design choices at each stage of design – not just at the end of the process. To properly apply this model I ensure that each stage of the design research component of this work describes justified rationales for the decisions made. Munzner's nested model (Figure 3.2) offers a structured framework for designing and assessing visualisation systems, encompassing four nested levels (Munzner, 2009):

1. **Domain Problem and Data Characterisation:** Understanding the tasks and data needs of the target users.
2. **Operation and Data Type Abstraction:** Translating domain-specific problems into generalisable operations and data types.
3. **Visual Encoding and Interaction Design:** Creating the interface and interaction mechanisms.
4. **Algorithm Design:** Implementing efficient algorithms to execute the design.

This model emphasises that decisions at each level cascade downstream, making upstream decisions critical to the success of the overall design. Validation is recommended at each level, which I approached through a combination of formal evaluation studies and ad-hoc methods embedded within an iterative design process.

Application of the Nested Model

Both Study I and Study II applied all four levels of the nested model, iteratively refining the visualisation system. Study I focused on developing the character-centric layout technique. I characterised user needs and sought to understand the specific requirements of the data domain by consulting a domain expert (Level 1), abstracted character data into task-appropriate representations (Level 2), designed an initial visual encoding and interaction layout (Level 3),

and implemented a functional technique to support these designs (Level 4). Formal validation was conducted through an evaluation study with non-expert users, assessing the usability and effectiveness of the technique.

Study II expanded upon the initial design, incorporating genre and plot encodings and additional menu system enhancements. Again, I followed the four levels, expanding my understanding of the domain to accommodate broader narrative context (Level 1), translating these into new data abstractions (Level 2), designing visual encodings and interaction mechanisms (Level 3), and updating the technical implementation to accommodate these enhancements (Level 4). Formal validation was similarly conducted at the study's conclusion.

In addition to formal evaluations, I employed ad-hoc validation methods throughout both studies to inform and refine decisions at all levels. These included:

- **Discussions with colleagues:** Informal feedback helped evaluate the conceptual clarity and perceived utility of the designs.
- **Ad-hoc testing:** Iterative testing of prototypes with people of varying backgrounds ensured that interaction mechanisms and encodings aligned with the design objectives.
- **Consultation with developers:** Consultations with other developers helped me to validate the technical feasibility of design decisions and data translations into visual encodings.

These activities played important roles in identifying and addressing design issues early in the process, while the formal evaluation components at the end of each design stage helped to ensure a rigorous validation process.

Meyer, Sedlmair, and Munzner (2012) extended the nested model to introduce the concepts of blocks and guidelines. Blocks represent the specific outcomes of design decisions at each level of the nested model, such as data abstractions, visual encodings, or algorithms. Guidelines define the relationships between these blocks, providing within-level comparisons or between-level mappings. For instance, a guideline might state that a node-link diagram is well-suited for representing social networks, offering actionable advice to designers.

In the context of this research, the blocks and guidelines framework was particularly useful for structuring the iterative enhancements in Study I and Study II. Within-level guidelines helped refine the visual presentation of the visualisation system, where research on icons, HCI and glyphs was consulted to create a clear and effective design. Whereas, between-level guidelines informed how, for example, character dynamics data abstractions, such as dialogue exchanges, could be mapped to visual encodings that represent conversation frequency, ensuring that the design choices aligned with the underlying data abstractions.

3.5.2 Design Activities During Visualisation Design

McKenna, Mazur, Agutter, and Meyer (2014) developed their design activity framework for

visualisation to model the four overlapping activities that characterise the design process: Understand, Ideate, Make and Deploy. Their framework functions as a complement to Munzner's nested model (Munzner, 2009) and its improvements (Meyer et al., 2012), aiding visualisation designers to think about how the levels of the nested model correspond with typical design activities. Each of the four design activities has an articulated motivation and connection to specific stages of the nested model(Munzner, 2009).

McKenna et al. (2014, p. 4) describe these as:

- **Understand:** to gather, observe, and research available information to find the needs of the user (nested model levels: characterising the domain; abstracting data and tasks)
- **Ideate:** generate good ideas for supporting the "Understand" outcomes (nested model levels: abstracting data and tasks; designing visual encodings and interactions)
- **Make:** to concretise ideas into tangible prototypes (nested model levels: designing visual encodings and interactions; developing the algorithm technique)
- **Deploy:** to bring a prototype into effective action in a real-world setting in order to support the target users' work and goals (nested model level: developing the algorithm technique)

While the framework is presented linearly, the activities can be conducted in an agile manner, whether in different orders or cyclically, as the authors acknowledge "a visualisation design process never seems to progress cleanly through a set of designated stages" (McKenna et al., 2014, p. 4). Hence, the framework pairs well with principles of RtD and ADR, and the overarching model of the two-stage visualisation assessment cycle. In both Study I and Study II, the activities I conducted mostly aligned with the McKenna et al. (2014) representation of the model, however, the Understand and Ideate activities were essential in all levels of the visualisation design process, as working with and designing for literary data was a new endeavour for me.

3.5.3 Designing for Non-Expert Users

Designing visualisations for non-expert users, such as casual readers, involves addressing unique challenges that differ from creating tools for domain experts. Non-experts are less familiar with the conventions of data visualisation and may misinterpret or struggle to grasp key elements. Therefore, additional considerations must ensure that visualisations are intuitive, accessible, and engaging while avoiding cognitive overload or misrepresentation of the data.

Gough et al. (2016) introduced a structured process for designing visualisations for non-expert users (NEUVis), focusing on merging user needs with the characteristics of the data. The authors propose the Six Questions (**SQ1-6**), a design tool that aids in defining the relationship between the data and its relevance to the user context (Gough et al., 2016, p. 2):

SQ1: How does this new knowledge benefit the user?

SQ2: What about this data is relevant or important?

SQ3: What is otherwise inaccessible to the user?

SQ4: What can the user access on their own?

SQ5: What myths and misconceptions are relevant to the data?

SQ6: What is the potential for impact, and what are the risks of this visualisation?

These questions served as a foundational framework in my research to understand the target users during Study I. For instance, SQ2 guided the selection of the most relevant character personal traits to visualise to summarise characters in each chapter, while SQ5 ensured that misrepresentations, such as oversimplifying character representations, were avoided. This approach enabled the prioritisation of data that aligns with the interests and needs of casual readers while minimising irrelevant or distracting elements.

TABLE 3.1: The NEUVis schematic developed by Gough et al. (2016, p. 3), reproduced here in table format.

Part	**Attribute**
Part 1	**Data**
Type (attributes)	Qualitative, quantitative, temporal, geospatial
Dimensionality (attributes)	2D, 3D, 3D temporal, high-dimensional, high velocity/real-time
Establishment (relevance)	Cutting-edge research, new developments on old concepts, classical sciences
Applicability (relevance)	Abstract, actionable, informational, warning, edification, insight
Acquisition (attributes)	Boundary Object type: Syntactic, Semantic, Pragmatic
Part 2	**Visualisation**
Goals (relevance)	The take-away message
Interface (interaction)	Playful, self-effacing, emotive, static, interactive, animated
Construction (interaction)	Novel, artistic, ambient, narrative, exploratory, familiar
Context (relevance)	Museum, public space, art exhibition, social media project, website, news article
Communication (relevance)	Boundary Object type: Syntactic, Semantic, Pragmatic
Responses (interaction)	Emotions and feelings you to provoke

Gough et al. (2016) also presented the NEUVis Data-Visualisation Schematic (Table 3.1), which provides a structured method for transitioning from empathy-driven insights to a concrete visualisation prototype. The schematic's dual focus on data (e.g., dimensionality, establishment, acquisition) and visualisation (e.g., goals, interface, construction) supports iterative design by ensuring both the data's integrity and the visualisation's usability are maintained throughout development.

In this project, the schematic was completed initially during the commencement of Study I and revisited at the commencement of Study II. Updating the schematic clarified the evolving goals of the project as new insights emerged from the first evaluation stage and reflections on the findings. This iterative process aligned with the schematic's intended flexibility and its role as a tool for refining visualisation design.

3.5.4 Understanding How Non-Expert Users Make Sense of Visualisations

Lee et al. (2016) developed the NOVIS model, which outlines the cognitive activities novice users undertake when encountering a visualisation for the first time. These activities (**NA1-5**) provide insights into the potential stumbling blocks and sensemaking strategies employed by non-experts (Lee et al., 2016, p. 502):

NA1: Encountering visualisation

NA2: Constructing a frame

NA3: Exploring visualisation

NA4: Questioning the frame

NA5: Floundering on visualisation

NAM: Miscellaneous

The authors consider the concept of a data-frame, put forward by Klein, Phillips, Rall, and Peluso (2007), to formulate their own definitions of two distinctive frames to which novice (non-expert) users of a visualisation refer: **frame of content** and **frame of visual encoding**. The frames functions similarly to the concept of schemata, as discussed in the literature review, serving as a user's explanatory internal structure of the topic and data (frame of content) and of how to interpret non-textual objects (frame of visual encoding) (Lee et al., 2016).

The NOVIS model was, at times, referenced when I was contemplating design choices and considering how they may be encountered by a non-expert user.

The combination of the design tools ensured that my research addressed both the creation and interpretation of visualisations for casual readers. This holistic approach allowed me to iteratively refine the visualisation design and to later evaluate it with non-experts.

3.6 Visualisation Evaluation

Carpendale (2008) highlights that evaluating information visualisations is a critical process for assessing how effectively these tools communicate data and support user interpretation. Through systematic evaluation, researchers and practitioners can identify design strengths, uncover usability challenges, and improve visualisations to better support comprehension and decision-making. A variety of methods are used to evaluate visualisation performance. User studies examine how individuals interact with visualisations, providing insights into usability and cognitive engagement. In other cases, expert reviews, often guided by usability heuristics,

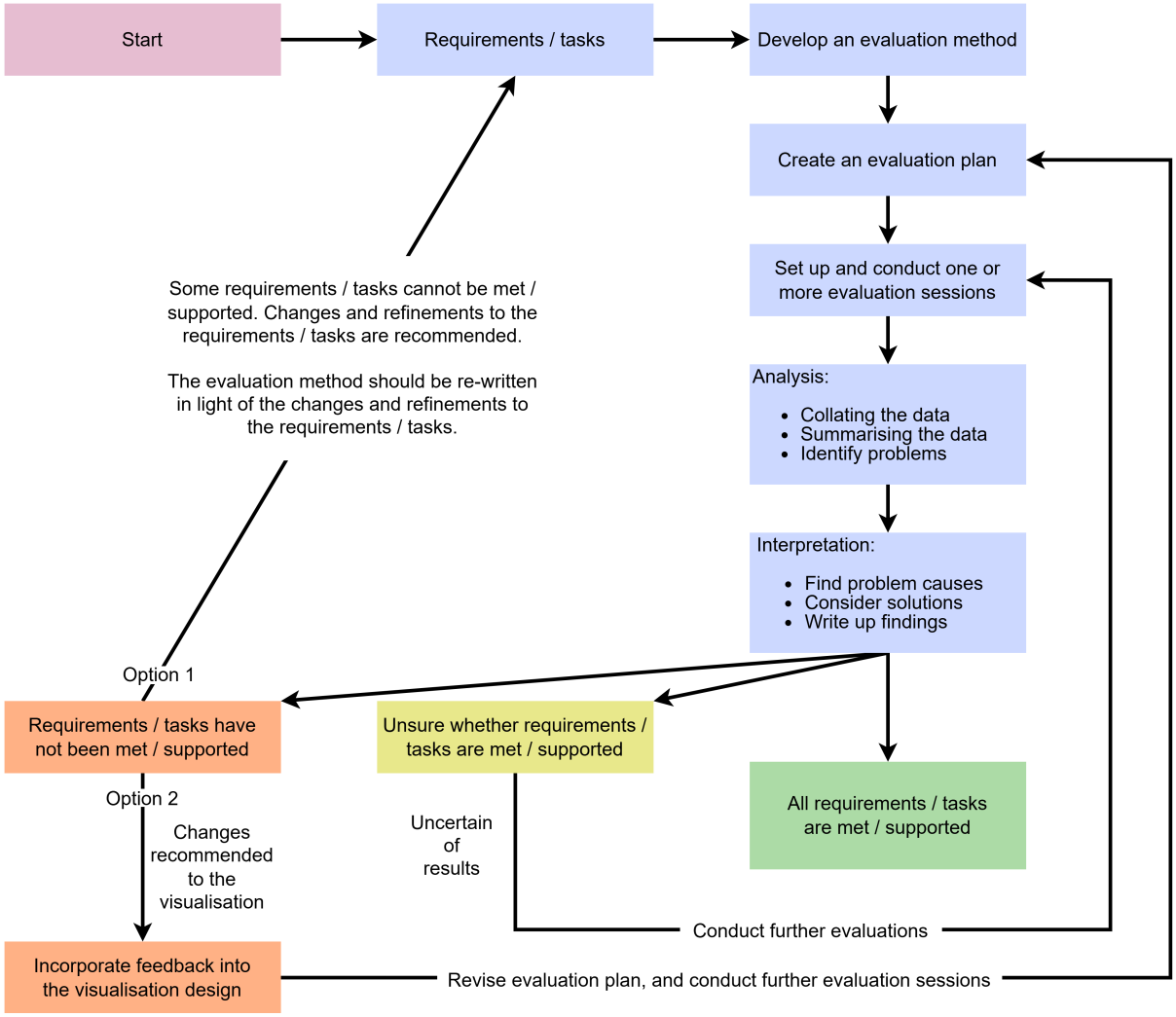

FIGURE 3.3: Process of evaluation, adapted from work by Stone et al. (2005).

help to systematically identify potential design issues for more advanced systems. Furthermore, computational models can predict user performance and highlight areas for refinement. Visualisation evaluations are important for several reasons. They improve user experience by ensuring visualisations are accessible and intuitive, verify the accuracy of data representation to prevent misinterpretation, and offer insights that inform iterative design processes. Overall, the evaluation process plays a foundational role in information visualisation research. It ensures that visualisation tools achieve accuracy and usability while enabling users to make relevant use of the data.

Quantitative evaluation methods are controlled, often comparative, experiments designed to elicit aptitude and performance measures for a set of tasks, for which completion time or number of errors are used to determine performance (Carpendale, 2008; Elmqvist & Yi, 2012). Quantitative methods are the traditional methods used to benchmark visualisation peformance and make minor optmisations to visualisation algorithms.

As visualisations became increasingly recognised as interactive user interfaces, there was a

growing shift towards using qualitative evaluation methods (Carpendale, 2008). While quantitative methods are still commonplace, many researchers complement these with methods that elicit qualitative feedback from target or potential users' perspectives. Typically, qualitative evaluations emphasise workflows (tasks), high-level trends and mental models, and other factors, such as whether the evaluation is formative or summative, if its conducted in a lab or in the target field, and if its at a single point in time or a longitudinal study also modify the study dimensions (Elmqvist & Yi, 2012).

The cycle proposed by Huang and Bednarz (2014) (Figure 3.1) captures the necessity to ensure the two stages complement each other, as findings from the evaluation stage are inputted directly back into the design, which are then to be repeated again to further refine the visualisation's effectiveness. The cycle is a reminder that the evaluation methodologies must be well-suited to the design's purpose and be structured in a manner that reflects how real-world users will interact with or indirectly benefit from it, and that the study participants have similar qualities to the target end-users.

Figure 3.3 provides an overview of the process of evaluating a user interface's usability, such as that of a visualisation, adapted from work on user interface design and evaluation by Stone et al. (2005). They note that the process is simplified in the diagram to represent the evaluation of a user interface prototype using a single evaluation technique, however, it is often necessary to combine or alternate several different techniques to cover different aspects of a design, such as its algorithmic constraints or possible usage scenarios.

As mentioned, the process of evaluation is iterative, which is often time consuming. Hence, it is important to plan evaluation activities in advance to determine the best allocation of a researcher's resources. In the following sections, I describe how each evaluation activity was addressed in the research project, and the rationales for selecting the described methods and techniques. The evaluation methodologies used in this research were designed based on a number of factors, including resource constraints (such as time and budget), suitability for answering the research questions and meeting the research objectives, and practical constraints (such as software, hardware, and the physical availability of participants to attend the study locations).

First, however, I provide insights into the necessity to recruit non-expert participants and the role of the visualisation design artefacts as central points of reference in both evaluation stages.

3.6.1 Non-Expert Participant Sampling and Recruitment

Burns et al. (2023) conducted a comprehensive review of the literature to investigate how "novice" and related terms such as "non-expert" and "general public" are defined and evaluated in visualisation research. Their review of 79 papers highlights inconsistencies in the definition of novices and the narrow demographic often used to represent them: primarily students and young adults from the United States. The paper's significance lies in its call for more inclusive definitions and broader participant representation in visualisation studies, ensuring that tools and designs cater to a wider range of users beyond academic and Western contexts.

Hence, when evaluating for non-experts, participants should be carefully vetted using a non-probabilistic sampling method to ensure their relevance to the intended audience. Rather than relying on convenience samples, such as students or readily accessible groups, researchers should deliberately select participants who align with the potential real-world users of the visualisation. By ensuring that the participants recruited to test the visualisation accurately reflect the target user base, I was able to ensure a more rigorous approach to capturing the non-expert user's experience.

Furthermore, Burns et al. (2023) noted that descriptions of participants sampled for non-expert studies often focus on what these individuals lack, rather than on the inclusive or specific attributes they might possess. While this broader focus allows for the inclusion of a larger number of participants, it reduces the accuracy in capturing the intended audience's experience. Therefore, a trade-off may be necessary, where fewer participants are recruited, but their relevance to the study is higher. I carefully considered this issue during the recruitment process.

Lastly, it is important to note that participants from Western, Educated, Industrialised, Rich, and Democratic (WEIRD) societies are often overrepresented in academic research, which can skew findings and make it difficult to generalise results to a broader "general public" audience (Burns et al., 2023). To mitigate this bias, I chose not to recruit through undergraduate university channels. Instead, I focused on recruiting through other networks, as well as using snowball/referral sampling. While all the participants I recruited were from a Western, industrialised, and democratic country (Australia), their educational backgrounds, ages, ethnicities, and socioeconomic statuses varied, providing a more diverse perspective.

3.6.2 Visualisation Artefacts

In the evaluation phase of a visualisation design study, the visualisation artefacts produced during the design phase play a vital role in assessing the effectiveness and usability of the proposed techniques, as they provide tangible representations of the design ideas. Artefacts create a conceptual and visual reference for each design iteration, which may be used in the evaluation process, however artefacts can serve three important but different roles (Dörk, Müller, Stange, Herseni, & Dittrich, 2020, p. 222):

- **Evocation:** Artefacts initiate design ideas or processes and trigger imaginations.
- **Articulation:** Artefacts support participants to express concepts, particularly if in a workshop setting.
- **Prototype:** Artefacts serve as a semi-functional interpretation of a concept.

I used the artefacts I generated in both Study I and Study II to elicit user feedback, assess usability, and identify design enhancements, in conjunction with the other data-collection instruments.

3.6.3 Use of Pilot Studies

Pilot studies are commonly used in qualitative and user-centred research to refine procedures and identify potential issues before full-scale implementation. Conducting a pilot study or test prior to the main evaluation helps ensure methodological soundness and improves the reliability of findings (Stone et al., 2005). While both pilot studies and tests are used to evaluate aspects of a research process or design, they differ in scope and purpose. A pilot study is a small-scale rehearsal of the entire research procedure, conducted to assess the feasibility and coherence of the study design, including materials, participant instructions, data collection methods, and overall flow. In contrast, a test focuses on examining a particular element of the system or user interface, such as the interpretability of a visualisation element or the functionality of a user interaction. In this research, the pilot studies evaluated the full end-to-end experience to identify and address methodological issues with a single participant in each stage.

For the Study I Evaluation Methodology (Section 3.7), the pilot study was used to assess the clarity of task descriptions and instructions, and to confirm that the participant could complete the tasks without confusion.

For the Study II Evaluation Methodology (Section 3.9), the pilot focused on evaluating the interpretability of the discussion prompts, the soundness of their connection to the corresponding visualisation elements, and the suitability of the post-discussion questionnaire.

3.7 Study I Evaluation Methodology

Task-based information visualisation evaluation is a widely adopted method for assessing the effectiveness, usability, and user interaction with visualisations in the context of specific tasks or objectives. The purpose of this evaluation is to measure how well a visualisation supports users in completing tasks, extracting insights, and making informed decisions (Amar & Stasko, 2004). Such evaluations are critical for determining the utility of visualisation tools and for informing design improvements that align with user requirements (Lazar, Feng, & Hochheiser, 2017). In this study, tasks were used to elicit specific judgements about the visualised data. I used the nine general character analysis tasks devised in Study I (Table 4.2), which were then mapped to the evaluation questions to ensure systematic alignment.

Surveys and questionnaires have proven to be effective tools for gathering valuable data and insights, as long as they are adapted to suit the goals of a study (Stone et al., 2005). They offer a structured approach to collecting information and opinions, enabling the systematic exploration of a wide range of topics and perspectives.

I conducted the evaluation, including the task-based component, through a single questionnaire divided into separate parts (viewable in Appendix A). While designing the questionnaire, I was mindful of the potential limitations associated with this method of data collection. Questionnaires, as standalone instruments, can be challenging to design effectively. Even the most straightforward questions may be subject to ambiguity, making it difficult to ensure clarity and precision. Additionally, researchers must anticipate the topics participants will be able to

address, which can be particularly challenging when participants' interactions with the visualisation are unpredictable. Closed questions, while easier to analyse, have their own limitations, as they often fail to capture the underlying reasons behind participants' responses (Stone et al., 2005).

Despite these challenges, the advantages of using a questionnaire ultimately outweighed its limitations. A key benefit of this approach is the structured nature of the data collection process, where all the necessary questions are predefined, minimising the risk of overlooking critical topics. Additionally, questionnaires ensure consistency by presenting the same set of questions to all participants, even if the order is randomised. This standardisation facilitates comparative analysis of responses across participants. Furthermore, questionnaires allow for the collection of quantitative data, enabling statements such as "Eight out of ten participants enjoyed this feature," which can provide clear and actionable insights into user preferences and behaviours (Stone et al., 2005).

I developed a custom questionnaire that incorporates both close-ended and open-ended components, including a combination of task-based questions, a comparative analysis component, and optional usability feedback questions. This approach aligns with long established HCI and visualisation evaluation methodologies (Amar & Stasko, 2004; Lazar et al., 2017; Nielsen, 1994). By integrating quantitative performance metrics with qualitative insights, the study ensured a systematic and rigorous evaluation of the visualisations' visual encodings and usability.

3.7.1 Procedure

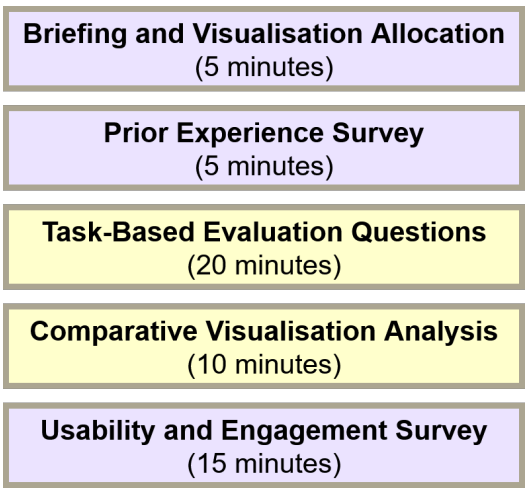

FIGURE 3.4: The light yellow boxes indicate the activities that required individual use of the visualisations. The purple boxes indicate the individual tasks completed by each participant before and after their session.

Study Set-Up and Materials

Participants were informed that the study would take approximately 55 minutes, split over multiple tasks (see Figure 3.4). Each participant was provided with an information sheet explaining the study's purpose and a consent form to sign. These are located in Appendix A. To

avoid introducing bias in task exposure, the allocation of the visualisations was randomised by drawing from a set of pre-labelled slips for Visualisation A or Visualisation B.

Sessions were conducted on an individual basis, and for each, the participant was seated in front of a computer hosting the visualisations – both A and B – with their primary study visualisation opened first onscreen. The questionnaire was hosted on a separate laptop in a Google doc, and the participant was directed to respond to the questionnaire, and use the visualisations as directed by its instructions. The questionnaire was structured into four parts to comprehensively assess the visualisation's effectiveness and usability. These are described in the following sections, while the complete questionnaire is available to view in Appendix A.

Part 1: Prior Experience Survey

TABLE 3.2: The Prior Experience Survey portion of the questionnaire.

Q#	Prior Experience Survey Question
A	On a scale of 1 to 7, with 1 being "not at all confident", and 7 being "completely confident", rate the level of confidence you have in your ability to read data/information visualisations.
B	Have you ever read novels for the purpose of discussion or study? If yes, please briefly describe your experience(s).
C	If you answered yes to the previous question, were there any barriers to effectively relaying your perspective(s) on the novel(s) under discussion? If yes, please briefly describe these barriers.
D	On a scale of 1 to 7, with 1 being "not at all confident", and 7 being "completely confident", rate the level of confidence you would feel in recalling and discussing the features and appearances of all the characters in a novel you have read and are quite familiar with (such as your favourite novel or a novel you have studied).

A preliminary survey in the questionnaire captured participants' baseline familiarity with visualisations and book discussions. This step contextualised their engagement levels and accounted for variations in prior knowledge, which can influence task performance (Nielsen, 1994). The survey included:

- **Confidence Levels:** In two separate questions, participants rated their ability to interpret data visualisations and discuss literary content from memory using a 7-point scale, where 7 represented the maximum level of confidence – "completely confident".
- **Prior Experience:** Open-ended questions explored past experiences reading or discussing novels and barriers to expressing perspectives in group settings.

These questions (Table 3.2) grounded the analysis of participants' interactions with the visualisations in their existing competencies and attitudes.

Part 2: Task-Based Evaluation Questions

Participants were introduced to the visualisation elements and menu settings before proceeding to complete the task-based component of the questionnaire. These questions were designed

to assess how effectively the visualisation supported character-centric analysis tasks. The questions (Table 3.3) were designed with increasing levels of complexity:

- **Simple Identification Tasks:** For example, "Who is/are the first character(s) to enter the story?"
- **Moderate Quantitative Tasks:** For example, "How many characters are in Chapter 7?"
- **Complex Analytical Tasks (requiring synthesis across chapters):** For example, "Name a character whose motivation is consistent in two or more chapters."

TABLE 3.3: The Task-Based Evaluation Questions portion of the questionnaire.

Q#	**Task-Based Evaluation Question**
1	Who is/are the first character(s) to enter the story?
2	Which character has the thickest storyline for the majority of the story?
3	How many characters are in Chapter 7?
4	Which character(s) appear in only one chapter of the story?
5	Which character(s) appear(s) in every chapter?
6	Which character(s) is/are negative in sentiment in Chapter 10?
7	If possible, name a character whose motivation is the same in two or more chapters. The chapters do not need to be consecutive.
8	Locate Mr. Grayson/Braxton and answer the following questions:
8A	What is Mr. Grayson's/Braxton's goal, action and motivation in Chapter 12?
8B	Is Mr. Grayson's/Braxton's sentiment the same in Chapters 7, 8 and 10?
8C	With which character(s) does Mr. Grayson/Braxton have the strongest social interaction(s) in Chapter 7?
8D	With which character(s) does Mr. Grayson/Braxton have the weakest social interaction(s) in Chapter 7?
8E	Which character commits the same action as Mr. Grayson/Braxton in Chapter 8?
9	Who is/are the main character(s)? Why?
10	Are there connections between character storyline thicknesses, chapter appearances, social interactions and/or goals/actions/motivations/sentiments? Why or why not?

Q8[A-E] (Table 3.3) referred to the anonymised character "Mr. Grayson" if the participant was allocated to Visualisation A or "Braxton" for Visualisation B. Participants also responded to one open-ended question that encouraged qualitative reasoning. This systematic design aligns with task-oriented evaluation frameworks (Amar & Stasko, 2004), ensuring the tasks were diverse, measurable, and relevant for visualisation performance analysis. In Section 4.14, Figure 4.32 illustrates the mapping of each question to character analysis objectives.

Part 3: Comparative Visualisation Analysis

TABLE 3.4: The Comparative Visualisation Analysis portion of the questionnaire.

Q#	Comparative Visualisation Analysis Question
11	Which visualisation contains more characters, and what is the difference in number?
12	What are the main similarities, if any, between the characters in the two visualisations?
13	What are the main differences, if any, between the characters in the two visualisations?

Participants engaged with both Visualisation A and Visualisation B for qualitative comparison tasks. These questions (Table 3.4) explored:

- Differences in how each visualisation supported intertextual character analysis (e.g., identifying similarities and differences in character relationships).
- Suitability for analysing characters in novels across multiple texts.

This was to gain insights into the generalisability of the layout technique across different texts that feature different numbers of characters.

Part 4: Usability and Engagement Survey

TABLE 3.5: The Usability and Engagement Survey portion of the questionnaire.

Q#	Usability and Engagement Survey Question
14	When exploring the visualisation(s), what felt intuitive and/or engaging? Why?
15	When exploring the visualisation(s), what felt like a struggle and/or confusing? Why?
16	Which question(s) did you find the easiest to answer? Why?
17	Which question(s) did you find the hardest to answer? Why?
18	Did the menu system provide enough context for you to understand how to read and explore the visualisation? If not, what additional context or settings would you add?
19	On a scale of 1 to 7, with 1 being "not at all confident", and 7 being "completely confident", rate the level of confidence you would feel in recalling and discussing the features and appearances of all the characters in a novel you have read and are quite familiar with (such as your favourite novel or a novel you have studied) if you had this visualisation to support you.
20	What improvements, if any, would you make to the visualisation for better visually representing characters in novels for the purpose of discussing those characters?
21	In what sort of environments/settings, if any, could you see this visualisation approach being used to visualise characters in novels (with or without your recommended improvements)?
22	(Optional) Please provide any final comments you wish to make in relation to this study and your experience using the visualisation.

To gather qualitative feedback on usability, participants completed a final open-ended survey based on usability dimensions (Table 3.5). Questions regarding what felt intuitive or confusing, and what improvements could be made, provided actionable insights into user experience. The

inclusion of reflective feedback ensured the study captured usability barriers, design opportunities, and participant satisfaction.

3.7.2 Mitigating Familiarity Bias

Ensuring the evaluation measured participants' interaction with the visual encodings rather than their prior knowledge of the novels was critical. Familiarity with the well-known novels used – *The Lion, the Witch and the Wardrobe* and *Harry Potter and the Philosopher's Stone* – could influence participants' abilities to interpret the visual encodings and textual descriptions objectively.

To address this, I adopted a multi-step anonymisation strategy, inspired by Watson et al. (2019):

- **Character and Story Anonymisation:** All identifying character names, locations, and plot details were replaced with neutral alternatives. For instance, "Hogwarts" or "Diagon Alley" were replaced with generic terms. This process was automated using ChatGPT (OpenAI, 2024), prompted to strip identifying features from the JSON dataset while retaining the same structural elements – that is, number of characters, chapters, etc.
- **Visualisation Labelling:** The visualisations were labelled as Visualisation A and Visualisation B, concealing the underlying novels.
- **Neutral Chapter Summaries:** Chapter summaries were edited to remove recognisable elements.
- **Removal of the Full Text:** The full text feature was removed entirely from the visualisation menu.

These steps ensured participants would be required to rely solely on the visualisation's encoding and structure, mitigating familiarity bias.

3.8 Study I Data Analysis

Data was collected in Study I to determine the suitability of the visual encodings to support a set of general character analysis tasks. Qualitative data was also collected to understand the user experience of the visualisation technique. These data were analysed after all participants had attended their study sessions.

3.8.1 Thematic Analysis

I applied thematic analysis (Braun & Clarke, 2006, 2013; L. S. Nowell, Norris, White, & Moules, 2017) to examine the qualitative data collected from the questionnaire. Thematic analysis is a method used to identify, analyse, and report patterns or themes within the data.

Thematic analysis was chosen as a method of qualitative analysis in this research due to its accessibility and flexibility, particularly for researchers who are new to qualitative research. One of the key advantages of thematic analysis is its straightforward approach to identifying,

analysing, and reporting patterns (themes) within data (Braun & Clarke, 2006). Thematic analysis does not require the researcher to adhere to specific theoretical frameworks, making it a highly adaptable method that can be applied across a variety of research questions.

Thematic analysis is framed as a method that can be used by novice researchers because it provides clear, structured steps that guide the process of data analysis (Braun & Clarke, 2006). These steps (familiarisation with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and reporting the findings) provide a helpful framework for qualitative analysis. The clarity of this process makes thematic analysis a method that can be effectively used without the need for advanced training or specialised knowledge.

In addition to its accessibility, thematic analysis is well-suited for exploring the broad and diverse range of experiences and perspectives that were likely to emerge from non-expert users. Because thematic analysis allows for a detailed yet accessible account of the data, the method provides flexibility to capture both expected and unexpected insights from the data, allowing the researcher to remain open to emergent themes that may not have been anticipated during the design stage.

3.8.2 Descriptive Statistical Analysis

I used descriptive statistics (Nicholas, 1990) to report on the task-based, usability and questionnaire responses collected from participants to develop some insights to supplement qualitative findings. Although the sample sizes were small, this provided valuable initial insights and allowed for confirmation of trends observed in the qualitative findings.

Even with a smaller dataset, quantitative data can reveal important areas of interest in regards to the sample as a whole and identify patterns or outliers within task-based questionnaire responses. Although the small sample size limits the generalisability of the findings, these insights can still serve to help scaffold qualitative findings in terms of quantifying participants' correctness at task completion and comparing that to their experiences of the interface.

3.9 Study II Evaluation Methodology

Plaisant (2004, p. 2) provides a compelling analogy to illustrate the challenge of evaluating information visualisations:

> Is a Segway a better vehicle? Questions race to your mind: Better than what? For whom? To go where? In which state of mind? How important is it to get there quickly, or to get there at all? What if you don't really know where you are going, what is the best vehicle then? Should I use my savings to buy a Segway when I have other needs? Usability studies and formal comparison of speed characteristics and incident data might help worried potential drivers but it is their judgment of utility that will likely trigger adoption.

This analogy underscores the complexity of evaluating a tool's utility, for which Plaisant (2004) emphasises that real-world utility must be demonstrated in a setting that mirrors intended use. For this study, the aim was to determine whether the proposed visualisation could enhance discussions about characters in novels. Consequently, the evaluation methodology sought to replicate a realistic, casual discussion setting, akin to a book club.

Evaluating a visualisation's effectiveness for non-experts introduces an additional layer of complexity. Non-experts' diverse knowledge, experiences, and goals require tailored evaluation techniques that reflect their unique interaction patterns. While the most common evaluation approaches focus on individual performance or user experience, few studies explore the potential of visualisations to support collaborative or group-based activities among non-experts (Burns et al., 2023).

In response to this gap, I decided to adopt a focus group approach. The decision to adopt a focus group methodology in this study stems from the need to evaluate the visualisation in a setting that closely mirrors its intended purpose: facilitating casual literary discussion among non-expert readers. This approach not only addresses gaps in existing evaluation methods but also provides insight into how visualisations can enhance collaborative interactions and shared interpretation within a group context.

Focus group evaluations are less common in information visualisation research. Nonetheless, evidence suggests that visualisations can effectively facilitate discourse in group settings (Hinrichs et al., 2008; Kauer et al., 2021). Focus group methodologies have been applied in prior visualisation research (Kinnaird & Romero, 2010; Mazza, 2006; Mazza & Berre, 2007), providing insights into exploratory user behaviours, trust in visual mappings, and perceptions of data accuracy. While such methods are not traditional usability tests, they are valuable for understanding users' exploratory engagement and evaluating the tool's ability to foster interpretative reasoning.

While a traditional focus group evaluation could have facilitated discussion around the perceived usefulness of the visualisation, it would not have adequately captured how the tool is actually used in practice. To address this limitation, I chose to embed the focus group format within a book-club scenario. This approach allowed participants to engage with the visualisation in a manner that reflected real-world use, enabling an evaluation of both its practical utility and its impact on collaborative literary discussions. By situating the evaluation in a context familiar to casual readers, the study aimed to move beyond theoretical perceptions of the visualisation's value, instead focusing on how it actively supports reflection, interpretation, and group interaction.

3.9.1 Book-Club Scenario Focus Group Methodology

The Study II Research Question – How do non-experts in literary analysis integrate character-centric literary visualisations into casual book discussions? – shaped the methodological approach, which focuses on capturing participants' exploratory interactions and integrative processes of using the visualisation within a casual discussion setting.

Hence, the book-club scenario focus group methodology was designed to simulate an authentic, collaborative discussion environment, reflecting how casual readers might use visual aids to enhance their personal approaches to literary analysis and engagement. This approach aligns with the methodological emphasis on evaluating tools in contexts that mirror their intended use (Plaisant, 2004). By embedding the visualisation within a familiar and social setting, the evaluation sought to capture natural interactions and authentic insights into how non-experts engage with character-centric literary visualisations.

Casual book clubs provide a unique context for exploring the role of visual aids in literary discussion. Book clubs focus on social collaboration, reflective thought, and shared insights (Clarke et al., 2017; Long, 2003; VanDeGrift, 2024). These qualities make them an ideal framework for testing a visualisation designed to support non-expert engagement.

The book-club scenario was carefully structured so that participants would engage in group discussions that mirrored the dynamics of a typical book club, with discussion prompts administered by a facilitator, tailored to encourage (but not require) referencing of the visualisation's elements. This alignment aimed to ensure that the discussion remained focused on the tool's capabilities while being able to observe how it was integrated, and if this integration could be perceived as beneficial.

To evaluate the visualisation across different usage scenarios, two discussion components were embedded in each session:

- **Discussion of a Read Novel:** This component was designed to evaluate the visualisation's effectiveness in aiding recall, supporting analysis, and facilitating discussion of a familiar text. By anchoring the discussion in a shared narrative, this phase aimed to provide a baseline for understanding how the tool supported group interaction and individual reflection in a setting such as a book club.
- **Exploration of Unread Novels:** The second phase focused on selecting a hypothetical next novel to read from three visualised options. Here, the visualisation's ability to summarise unfamiliar texts and support decision-making was evaluated.

The dual-phase structure allowed for a comprehensive evaluation of the visualisation's utility in both retrospective and exploratory contexts, offering insights into its versatility and limitations. The facilitator plays a key role in this evaluation method (much like in focus groups), fostering a relaxed yet structured atmosphere. Ultimately, this evaluation was designed to observe how participants negotiated meaning, resolved differing interpretations, and integrated visual data into their literary analysis.

3.9.2 Procedure

Study Set-Up and Materials

Prior to participating in the study, participants were provided with an information and consent form to sign (located in Appendix B). They were also informed that the study would require an **approximately seven hour total time commitment**, split over multiple tasks (see Figure 3.5).

Sessions were conducted on a collaborative basis, with participants attending on the same day as their allocated group. Each group was seated in a configuration conducive to both referring to the visualisations and interacting with one another during the discussion. The visualisations were displayed across two screens, ensuring visibility and ease of reference for all participants while facilitating group interaction. The specific configuration of the room I used when running the sessions is described in the Study II chapter in Section 5.12.4.

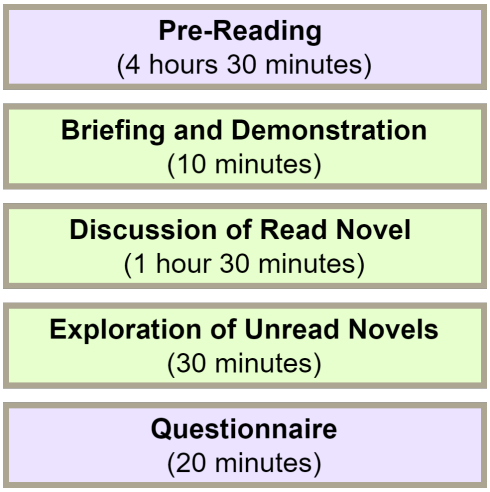

FIGURE 3.5: The green boxes indicate the book-club scenario focus group component of the evaluation. The purple boxes indicate the individual tasks completed by each participant before and after their session.

Pre-Reading

Of the four novels I visualised in Study II, *A Study in Scarlet* by Arthur Conan Doyle (A. C. Doyle, 1888) was chosen for its relatively short length and the diversity of its characters. This novel, the first to introduce the iconic detective Sherlock Holmes, presents a wide array of character interactions and plot developments, making it an ideal candidate for testing the effectiveness of the visualisation in mapping complex narrative data. The detective genre, in particular, tends to involve intricate webs of clues, suspects, and motives, all of which align well with a visualisation tool designed to assist in narrative analysis and discussions.

Participants were tasked with reading *A Study in Scarlet* **two weeks prior** to their allocated session. All participants confirmed that they had not read the novel previously.

A Study in Scarlet, which takes approximately **four hours and 30 minutes to read**, was selected not only for its manageable length but also for its balance of narrative depth and accessibility to casual readers. By choosing a novel of this length, the aim was to reduce the burden on participants while still offering a rich text with multiple layers of character dynamics for discussion. Furthermore, *A Study in Scarlet* exemplifies the genre-specific elements of detective fiction, allowing the capturing of data on how the contextual markers – particularly the clues – were referenced to contextualise the character journeys.

Briefing and Demonstration

I acted as the facilitator for the sessions, and began each with a detailed briefing and demonstration of the visualisation. This introduction served to acquaint participants with the tool's features, including the menu system. I, as the facilitator, made it clear that all features of the visualisation were available for use during the study, providing participants with the freedom to experiment as they saw fit.

Participants were informed that during the discussion they could build on each other's ideas, raise new points, or ask follow-up questions. They were also informed that the discussion was to follow a round-robin format of responding to discussion prompts (discussed in the next section), and that they therefore needed to be mindful of allowing each other time to share their opinions.

After the briefing, participants were given time to independently familiarise themselves with the visualisation. This phase of the session was unstructured, allowing individuals to explore the visualisation at their own pace for a couple of minutes.

Book Club Part 1: Discussion of *A Study in Scarlet* (Read Novel Component)

The first portion of the book club focused on a structured discussion of *A Study in Scarlet*, a novel all participants had previously read. The visualisation was displayed prominently on the main screen to act as a discussion support tool, allowing participants to refer to specific elements while engaging in conversation. This section of the study was designed to understand how the visualisation functioned to support and enhance discussion of a familiar text.

Casual book clubs typically rely on a facilitator to guide discussions, often using a set of prompts to structure the conversation. These prompts help participants engage with key themes, character development, and plot elements. They also encourage everyone in the group to contribute their thoughts, fostering a collaborative and reflective environment. Many examples of such prompts can be found online – such as those provided by Australia Reads (2024) – devised to help book club hosts facilitate and structure meaningful discussions in casual settings.

Table 3.6 provides the discussion prompts used for each session, showing how each was linked to a specific visualisation element. Additionally, in maintaining alignment with the focus group approach, the facilitator can ask probing questions. At various points, the facilitator may pursue an interesting line of thought from one or multiple participants to gain deeper insights, or to clarify a statement made. However, facilitators should be cautious not to derail the discussion and instead use probing questions sparingly to maintain the session's natural flow. Key to this is considering whether the information that may be extracted via a probing question is essential or highly useful to know (Krueger, 1998).

TABLE 3.6: The evaluation discussion prompts based on book club prompts, linked to specific visualisation elements.

ID	Discussion Prompt	Visualisation Element
DP1	What did you think of the timing of when different characters were introduced?	Temporal dynamics
DP2	How did the interactions between characters impact how the events unfolded?	Social dynamics
DP3	Which characters did you enjoy and not enjoy, and why?	Personal dynamics
DP4	What was the significance of the different settings in the story?	Setting
DP5	Were you satisfied with how the key events in the story unfolded?	Key events
DP6	How did you piece together the clues in the story?	Clues
DP7	Which chapter did you find the most memorable or critical to the story?	Plot function
DP8	Did the novel meet your expectations of the detective genre? Why or why not?	Combined elements
DP9	What are your overall thoughts on *A Study in Scarlet*, and would you recommend it?	Combined elements

During the session, the discussion prompts were delivered in a round-robin format to ensure equitable participation among all participants and encourage a balanced dialogue. Here, I provide an example of how this is conducted:

1. **Introduction of the Prompt:** The facilitator introduces a discussion prompt. This ensures that all participants have a shared understanding of the topic.
2. **First Participant Response:** The facilitator then invites the first participant (chosen randomly or using an assigned order) to provide their response. The participant shares their thoughts without interruption, ensuring they had the opportunity to express their perspective fully.
3. **Sequential Contributions:** Following the first response, the discussion moves sequentially around the group, with each participant taking their turn to contribute. This continued until everyone had an opportunity to respond to the prompt.
4. **Transition to the Next Prompt:** Once the discussion of the prompt came to a natural conclusion, the facilitator introduced the next prompt, and the process repeated with a new starting participant to ensure variety in speaking order.

This approach meant that each participant had the opportunity to respond to prompts in turn, fostering inclusivity and minimising the risk of dominant voices overshadowing others in the group. The structured nature of the round-robin delivery also helped maintain the flow of the discussion, giving each participant a clear opportunity to contribute.

Book Club Part 2: Selection of the Next Novel (Unread Novels Component)

The second portion of the book club session involved selecting a novel for the group's next hypothetical meeting. Participants were given free reign to explore three additional novels, through visualisations – none of which they had read before.

The aim of this segment was to evaluate how well the visualisation could support decision-making when participants had no prior knowledge of the texts. They were given 30 minutes to explore these visualisations, comparing them side by side if desired (using a second screen), and discussing their insights as a group.

During this phase, participants are encouraged to rely heavily on the visualisation to make their decision. Of course, as they have no prior knowledge of the novels, they are inclined to defer to the visualisations anyway. This segment of the study tested the visualisation technique's ability to summarise complex literary data effectively, allowing participants to engage with unfamiliar texts in a meaningful way. It also provided insight into how non-expert readers might use visual tools to guide their literary choices, revealing the strengths and limitations of the visualisation in this context.

In this part of the evaluation session, the facilitator adopts a hands-off approach, allowing the data to reflect the natural process of collaborative analysis of an unfamiliar text without intervention.

The final step in this portion was for the group to reach a consensus on which novel they would read next, at which point the discussion component is concluded.

It is relevant to note that during recruitment, participants were asked general questions regarding the genres and books they enjoy, and series they had read, which did not uncover any of the novels visualised for the study. They were not, however, asked about the specific titles used, which did run the risk of them having read one. Fortunately, no participants had read any of the novels, bar one, who during their session mentioned having possibly read one of the novels a very long time ago. This approach could be improved by incorporating additional screening questions during recruitment to confirm participants' unfamiliarity with the specific novels selected, however, this also runs the risk of them investigating those novels before the session.

3.9.3 Post-Discussion Questionnaire

At the conclusion of the session, participants were each provided with a short questionnaire comprised of one select-all-that-apply question (Q1), 19 questions (Q2-20) using semantic differential scales, and one optional free-form feedback section (Q21) to gather additional insights into their experiences. To minimise influence from others, participants were provided with paper-based questionnaires and instructed to complete them while seated independently. This approach ensured that each participant's responses reflected their individual perspectives, free from outside influence. Table 3.7 lists all the questions from the questionnaire, and the full questionnaire as presented to the participants is available in Appendix B.

TABLE 3.7: The Post-Discussion Questionnaire questions.

Q#	**Post-Discussion Questionnaire Question**
1	In which settings have you participated in discussions about novels with others in the past?
2	How enjoyable was the experience of reading (or listening to the audio book of) the novel *A Study in Scarlet*?
3	How complete was the information presented in the *A Study in Scarlet* visualisation?
4	How visually perceptible were the elements used to display data in the *A Study in Scarlet* visualisation?
5	How accurate (to the novel) was the information in the *A Study in Scarlet* visualisation?
6	How familiar were the *A Study in Scarlet* visualisation's graphs and interface?
7	How useful was the information provided by the *A Study in Scarlet* visualisation for answering the discussion prompts and responding to others?
8	How effective was the *A Study in Scarlet* visualisation in supporting recollection of the novel?
9	How aesthetically pleasing (attractive) was the *A Study in Scarlet* visualisation?
10	How appealing (engaging) was the *A Study in Scarlet* visualisation in drawing you into the data?
11	To what extent did the *A Study in Scarlet* visualisation impact the flow and quality of the discussion?
12	How helpful was the *A Study in Scarlet* visualisation in supporting you to gain improved insights or understanding of the novel?
13	How did the *A Study in Scarlet* visualisation influence the way you collaborated and interacted with others?
14	How did using the *A Study in Scarlet* visualisation compare to more traditional discussion aids (such as printed notes, websites, Wikipedia summaries, etc.)?
15	How useful was the information provided by the other three visualisations in selecting a novel to read?
16	How appealing (engaging) were the other three visualisations in terms of drawing you into their data?
17	Compared to the *A Study in Scarlet* visualisation, how was the experience of locating information on the characters, chapters and overall narratives in the other three visualisations?
18	How was the experience of comparing the visualisations of different novels to each other?
19	How did using the other three visualisations to select a novel to read compare to more traditional methods (such as Google searches, online reviews, looking through library/bookstore shelves, etc.)?
20	How enjoyable was your overall experience of using the visualisations to discuss novels with others?
21	Comments, suggestions or feedback on any aspects of the design and this experience: (Freeform feedback)

Initially, the questionnaire was comprised of multiple open-ended questions, however, the pilot participant expressed a sense of fatigue and feeling overwhelmed in response to being asked to complete these after the lengthy discussion. Hence, the questionnaire was converted to semantic differential scales to support capturing the range of feelings participants may experience in relation to different aspects of the visualisation and evaluation experience, without the pressure of having to form considered, written responses.

I opted for a semantic differential scale in the questionnaire rather than the more commonly used Likert scale. The semantic differential scale allows for a more nuanced understanding of participants' attitudes by asking them to rate items along a continuum between two polar adjectives, such as "useful" vs. "useless" or "harder" vs. "easier" (Rosala, 2020). This provides a richer insight into the perception of the literary visualisations being evaluated, offering participants the ability to express more subtle shifts in their opinions.

Unlike Likert scales, which measure agreement or disagreement with specific statements, the semantic differential scale measures the connotative meaning participants associate with the object of evaluation. This approach is particularly advantageous when evaluating complex constructs such as engagement with a visualisation, where participants' responses may span multiple dimensions of perception, including usability, appeal, and cognitive load (Rosala, 2020).

Additionally, the semantic differential scale reduces the risk of response biases commonly seen in Likert scales, such as acquiescence bias (the tendency to agree with all statements) and central tendency bias (the tendency to choose middle points) (Rosala, 2020). This approach provided me with data that is aligned with the subjective and varied experiences of the non-experts involved in the study. By mapping their responses across a continuum of opposing adjectives, I aimed to capture the subtleties in how participants perceive different aspects of the visualisations.

3.10 Study II Data Analysis

Multimodal data was collected in Study II with the aim of providing a well-rounded and rigorous view of how participants integrated visualisations during their discussions. These data were analysed using a grounded theory analysis approach. Again, basic descriptive statistics were used to produce quantitative insights from the quantifiable questionnaire responses.

3.10.1 Grounded Theory Analysis

Grounded theory, originally developed by Glaser and Strauss (2009) in 1967 (I reference a later edition here), is a methodology designed to generate theory directly from systematically gathered and analysed data. The approach emphasises the importance of building theory that is "grounded" in real-world observations rather than relying on existing theoretical frameworks. This method is particularly useful in exploratory studies where the goal is to generate new insights rather than test existing hypotheses. Glaser and Strauss's version of grounded theory

is flexible and inductive, allowing for the discovery of patterns and relationships within data through iterative analysis.

Later developments in grounded theory introduced variations to the original methodology. Strauss and Corbin (1990) introduced a more structured approach, emphasising coding frameworks and detailed procedures for axial and selective coding. Their version of grounded theory focuses on systematically categorising data to develop theoretical concepts, providing a more prescriptive framework for analysis.

Charmaz (2006), in *Constructing Grounded Theory*, offers revisions to the methodology. Her approach acknowledges the co-construction of meaning between researchers and participants, arguing that both the researcher's interpretation and the participants' lived experiences shape the emerging theory. Charmaz's approach emphasises reflexivity, recognising that researchers bring their own perspectives into the process.

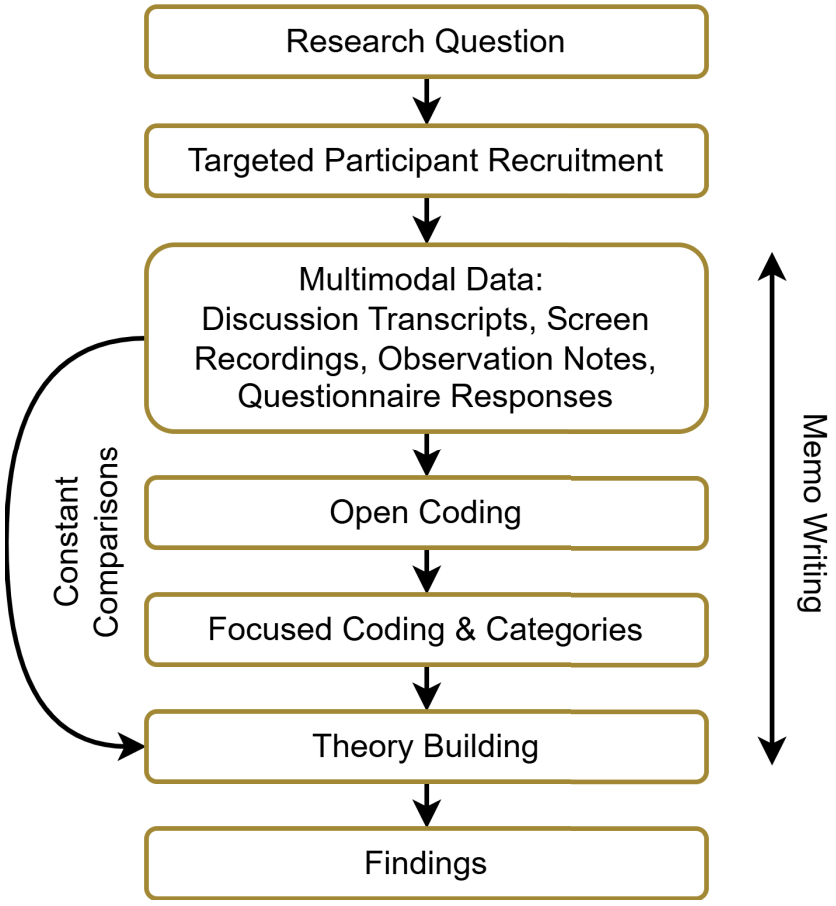

FIGURE 3.6: Grounded theory analysis approach used in Study II, based on the constructivist approach (Charmaz, 2006).

Bryant and Charmaz (2010) later provided an overview of the key debates and variations within grounded theory, bringing together both the classic (positivist) approaches and later constructivist approaches, to provide insights into the evolving nature of the methodology. This served to highlight both the strengths and limitations of these different interpretations and demonstrates the versatility of grounded theory in contemporary research contexts.

In this research, I adopt a constructivist approach to grounded theory to explore the experiences and interpretations of participants engaging with literary visualisations. Constructivist grounded theory, as defined by Charmaz (2006), emphasises the role of the researcher and participants as co-constructors of meaning, rather than assuming an objective reality. This approach aligns with my study, where participants' interactions with the visualisations and their discussions about characters in novels are viewed as co-constructed realities shaped by their personal experiences, social contexts, and the visualisations they are using to engage with the data.

In my application of constructivist grounded theory, I focused on understanding how participants made sense of the visualisations in the context of a casual book discussion, that is, casual literary analysis (rather than seeking to uncover a singular "truth"). This involved acknowledging my role as a researcher in shaping the research process, from data collection to analysis, and continuously reflecting on how my own interpretations influence the study's outcomes. I engaged with the collected data (Section 3.10.2), paying attention to how the participants interacted with and interpreted the visualisations based on their possible prior knowledge, experiences, and the prompts given during the focus groups. This process of co-constructing knowledge is central to how the grounded theory is developed.

The coding process in constructivist grounded theory is iterative and reflexive. Figure 3.6 provides an overview of this process. As I analysed participants' discussions and interactions, I engaged in open coding to identify initial patterns and concepts. These codes were then refined and later grouped under higher level code categories, ultimately leading to a theory to answer the Study II Research Question. A detailed description of the coding process is located in the Study II findings in Section 5.13.

3.10.2 Collected Data

To ensure rigour and support triangulation in the data analysis process (Carter, Bryant-Lukosius, DiCenso, Blythe, & Neville, 2014), multimodal data were collected (see Figure 3.6). These multiple sources comprised the audio recordings (later transcribed), screen recordings, written observations, and the questionnaire responses. It is also important to note that the visualisation datasets form part of the data sources for the analysis, as data within the visualisations were used to confirm participants' interpretations of specific elements, such as character personal traits.

Audio Transcriptions

The discussion audio was recorded for all evaluation sessions, and the audio transcriptions from these discussions form the backbone of the qualitative analysis. To streamline the initial transcription process, I used an AI service (Otter.ai, 2024), which provided a foundational draft. This draft was then meticulously refined by listening to the audio recordings and reviewing the text line by line to ensure accuracy. Particular care was taken to correctly associate dialogue lines with their respective speakers. Additionally, I re-added nuanced elements such as pauses

and laughter that the AI service did not include, as these are crucial for understanding the conversational dynamics and emotional tone of the discussions.

Screen Recordings

Alongside the audio data, screen recordings were made to track how participants interacted with the visualisation tools in real time. These recordings provided a direct observation of how users navigated through the visualisations, what features they explored, and how they used the tools to respond to discussion prompts. By aligning the timestamps from the audio transcriptions with the screen recordings, I was able to confirm specific moments in the interactions, such as when a participant referenced a particular visualisation feature or paused to discuss a specific element. This synchronisation allowed for a deeper understanding of the context behind participant behaviours, revealing patterns such as common navigation paths, pauses in interaction, or areas where participants seemed to struggle. This combined data was necessary to understand how the visualisations were practically integrated during various discussion points.

Written Observations

Though limited in quantity, my own written observations added an important layer of contextual information. I note that these were limited, as I wrote these between administering the prompts. These observations captured notable moments during the discussions that might not have been fully expressed in the audio or screen data, such as body language, facial expressions, or subtle group interactions that stood out to me. These insights supported the interpretation of the other data sources by highlighting immediate participant reactions or behaviours that reflected their comfort and engagement with the visualisation tools.

Questionnaire Responses

Responses to the semantic differential questionnaire and the optional freeform feedback section captured individual participants' experiences with the visualisation. These responses supplemented the observational and discussion-based data gathered during the sessions. By incorporating these individual perspectives into the analysis, the data provides a more comprehensive understanding of participants' interactions with the tool, balancing collective insights with personal experiences.

3.11 Ethical Considerations

This section outlines the considerations for and measures taken to ensure that the research was conducted ethically. This involved adhering to the University of Technology Sydney's ethical guidelines related to participant consent, privacy, and data security, as well as ensuring the fair and transparent use of AI-summarised and AI-generated data in the visualisations. Additionally, I was careful not to violate copyright laws regarding the distribution and analysis of literary texts used in the research. By addressing these considerations, this section ensures

that the research was carried out in an ethical manner, upholding the integrity of both the study's processes and the resulting data.

3.11.1 Ethics Approval Procedures, Informed Consent and Data Handling

I followed the University of Technology Sydney's ethics approval procedures to gain permission for conducting research involving participants, for Study I and Study II. These processes involved submitting detailed applications outlining the research objectives, participant involvement, data collection methods, and measures for ensuring participant privacy and consent. These applications were carefully reviewed and approved by a panel of ethics committee members ensuring that all ethical considerations were thoroughly addressed. Following this approval, the ethics applications were formally lodged with the University, granting official approval to proceed with the evaluations.

One of the primary ethical considerations in my research was ensuring informed consent and protecting the privacy of participants. I made sure that all participants were fully informed about the purpose of the study, their role, and how their data would be used. I emphasised that participation was entirely voluntary and that they could withdraw at any point without any negative consequences. Additionally, I took care to anonymise all participant data throughout the data collection, analysis, and publication processes to protect their identities and ensure confidentiality. The information and consent forms for Study I and Study II can be found in Appendix A and Appendix B respectively.

3.11.2 Using Generative AI

An important ethical consideration in this research was the integrity and reliability of the AI-generated data used in the visualisations. Generative AI tools, including ChatGPT (OpenAI, 2024), are known to produce summaries that may omit critical details, alter nuances, or even introduce inaccuracies, often referred to as "hallucinations". These limitations posed a potential risk of misrepresenting the original novels and affecting the quality of the visualisations. To address this, I personally read all the novels used in this research, and carefully reviewed the AI-generated summaries to confirm their accuracy to the best of my ability.

By cross-referencing the summaries with the source material, I sought to ensure that key narrative elements were correctly represented and that no significant inaccuracies distorted the data. While this process could not entirely eliminate the risk of errors inherent to AI-generated content, it allowed me to mitigate these issues and create visualisations that were as reliable as possible.

3.11.3 Copyrighted Literary Works

In addition to ensuring informed consent and participant privacy, I carefully considered the ethical implications of using copyrighted texts in my research. The novels I chose to visualise in Study I are protected under copyright law, and I made sure to adhere to fair use guidelines

throughout the project. Since the research involved AI-summarised text data rather than reproducing or distributing large portions of the original novels, I ensured that the usage fell within the boundaries of ethical and legal standards for educational and research purposes.

I was mindful to only use brief excerpts and summaries generated by the AI, rather than full-text reproductions, and the visualisations were designed to focus on narrative structure and character dynamics, rather than on directly replicating or sharing large sections of the original works. I ensured that the visualisations provided an interpretation of the texts rather than a substitute for reading them, and the original works are credited in this work. By keeping the use of copyrighted material to a minimum and framing it within the context of academic research, I aimed to respect the intellectual property rights of the authors while contributing to the field of literary visualisation.

This ethical concern was further mitigated in Study II, where I exclusively used novels that are in the public domain. By focusing on works that no longer fall under copyright protection, I was able to avoid issues related to the use of copyrighted material entirely. This allowed me to conduct the research freely, without restrictions on the types of data I could use or share.

3.12 Conclusion

In conclusion, the methodologies employed in this research provided a robust framework for designing and evaluating visualisations targeted at non-expert users. By adopting user-centred design principles, I ensured that the design of the visualisation technique was tailored to the interests of casual readers. The two-stage visualisation design and evaluation cycle facilitated an iterative process, allowing for refinement of the visualisation based on user feedback and evaluation findings from the first study.

The integration of design methodologies, such as Munzner's nested model (Munzner, 2009) and the design activity framework (McKenna et al., 2014), offered a structured approach to the visualisation development process. These models ensured that design decisions were validated at each stage, contributing to the creation of more effective and user-friendly visualisations. Additionally, the use of the Six Questions and NEUVis schematic (Gough et al., 2016) helped maintain a focus on the needs of non-expert users throughout the design phase, ensuring that the final artefacts were aligned with the goals of this research.

Evaluation methodologies, including task-based and focus group evaluations, played a critical role in assessing the effectiveness of the visualisations. By incorporating both quantitative and qualitative data collection methods, I was able to capture a comprehensive view of user experiences and satisfaction. The custom book-club scenario focus group evaluations, in particular, provided valuable insights into how the visualisations functioned as discussion supports in collaborative settings, offering a unique perspective on their utility in non-expert literary analysis.

Overall, the combination of design and evaluation methodologies adopted in this research facilitated an in-depth exploration of the challenges involved in creating literary visualisations

for casual readers. The iterative, user-centred approach, supported by rigorous evaluation methods, enabled the development and repeated testing of a visualisation technique with non-expert end-users.

Chapter 4

Study I: Designing a Character-Centric Literary Visualisation

4.1 Introduction to the Study I Chapter

Study I focuses on the first of the design and evaluation cycles, including prototyping a visualisation of characters applicable to different novels, along with describing a comprehensive pipeline, and then conducting the first formal user evaluation.

4.1.1 Study I Research Question and Objectives

Study I Research Question: How can data on characters in novels be abstracted and visually encoded to represent their development and connections to each other?

Study I Research Objectives:

- Conduct an interview with an expert in literary analysis to gain insights into the domain and identify the types of data needed to represent characters in novels
- Perform data type and task abstraction for character and contextual data
- Investigate and design appropriate visual encodings for representing the data, including connections and developments
- Develop a web-based implementation of the visualisation system
- Build two test datasets using two well-known novels to demonstrate the applicability of the visualisation
- Design and administer an evaluation methodology to determine the suitability of the visual encodings for non-experts performing character analysis tasks
- Analyse findings from the evaluation to draw conclusions for the next design iteration

4.2 Design Stage I

Design Stage I marked the formal beginning of my design research project, focusing on developing an initial prototype of a visualisation technique and gathering early user feedback to guide the next iteration. The primary goal during this phase was to create a baseline visualisation that non-experts could use to explore character dynamics in a novel, providing a tool that would support more interactive and collaborative literary discussions.

Documenting the design process is crucial for transparency and reproducibility. A detailed account of the decisions made during the design study, from the choice of visualisation techniques to the selection of data extraction methods, provides a roadmap for others interested in applying similar approaches. This documentation not only aids in understanding the intricacies of the visualisation but also empowers other researchers to adapt and modify the pipeline for different novels or genres.

The design stage encompasses the rationale behind a pipeline that integrates both automatic and manual data extraction methods. This hybrid approach ensures flexibility and accuracy in handling textual data. The pipeline is designed to be generic enough to accommodate different novels, allowing it to produce different visualisations without requiring modifications. Furthermore, clear and comprehensive documentation supports the pipeline by detailing the decision-making processes, ensuring transparency and reproducibility. This documentation serves as a guide for refining and adapting the pipeline to future use cases or research needs.

The potential impact of this design stage extends beyond the immediate visualisation of characters in a novel. It establishes a framework for integrating literature and information visualisation, establishing interdisciplinary knowledge that bridges literature and character data visualisation. As a result, the study not only contributes to advancing the understanding of specific literary works but also promotes the development of innovative visualisation techniques for non-expert literary analysis.

4.3 Domain Problem and Data Characterisation

The first step of this design study was to gain a comprehensive understanding of the target domain, its users, and the associated data and tasks, per Munzner's model (Munzner, 2009). By delving into the specific context of the literary domain, this step helped to identify key problems and requirements, and to characterise the data that will inform the visualisation design.

4.3.1 Authentic Representation of Fictional Characters

In the literature review in Section 2.8.5, I examined the distinctions drawn by Forster (2023) between fictional characters and real people. Forster emphasises that fictional characters, while often depicted with human-like traits, are constructs of narrative and imagination, lacking the ontological grounding of real individuals.

Expanding on this distinction, Bunce and Harris (2014) explored how older children and adults perceive and evaluate fictional characters through two key judgments. The first involves determining whether a figure belongs to "the real world" (ontology question), and the second assesses whether the figure authentically represents "the real" fictional character (authenticity question).

The findings of Bunce and Harris (2014) reveal that both older children and adults are capable of reliably distinguishing fictional characters from reality. Furthermore, familiarity with the original version of a character enables participants to accurately judge whether a given representation authentically captures the character's properties. This research underscores the sophisticated cognitive processes at play in evaluating fictional characters, bridging the narrative constructs of fiction with individual perception and understanding.

Further investigation during this design stage uncovered that a major theoretical approach to understanding character representations in novels is to consider the psychology of the characters as though they were human beings (Paris, 1997). Fictional characters are not constructed or represented with a uniform structure or composition (Bunce & Harris, 2014). Within different forms of literature, and across different genres, characters range from those who commit actions that would be impossible in the real world, to those whose actions quite accurately reflect what can be achieved in reality (Harris, 2012). This highlights the necessity to decompose a character into a set of properties that is either generic enough that it fits a multitude of characters or specific enough that it can only be used in the context of their world.

Hence, using the example of the highly recognisable fictional character, Sherlock Holmes, I considered how his character may be described. My first thought was that his appearance is typically associated with the hat he wears, called a deerstalker. This is evidenced in early illustrations of the character, such as that shown in Figure 4.1. However, the author, Arthur Conan Doyle, never described Sherlock Holmes wearing a deerstalker, as it only became part of his iconic look through illustrations and later screen adaptations.

So, my question was: How can characters be summarised faithfully to their representations in the text? Ignoring illustrations and film adaptions, I aimed to create a visualisation that helped readers to investigate characters through the lens of the original source material. Across the novels, Holmes is described in a manner of ways, including as curious, having hawk-like features, a bachelor, and having a methodical approach (A. Doyle & Freeman, 2003). In the context of my work, this helps to establish the argument that while fictional characters may be difficult to decompose, it appears feasible to determine if the data and its representations accurately portray a character in a manner perceived authentic by end-users.

However, while such descriptions help to form an image in one's mind of a character, they do not describe the character's evolution or journey throughout the novel. A first step towards maintaining this authenticity, while further investigating how to map their development and connections to other characters, was to derive data on characters solely from their original source material, but to do so I needed to understand more about the data domain.

FIGURE 4.1: An illustration of the character Sherlock Holmes (right) wearing his iconic deerstalker hat, which appeared in The Strand Magazine in December, 1892. This image is in the public domain.

4.3.2 Consulting an Expert in the Data Domain

To understand how to support non-experts to interpret the journeys of characters in a novel, I met with an expert in the data domain. At the time, the expert was a lecturer, tutor and researcher in criticism and literary analysis of novels at an Australian university. Before meeting with the expert, I compiled a list of 20 open-ended questions regarding a target audience of non-expert or novice literary analysts and their needs, the specific features of characters that may be desirable to understand, and ideas on digital supports for analysing characters in novels. While I did not have the goal of formally collecting data and analysing it, I documented direct remarks made by the domain expert with their consent, which they later reviewed. The questions and the domain expert's answers can be viewed in Appendix A.

4.3.3 Target Audience and Domain Problem

The domain expert explained that formal literary "character analysis is performed as a close reading task," but those unfamiliar with the process often "struggle with close reading [of novels] ... [as it] can feel boring". Close reading is a literary analysis approach that examines the detailed elements of a passage or text to uncover its deeper meanings (Kusch, 2016). While this method is highly effective for deep analysis, it demands significant time and attention to textual detail, which may not align with the motivations or capabilities of casual readers.

As discussed in the literature review (Section 2.2), casual readers, in contrast, often prioritise gaining a general understanding of a story and its characters rather than engaging in detailed textual analysis. When introducing new participants to literary discussions, the domain expert described using selected paragraphs from a text to prompt conversation "concerning character, a pivotal moment, and an interesting dynamic at play". Such discussions can provoke new interpretations, foster collaborative exploration of the text, and support participants in articulating and defending their perspectives.

Determining what to visualise about characters to support these discussions is not straightforward. While it is essential that any visualised information is accurate to the text, the domain expert noted the absence of a definitive model for what constitutes "must know" information about a character. They elaborated: "There is no specific model to understand the must know ... information about a character ... [but] you cannot say something falsifiable [either]". This underscores the complexity of identifying universal character attributes that resonate across diverse reading experiences.

For non-experts in literary analysis, analysing some linguistic features may be more accessible than others. Semantic patterns, for instance, refer to recurring words, phrases, or themes that convey specific meanings or ideas throughout a novel. These patterns are often intuitively recognisable even to casual readers, making them a promising focus for visualisation. In contrast, more specialised features, such as lexical patterns (word frequency, variation) or dispersion (distribution of words across a text), may be less engaging or interpretable for non-experts. Semantic patterns of characters could include their thematic associations, repeated actions, or relationships with other characters, offering a natural entry point for analysis.

The domain expert expressed interest in technologies that could automate aspects of character analysis, provided the data's accuracy can be ensured. When asked to imagine an interface for non-experts in literary analysis, the expert suggested that "being able to map character interactions at different points" and "a mind map explaining character values" would be particularly useful. These suggestions align with findings from the literature review, which highlight the demand for tools that present complex character information in accessible ways (see Section 2.2.1). The expert's reference to mind maps also corroborates the observed reliance on informal tools that, while useful, lack the cohesive overview of a data-driven approach.

To better understand the challenges and opportunities in supporting character analysis, I immersed myself in the experience of close reading by working with the selected texts for this study prior to the data abstraction phase. This hands-on engagement allowed me to extract character information firsthand, providing insights into the nuances of textual analysis and informing the subsequent design and data abstraction processes.

4.3.4 Selecting Novels for the Study

To guide my understanding of interpreting characters from a text, I selected two well-known novels I was already familiar with early in the design process. Working with familiar texts allowed me to focus on identifying patterns and experimenting with encoding techniques

without the added complexity of deciphering unfamiliar storylines. This familiarity ensured a strong foundation for exploring how character information could be abstracted and visualised effectively.

Having texts to work with from the start also enabled me to test how well different visual encoding techniques performed across different novels. Testing with more than one text revealed the extent to which the encodings could adapt to the unique narrative structures, character dynamics, and other contextual elements of each story.

In the following subsections, I provide the rationale for the two novels I chose.

Harry Potter and the Philosopher's Stone by JK Rowling

I selected *Harry Potter and the Philosopher's Stone* by JK Rowling (Rowling, 1997) to visualise, as I aimed to use a well-known example of genre fiction that I was already familiar with so that I could explore the character dynamics within a familiar narrative framework. As a widely recognised work of fantasy, *Harry Potter* offers a detailed and complex cast of characters whose relationships, goals, and personal development are central to the plot. The fantasy genre, in particular, often involves intricate world-building and a wide range of character interactions, making it a suitable choice for examining how visualisation can effectively represent these dynamics.

I consider *Harry Potter and the Philosopher's Stone* to fit well within the parameters of genre fiction that appeals to casual readers. The interplay of magical elements, character development, and complex relationships has spawned many online communities dedicated to its discussion. The novel contains clear examples of characters with personal goals and motivations, such as Harry's desire to learn more about the changing world around him, and how these evolve over time in response to the challenges he faces. Additionally, the social dynamics within the novel, including Harry's relationships with other key characters such as Hermione Granger, Ron Weasley, and Rubeus Hagrid, are fairly recognisable in the world of literature, but visualising these with accuracy to the text presented an intriguing challenge.

The Lion, the Witch and the Wardrobe by C. S. Lewis

In addition to Harry Potter and the Philosopher's Stone, I selected *The Lion, the Witch and the Wardrobe* by C.S. Lewis (C. S. Lewis, 2001). This choice was driven by several factors, including my prior familiarity with the text and the opportunity it provided to balance complexity with accessibility. Having already worked with *Harry Potter*, a narrative dense with characters and intricate relationships, *The Lion, the Witch and the Wardrobe* offered a simpler text to approach in terms of length. This allowed me to focus less on the time-intensive challenge of text extraction and more on refining the visual design aspects of my project.

The Lion, the Witch and the Wardrobe is another well-known work of fantasy fiction with a dedicated fan base, however, choosing *The Lion, the Witch and the Wardrobe* as a complementary text to *Harry Potter* also allowed me to explore visualisation across different types of fantasy narratives. While both texts belong to the same genre, the differences in their narrative complexity

offered insights into how well my visual design would suit different text lengths and densities, ensuring that the final design could cater to a range of texts with varying levels of complexity.

4.3.5 Data Characterisation and Tasks

In the process of developing a visualisation for literary analysis, it was necessary to first characterise the data that could be derived from a novel and define the associated tasks. Typically, novel text is converted into raw text, which then undergoes cleaning and pre-processing to make it suitable for text analysis tasks (Malik, Keikhosrokiani, & Asl, 2021). Unlike structured datasets, fictional novels are considered unstructured data, as they lack a predefined format for computational processing. The required information for these processes can be poorly documented, which presents significant challenges in terms of extraction and analysis (Sukanya & Biruntha, 2012). The study of such data lies at the intersection of data science and NLP, an area that is relatively understudied and requires specialised data processing techniques (Benoit, 2021). In light of these challenges, the domain expert consultation was integral to informing my approach, particularly in relation to which aspects of character data were interesting to visually encode and the available references to support my understanding.

TABLE 4.1: The NEUVis schematic (Gough et al., 2016) completed in Study I.

Part	**Attribute**
Part 1	**Data**
Type (attributes)	Qualitative, quantitative, dynamic.
Dimensionality (attributes)	2D, high-dimensional.
Establishment (relevance)	Facilitating access to complex unstructured data that are difficult to organise and categorise.
Applicability (relevance)	Informational aspects and new insights may be formed.
Acquisition (attributes)	Structure and organisation of visual elements, meaning of visual elements, useful data.
Part 2	**Visualisation**
Goals (relevance)	Accessible singular reference point, supports individual or shared viewing.
Interface (interaction)	Interactive elements, emotive imagery, static elements.
Construction (interaction)	Narrative pathways, exploratory navigation, familiar metaphors.
Context (relevance)	Individual use, shared use, in-person or online, public-facing.
Communication (relevance)	Digital discussion artefact, non-experts with non-experts.
Responses (interaction)	Validated, corrected, emotional, surprised, critical.

After consulting with the domain expert, completion of the NEUVis schematic template (Gough et al., 2016) was conducted to articulate initial ideas on what would be required for the visualisation (see Table 4.1). It guided my thinking regarding the data to be visualised and the

visual representations that could be effective in mapping that data for casual readers, ensuring the design would be both accessible and informative. As the project evolved, so too did the schematic. The below version shows the original version, demonstrating initial thought processes. Later, in Study II the schematic was updated (Table 5.1) to reflect the evolution of the project.

Relying solely on basic representations of characters as points or lines without adding contextual information was deemed insufficient for the goals of this research project. The domain expert further motivated the desire to enrich a layout with textual data, remarking that when analysing characters it "is important to record is whatever is contextually relevant information. That is, whatever situates the characters in a world". The domain expert also underscored the need to record data types and visual structures in a consistent, replicable manner that supported comparative tasks across characters: "What is recorded on one character should be recorded for all characters to support comparison tasks". Further investigation of the literature (following recommendations from the domain expert) lead to improved understanding that characters and their interactions in the narrative are shaped by both the spatiotemporal organisation of the story world and the actions they undertake within it (Frow, 2014). It is through these actions and goals that characters are understood by the reader, with character goals often functioning as the key to interpreting narrative progression (Egidi & Gerrig, 2006). Such goals help establish motivations behind actions, creating a coherent causal network that ties events in the narrative together (Trabasso & van den Broek, 1985).

For casual readers to benefit from the data as a reference point, it became clear that it was essential to include data that captured how characters evolve over time and how they compare to one another. Characters have goals, commit actions, and hold motivations, not just in isolation but also in response to other characters. Furthermore, the emotional dimension of characters adds a layer of nuance, which through dynamic sentiment visualisation techniques, can help to convey the emotional arcs of characters across the narrative (Watson et al., 2019). Relationships between characters, particularly within social networks such as familial or friendship ties, also play a pivotal role in interpreting the novel. As the domain expert noted, "In many novels, social networks ... are central to interpreting the novel".

In response to these considerations, I categorised the character data into three key dimensions: **temporal dynamics**, **social dynamics**, and **personal dynamics**, which I collectively refer to as **character dynamics** (Figure 4.2). Furthermore, novels often distinguish between primary characters – whose goals drive the story – and secondary or tertiary characters, who either support or create obstacles for the primary characters. To account for this, I determined the importance of encoding **character prominence**, as it aids users in identifying which characters are central to the narrative and which serve more peripheral roles (Watson et al., 2019). Additionally, I included **contextual data**, such as **chapter summaries** and **character profiles**, to provide users with a fuller understanding of the narrative.

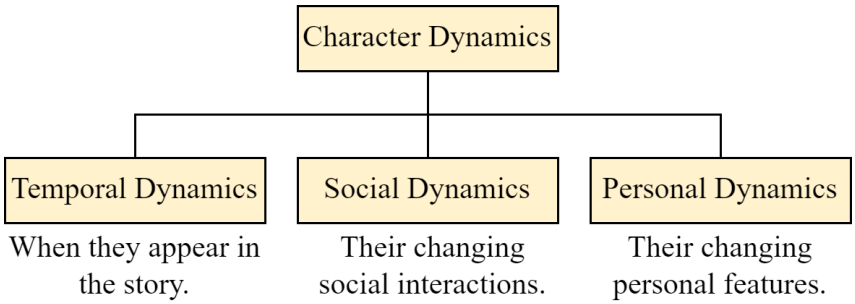

FIGURE 4.2: The character dynamics defined to capture key character data.

The overarching goal of this investigation was to develop an interface that could support structured and repeatable interactions that could lead to deeper discussion and analysis of characters in novels. As part of this, I devised nine general character analysis tasks, which are summarised in Table 4.2. Determining the tasks a visualisation can support is core to the design process (Munzner, 2009; Shneiderman, 1996). The tasks reflect what I consider fundamental aspects of character analysis – based on the proposed data types and discussion with the domain expert. Additionally, I aimed to develop tasks that would be applicable across different genres and narrative styles. While the visualisation is not limited to supporting end-users in conducting these tasks, the characterisation of them essentially holds the designer accountable to ensure that the design supports character analysis in a meaningful and replicable way. They also provide a means to evaluate the visualisation at a later stage.

TABLE 4.2: General character analysis tasks to be supported by the visualisation design.

ID	**Task**
T1	Identify characters in the novel.
T2	Locate when characters make appearances in chapters.
T3	Locate when characters have social interactions.
T4	Identify the directions of characters' social interactions.
T5	Compare the intensity of characters' social interactions.
T6	Identify characters' goals, actions, motivations and sentiments.
T7	Compare characters' goals, actions, motivations and sentiments.
T8	Identify the main characters based on their prominence.
T9	Compare the prominence of characters.

4.4 Character Dynamics Data Types and Abstraction

Before proceeding with the design of the visual encodings, it was essential to bridge the gap between the domain-specific vocabulary of the target text and the formal descriptions used in computer science. This step was crucial for transforming the raw data into structured data

types that could be effectively used by visualisation techniques, following established methodologies in the field (Munzner, 2009). The process involved mapping the complex narrative elements – such as character relationships, traits, and evolving appearances – into computational representations that could be manipulated and analysed. This mapping enabled me to treat the narrative data as abstract entities, which could then be encoded into visual forms that preserve their inherent structure and meaning.

This operation involved identifying key attributes – such as character traits, interactions, and temporal shifts – and converting them into corresponding data structures, such as nodes, edges, and attributes that could be processed by visualisation algorithms. These abstractions provided a crucial intermediary step between the textual data and its visual representation, allowing me to apply standard visualisation techniques while preserving the narrative context. Thus, this process laid the groundwork for an effective and coherent visualisation design that would support the exploration and interpretation of character dynamics.

4.4.1 Temporal Dynamics Data

Novels are traditionally segmented into chapters, a structure that not only provides narrative breaks but also serves to indicate the passage of time, albeit often ambiguously. While film scripts may follow a more linear progression of events, the treatment of time in novels can vary widely. The domain expert provided insights into how to approach the temporality of novels: "time expands and contracts based on when interesting things happen. The dynamics of time are not linear. They are clustered around particular moments or important life events ... These important moments are given the most textual space ... [so] dividing a summary into chapters makes the most sense". This highlights the importance of representing chapter divisions when visualising narratives from novels, as this segmentation better reflects the pacing and flow of how they are written. Essentially, the chapter structure offers a more accurate reflection of the varying significance of events and allows for an understanding of how time is manipulated within the text.

Characters were extracted using a combination of NER techniques and manual verification. At first, NER methods were helpful to identify and extract character mentions from the text automatically, but manual verification became essential to ensure accuracy, which is where my familiarity with the texts also became important. I had to account for the various ways characters are referenced throughout the text. For example, a single character like Harry Potter might be referred to as "Harry," "Potter," "Mr. Potter," or "The Boy Who Lived", depending on the context. Additionally, characters may be present but only be referred to through physical trait descriptions, such as "the pale boy", which was the case for the character of Draco Malfoy in his first appearance in the novel. Hence, manual verification allowed for consolidating these variations under a unified identifier, ensuring consistency in the data and mitigating potential inaccuracies introduced by automated methods. Characters were then assigned unique IDs, in the format of Cn.

To accommodate the character dynamics, the temporal data within the visualisation is organised into ordinal chapter lists, with each character's presence marked by chapter nodes. These chapter nodes serve as indicators of where and when a character appears in the narrative, capturing the temporal aspect of character development. Each node is then linked to data representing the character's social and personal dynamics, allowing for a more holistic view of character progression throughout the novel. This method not only highlights when and where characters interact but also captures how their internal goals and social relationships evolve over time. By incorporating chapter-based segmentation, the visualisation accommodates the non-linear portrayal of time common in novels while also presenting a clear framework for understanding the multifaceted dynamics that drive the narrative.

4.4.2 Social Dynamics Data

To capture the social dynamics within the novel, I began by connecting the temporal layer between chapter nodes using the chapter table from the dataset, which allowed me to form what is known as a temporal community (Dang et al., 2016). These temporal communities provided a way to represent characters co-existing within the same timeframe, laying the groundwork for social network formations. To abstract the social dynamics data, I drew upon the definition of a dynamic graph (Beck, Burch, Diehl, & Weiskopf, 2017), where a static graph $G := (V, E)$ models the set of vertices, V, and their edges, $E \subseteq V \times V$. By extending this to a sequence of static graphs over time, I was able to represent how relationships between characters evolve throughout the novel. This sequence formed a dynamic graph, $\Gamma := (G_1, G_2, \ldots, G_n)$, where $G_i := (V_i, E_i)$ represents the static graph at each time step, $\tau := (t_1, t_2, \ldots, t_n)$.

In my dataset, social network edges represent the **frequency of dialogue interactions** between characters, which can be used to model the formation of social groups (Chowdhury, Muhuri, Chakraborty, & Chakraborty, 2019). Social relationships in the novel are directed, meaning each interaction is captured as $e_1 = (v, w)$ and $e_2 = (w, v)$, with each character acting as both source and target of dialogue. This directed nature reflects the nuances of social interactions in novels, where characters may dominate conversations, interrupt, or remain passive, depending on their roles in the narrative. The domain expert explained in the interview that "relationships are assumed to be formed when a dialogue interaction occurs", which reinforced the decision to use dialogue as a key measure of social connection.

	Peter	Aslan	Lucy	Susan	Mr. Beaver	Edmund	Professor
Peter	0	2	4	6	0	5	0
Aslan	1	0	5	1	0	1	0
Lucy	8	3	0	8	0	2	0
Susan	9	0	8	0	0	5	0
Mr. Beaver	2	0	2	2	0	2	0
Edmund	4	0	2	4	0	0	0
Professor	2	0	2	2	0	2	0

FIGURE 4.3: An example of a social interaction matrix for a chapter of the *The Lion, the Witch and the Wardrobe*.

To achieve this, I used regular expressions to extract all dialogue lines within each chapter and store these in a CSV with their respective character associations. From these, I constructed a social interaction matrix for each chapter (see Figure 4.3 for an example), where the edges of the social network were determined by the number of dialogue exchanges between characters.

For each chapter, I calculated the number of dialogue lines spoken from one character (the source) to another (the target), creating weighted edges that represent the intensity and frequency of their interactions. This multivariate approach allowed me to analyse each chapter's social dynamics in detail, anticipating that multiple social groups with varying degrees of interaction would emerge for visual analysis.

4.4.3 Personal Dynamics Data

To effectively capture the personal dynamics of each character, I identified four key traits that serve as the foundation for their analysis: goal, action, motivation, and sentiment; offering insight into how each character's personal storyline unfolds across the narrative. By focusing on these aspects, I aimed to provide a structured understanding of the characters' individual journeys, highlighting their objectives, the reasoning behind their actions, and their overall emotional state throughout the story. Table 4.3 outlines these key traits, presenting a systematic way to analyse and interpret character behaviour.

The terms goal, action, and motivation were prefixed with "salient" to emphasise the subjective nature of identifying these traits within the text. Characters' personal dynamics are often not explicitly stated, and much of this information must be inferred from their actions, dialogue, or subtle narrative clues. By using the term "salient," I acknowledge that what stands out as important in terms of a character's personal dynamics can vary depending on interpretation, making the analysis inherently interpretative.

TABLE 4.3: Definition of character personal traits used in the visualisation.

Trait	**Description**
salientGoal	What the character is trying to achieve or are told to do.
salientAction	The character's key action, reaction, behaviour or state.
salientMotivation	The reason for the character's goal and/or action.
meanSentiment	The polarity of the character's spoken and internal dialogue.

As confirmed by the domain expert I consulted, this interpretative approach is common practice in character analysis, where identifying traits like motivation and goal is often done through contextual cues rather than explicit text. The domain expert explained that there is "no formal method for doing this"; in other words, character analysis is highly subjective and interpretive. Much of the insight into characters' personal dynamics is derived from the implied meanings and subtleties within the text, making interpretation an essential aspect of the process. This method provides room for deeper, more nuanced analysis, allowing readers to engage with characters on a more personal and reflective level.

The challenge of capturing personal dynamics is compounded by the lack of a formal methodology for retrieving these traits directly from unstructured text. Existing visualisation tools designed for close reading often rely on supplementary human-generated information to fully interpret the text (Jänicke et al., 2017). With this in mind, my initial approach involved manually coding these personal traits through an iterative process. I used short text strings to summarise each trait for every character in each chapter, with the goal of identifying overarching patterns in their personal development. This manual coding process required in-depth knowledge of the novel and involved multiple iterations to refine and consolidate the trait descriptions into higher-level concepts. While effective, this method was time-consuming and demanded significant effort even when already well-versed in the text.

To streamline this process, I explored the potential for automation by investigating various NLP techniques that could be applied to summarise the text. Techniques such as extractive summarisation (Gupta & Lehal, 2010), where key sentences or phrases are identified and extracted from the text, and abstractive summarisation (M. Lewis et al., 2020), which generates new sentences based on the meaning of the input text, were considered. Tools such as *spaCy* (Montani et al., 2023) and *Hugging Face*'s transformers (Wolf et al., 2020) offer robust frameworks for these methods, enabling the extraction of relevant information from unstructured data. However, these techniques often require fine-tuning, pre-processing, and custom model training to achieve satisfactory results, making them less accessible for a rapid iteration process. In contrast, I found that ChatGPT (OpenAI, 2024) provides an intuitive interface and consistently high-quality outputs without the need for extensive configuration. Its ease of use, coupled with its ability to understand context and produce coherent summaries, made it the ideal choice for this task. By leveraging ChatGPT, I was able to quickly generate personal dynamics data while maintaining the necessary level of nuance and accuracy, making it a more efficient and effective solution for my project.

Ultimately, my project focuses on how to effectively and accessibly visualise character dynamics, rather than on refining methods of extraction or abstraction. While the extraction of personal character data is essential for creating meaningful visual representations, the primary goal is to ensure that these visualisations are clear, intuitive, and provide users with insights into the novel's narrative. The process of summarising and extracting the necessary data, whether through manual coding or leveraging NLP techniques, serves as a foundation for this visualisation. However, my project is not concerned with improving or optimising extraction and abstraction methods themselves. Instead, it emphasises how these extracted data points can be represented in a way that supports users in exploring complex literary elements, such as character goals, motivations, and relationships, in an accessible manner.

Hence, ChatGPT provided an additional layer of verification for some of the initial summaries I had manually coded, while also offering deeper insights in other cases. By leveraging ChatGPT, I was able to accelerate the coding process, particularly when generating consistent representations of the characters' personal traits.

Initially, the process involved copying the full text of a chapter into ChatGPT, providing a

prompt to identify a specific character and to generate their personal traits, and then transferring the output into a CSV file. Later, I engineered prompts (see Appendix C) to ensure that the personal dynamics data was returned in a compatible JSON format, which allowed me to copy the results into the visualisation's JSON files. While the use of generative AI helped improve efficiency, I found that a thorough review of the automated outputs was still necessary. In some instances, the traits were incorrectly assigned or did not align with the narrative context, highlighting the importance of having a person familiar with the text oversee the process.

In addition to goal, action, and motivation, I also included an analysis of sentiment as part of the personal dynamics data. Sentiment analysis provided insight into each character's emotional state by examining both spoken dialogue and internal monologues across chapters. For this, I employed an open-source language model toolkit (Barbieri, Espinosa Anke, & Camacho-Collados, 2022), which I configured to return a positive, neutral, or negative sentiment score for each character's appearance, to represent the emotional fluctuations experienced by characters throughout the narrative.

4.5 Novels Datasets

The data and task abstraction phase resulted in complete datasets for the two novels. In the following sections, I reflect on some key insights and observations I documented throughout this process.

4.5.1 Reflections on the *Harry Potter and the Philosopher's Stone* Dataset

When building the dataset for *Harry Potter and the Philosopher's Stone*, the primary challenge lay in identifying the salient character personal traits within the particularly long chapters. The narrative's complexity, with multiple intertwining storylines and richly detailed scenes, demanded a careful distillation of the most significant aspects for each character.

This task presented a double-edged sword: while main characters provided ample data for summarisation, identifying the most salient features required careful focus and discernment. In contrast, minor characters often had more straightforward appearances and performed isolated actions. However, in cases where their defining personal traits could not be confidently inferred or they lacked sufficient dialogue to determine sentiment, it was necessary to label them as having "Insufficient data". This variability highlighted a major challenge in ensuring accurate and effective representation of both major and minor characters.

Additionally, the nature of the plot, which involves significant world-building and extensive interactions among a wide cast of characters, added to the complexity. For instance, character relationships like those between Harry, Ron, and Hermione evolve gradually, with pivotal moments spread across lengthy scenes. Extracting the most relevant actions and motivations from these scenes required discerning which interactions were not only central to the overarching story, but also to their personal development. This process highlighted the difficulty of summarising and encoding such rich narrative content into more simplified data points.

A specific challenge arose in handling character appearances for the novel's portrayal of Lord Voldemort, the primary antagonist. My initial approach was to log character appearances based on explicit mentions or physical presence within chapters. However, Voldemort's appearance in Chapter 15 complicates this, as it is effectively a scene where Quirinus Quirrell is talking to himself. Prior to this, he is embodied by the character Quirinus Quirrell, who largely acts as an independent figure until the two characters are revealed as separate entities in Chapter 17.

This scenario highlights a nuanced challenge in text analysis: handling characters with shared identities, dual roles, or evolving relationships. To address this, a decision was made to represent both characters distinctly within the visualisation, even when their physical forms overlap. In Chapters 15 and 17, both Quirrell and Voldemort are shown as present in dataset and conversing with each other, reflecting their dual appearances while preserving the unique identity of each character. This approach aims to provide clarity for the end-user, ensuring that the visualisation captures the complexity of their intertwined roles while maintaining their distinct narrative contributions.

4.5.2 Reflections on the *The Lion, the Witch and the Wardrobe* Dataset

In contrast, compiling the dataset for *The Lion, the Witch and the Wardrobe* was more straightforward, as the novel's structure and character relationships are simpler and more direct. The goals, actions, and motivations of the characters were easier to discern due to the clear roles they play within the story. For example, the main characters, Peter, Susan and Lucy, have clear, defined goals as they progress through the narrative, mostly pertaining to finding their brother, and their interactions with figures like the White Witch and Aslan follow a linear and predictable pattern. This made it simpler to extract and summarise their personal dynamics without needing to navigate the complexities of long, multifaceted chapters. With fewer character storylines to juggle and a more straightforward plot, the process of building a dataset from this novel was less demanding in comparison to *Harry Potter*.

4.6 Visual Encodings and Interaction Design Process

Visual encoding and interaction design are mutually interdependent (Munzner, 2009), so both are addressed in this section. When designing for non-experts a primary goal is communication of the data (Gough et al., 2016). In the context of my design work, non-experts are supported to navigate a range of semantic patterns represented within and across visual structures that guide their interpretation, with options to show or hide elements when needed.

Core to ADR is the investigation of design alternatives in order to land on what is most appropriate to the designer's goals. I approached this process iteratively, where data were paired with visualisation options to explore ideas on its representation and appropriateness to a non-expert audience. A deep dive into the literature on visualising these specific data types provided the theoretical foundation from which to build a practical design for implementation.

Secondary to this process was the receiving of informal insights from colleagues, as design iterations were presented and modified in accordance with informal feedback.

In Sections 4.7, 4.8, 4.9 and 4.11, I describe the visual encodings and interaction design for the character-centric literary visualisation technique, resulting in the final design output for Study I (Section 4.12). While the process is documented in a linear format (beginning with temporal dynamics, followed by social dynamics, and then personal dynamics) the process itself was far more iterative and fluid in nature. Changes made to one encoding type often had a direct impact on the design and functionality of another. For example, adjustments to how chapters were represented influenced how character relationships were constrained, and changes to personal dynamics encodings impacted the layout arrangement and spacing. This interconnected approach allowed for a flexible and evolving design process, ensuring that each visualisation element complemented the others while maintaining clarity and functionality.

So, the figures used to illustrate the process often combine elements of the various encodings, despite each being described in isolation. As a result, the figures showcase the integrated nature of the encodings, with temporal, social, and personal dynamics working together to form a cohesive visual representation of character interactions and development. While described sequentially, these elements were continuously refined in parallel throughout the design process.

4.7 Designing the Temporal Dynamics Encodings

In the following subsections, I present the rationale behind the development of the temporal dynamics encodings that underpin the visualisation layout. Each subsection begins by exploring relevant related work – such as visualisation precedents, theory, and examples – to situate the design choices within established practice.

4.7.1 Exploring Timeline Visualisation for Narrative Segmentation

In order to effectively visualise temporal data within my research, I began by investigating the use of timeline visualisations. Timelines are a well-established method for representing time-based data, providing a clear and intuitive way to display interactions and trends over time. Figure 4.4 is an early example of timeline visualisation (Marey, 1885).

Timeline visualisations have proven valuable in fields where tracking temporal dynamics forms a useful part of the analysis. For example, Aigner, Miksch, Schumann, and Tominski (2023) discuss various techniques for time-oriented data visualisation, showcasing how timelines can simplify the process of analysing historical or event-based data. Timelines provide a means to visualise dynamic systems where multiple actors or variables interact over time, revealing temporal patterns and correlations that would be difficult to discern from raw data.

While the chapter divisions in a novel are not strictly time-series data, they often function to provide a sense of time passing within the narrative. In novels, chapters mark the segmentation of the narrative into distinct units, which (as the domain expert noted) can signify shifts in time,

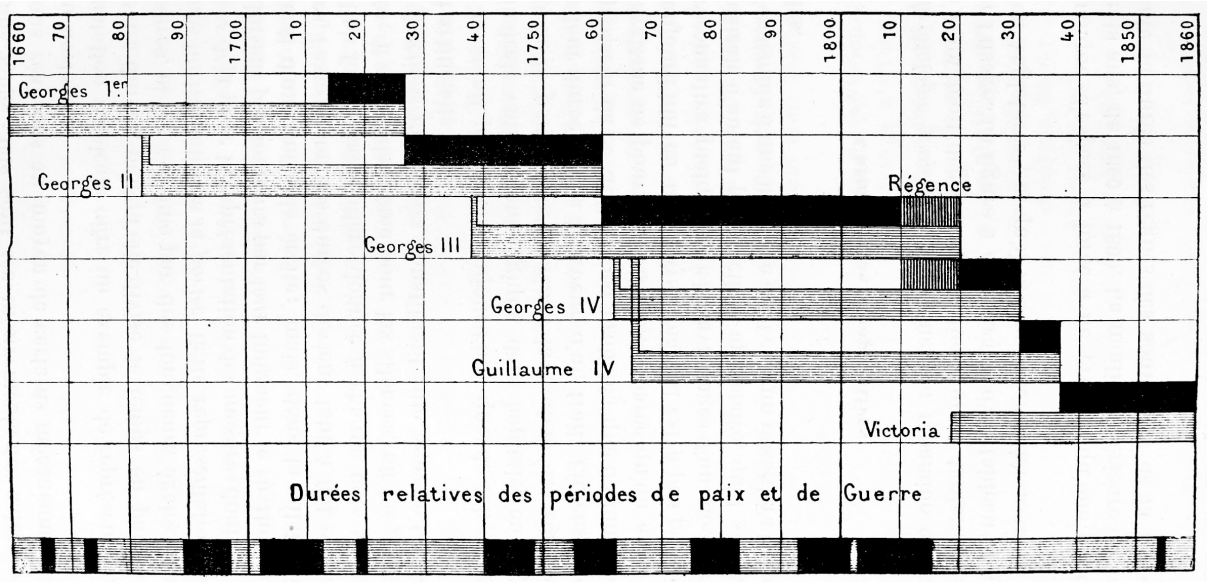

FIGURE 4.4: An early example of timeline visualisation, created by Marey (1885), shows the reigns of queens and kings of England during periods of peace and war between 1660 and 1860. This image is in the public domain.

perspective, or thematic focus. By aligning chapter divisions with a timeline-inspired structure, I aimed to convey the progression of the story in a way that is both familiar and meaningful to casual readers, reflecting the narrative's temporal flow while preserving the integrity of the literary text. Notably, timeline visualisations (with varying representation methods) are used in a number of existing character-centric literary visualisations (Hoque et al., 2022; John et al., 2016; S. Liu et al., 2013; Watson et al., 2019).

4.7.2 Exploring Storyline Visualisation for Mapping Characters' Journeys

A collection of hand-drawn charts mapping characters' journeys in movie narratives (Munroe, 2009) (Figure 4.5) served as the inspiration for a visualisation technique known as storyline visualisation (Ogawa & Ma, 2010). Storyline visualisation is a powerful tool for illustrating the dynamic co-occurrences and interactions between characters in existing narratives (John et al., 2016; S. Liu et al., 2013; L. Shi et al., 2010). In this technique, visually distinct lines – referred to as storylines – are encoded as separate entities on a layout dependent on entity co-occurences. When these storylines converge, the entities are interpreted as sharing a temporal grouping (Tanahashi, Hsueh, & Ma, 2015) or as socially interacting (Tanahashi & Ma, 2012). The layout's left-to-right presentation, which mirrors the passage of time, offers an intuitive reading experience for users, particularly in terms of tracking character interactions and developments. The appeal of storyline visualisation lies in its ability to effectively communicate the dual nature of characters as both distinct entities and socially interacting participants within the story (Arendt & Pirrung, 2017; Di Giacomo, Didimo, Liotta, Montecchiani, & Tappini, 2020).

The original *Movie Narrative Charts* were originally drawn to engage members of the general public (Munroe, 2009). Their popularity underscores the immediate accessibility of the intuitively presented layout – a feature I aimed to preserve and build upon in my work. While

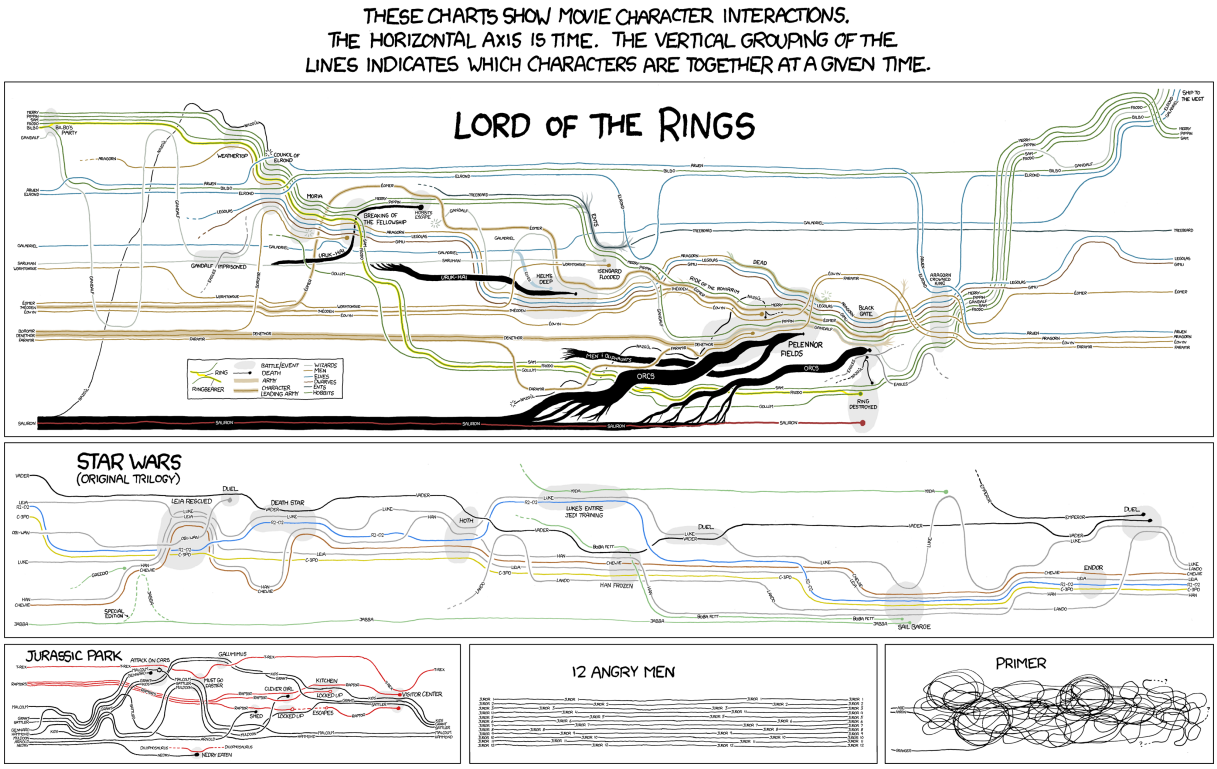

FIGURE 4.5: The original move narrative charts by Munroe (2009), which inspired the storyline visualisation technique. This image is licensed under a Creative Commons Attribution-NonCommercial 2.5 License.

some literary analysis tools integrate storyline visualisation as one of several views to enable multi-faceted analysis of textual features (John et al., 2016; L. Shi et al., 2010), the introduction of multiple views adds system complexity and imposes a cognitive cost, as users must mentally switch between different contexts (Wang Baldonado, Woodruff, & Kuchinsky, 2000). To avoid this challenge, I focused on enhancing the utility of storyline visualisation as a standalone view, enabling users to track character dynamics without needing to shift between different visual perspectives. By doing so, I aimed to maintain the simplicity and accessibility of the layout while enhancing its functionality for character analysis.

The storyline visualisation layout is heavily influenced by the scene-based sessions found in film scriptwriting, where multiple characters share the same physical space, interacting within a given scene to progress the story (S. Liu et al., 2013; Munroe, 2009; Watson et al., 2019). This approach lends itself well to film scripts, where visual cues and direct character interactions are the primary drivers of the narrative. However, this model does not fully capture the nuanced character interactions in novels. In literary texts, characters may be present within the same scene without engaging socially, or entire scenes may focus on a single character's inner monologue or solitary actions, making it distinct from the direct social interactions typically observed in film (Di Giacomo et al., 2020; Padia, Bandara, & Healey, 2018). This discrepancy necessitates adaptations when applying scene-based structures to literary analysis, especially when visualising character dynamics. Visually, the layout incorporates a thread-like motif,

FIGURE 4.6: *The Triumph of Death, or The 3 Fates* by an unknown artist is a tapestry that shows the use of the thread metaphor to symbolise a person's "timeline". This image is in the public domain.

where each storyline functions as the thread that symbolises the longevity of the character appearances. This can be likened to historical representations in art that depict one's thread of fate to represent the commencement, journey, and conclusion of their lifespan (Figure 4.6).

4.7.3 Drawing Inspiration from *MeetingVis*

A specific example of a visualisation tool that uses the storyline visualisation technique is *MeetingVis* (Y. Shi et al., 2018). This tool was designed to enhance the recall of meeting content and context through narrative-driven visual summaries. Its design demonstrates important parallels to my own work, as the system incorporates five key meeting elements: participants, topics, tasks, timeline, and interactions; mapped onto a storyline visualisation. Participant activity is visualised using colour-coded lines of varying thickness, indicating the level of contribution, while topic evolutions are represented as colour-coded bubbles, with attached word clouds illustrating keywords. Task assignments are denoted by triangle glyphs appended to the participant lines.

The primary benefit of *MeetingVis* is its ability to support memory retrieval, allowing users to recall both detailed aspects of the discussion and the broader context of meetings. It offers a more efficient method for summarising key points without requiring users to revisit lengthy transcripts or audio recordings. Additionally, the tool facilitates personal reflection by enabling individuals to assess their own contributions and interactions within the meeting. By providing an intuitive and accessible representation of meeting dynamics, the technique can improve

preparation for future meetings and support collaborative work by highlighting both individual and group tasks and interactions (Y. Shi et al., 2018).

Although the technique is not directly related to summarising fictional narratives, I reflected on its visualisation approach in relation to the goals of my own research. Both involve the recall of dynamic data associated with actors (like characters) and associated dynamic data anchored to specific time slices. This paper provides evidence supporting the use of the storyline visualisation layout for representing and recalling such data, as the technique was demonstrated to improve end-users' abilities to recall meeting details (Y. Shi et al., 2018).

4.7.4 Layering Visualisation Techniques

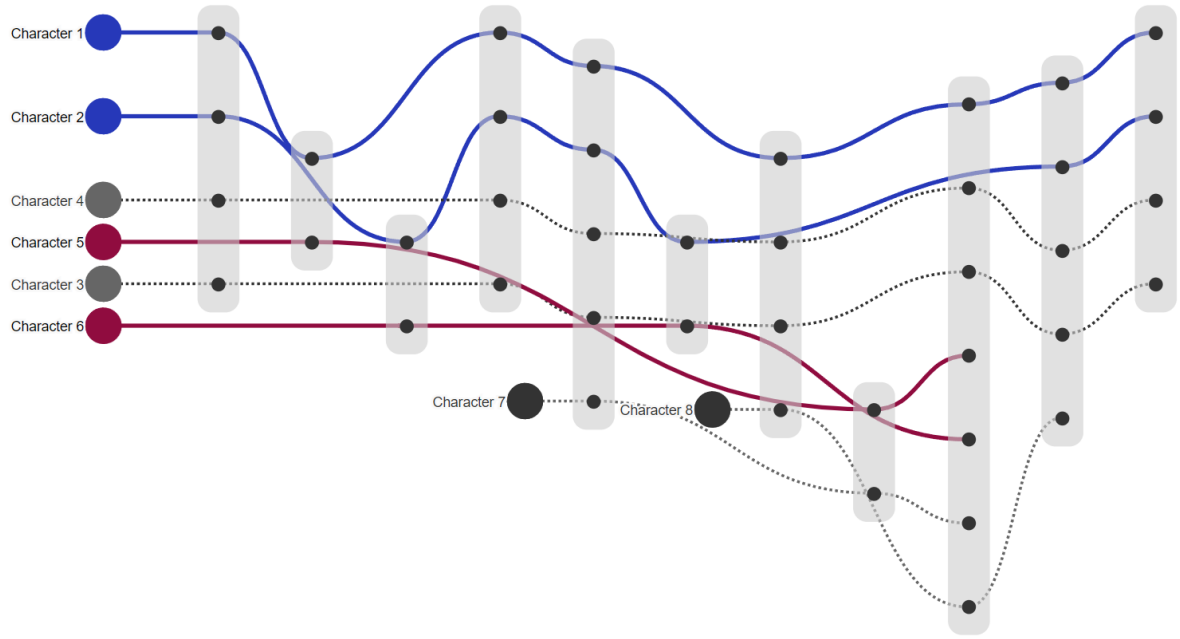

FIGURE 4.7: Early in the design cycle, when the layout did not yet feature interactive chapter signposts, uniquely coloured storylines or chapter nodes encoded with character attributes.

Layering or blending multiple visualisation techniques within a single view can offer a solution for analysing different data structures at varying levels of detail or distance (Pupin de Oliveira, Silva, & Eler, 2015). For instance, in the visualisation tool *TimeArcs* (Dang et al., 2016), arc diagrams are layered onto a timeline to depict the evolving connections between entities across events. This approach provides an effective way to avoid the disorientation caused by context switching across multiple views while keeping the user focused on specific elements within the dataset (Pupin de Oliveira et al., 2015). In the context of data storytelling, graph/data comics employ a similar metaphor by representing network changes panel by panel, allowing users to visually trace the evolution of nodes or characters over time (Bach et al., 2016). This method supports the readability of each time step while emphasising shifts in relationships between

distant time points, facilitating comparative analysis (Sallaberry, Muelder, & Ma, 2013). Furthermore, by augmenting social network nodes with attributes, the visualisation can better represent actor groupings and their interactions across various stages of the narrative (N. Z. Gong et al., 2012), helping to elucidate the complex web of relationships within the story.

I incorporated several of these ideas while building upon the foundational storyline visualisation layout – see an early iteration in Figure 4.7. The techniques used in data storytelling, such as data comics and layered visualisation, offered valuable insights for representing character dynamics in a coherent and easily navigable format. These approaches informed my decision to layer visual structures into the storyline visualisation, ensuring that the dynamic nature of character interactions was preserved without overwhelming the user.

4.7.5 Representing Storyline Identities

The first node for each storyline introduces the presence of characters and provides a short character profile on-hover (Figure 4.8). To situate the design in the context of what may be familiar to non-experts, I used a coloured circle with each character's main initial at its centre, similar to the visual identity representation used by email providers. The colour is the same as the character's storyline, which is default represented with a dashed line.

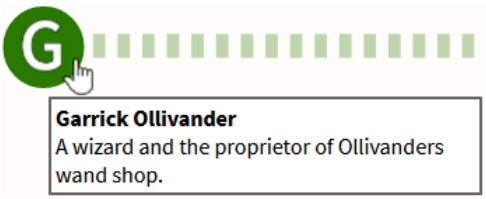

FIGURE 4.8: Each character's distinct visual identity is introduced on the first node on their storyline. A short character profile is viewable on-hover.

I experimented with different line encodings and landed on the dashed approach for two reasons: 1) this visual is seen in different public-facing media as a visual metaphor for paths across maps or abstract world representations; and 2) it helps to remediate issues with path occlusion when visualising many characters. When the user makes a character active, by clicking their introduction node or a chapter node, that character's path is made solid, enhancing its visibility in the layout at different zooming distances.

To signify character prominence, I applied a secondary visual encoding to the storylines, where line thickness corresponds to the total value of dialogue lines spoken to and by the character in the subsequent chapter along their timeline. This representation was chosen based on the rationale that a character becomes more noticeable to the reader as their interactions and the interactions directed toward them increase. Additionally, I introduced a minimum line-spacing between each storyline and incorporated a measure of transparency. These adjustments aim to reduce issues with path occlusion, ensuring the clarity and accessibility of the visualisation.

4.7.6 Integrating Chapter Boxes into the Storyline Layout

The bookmark-inspired (Figure 4.9) visual metaphor represents each chapter of the novel as a distinct object, visually separated from the storylines yet connected to them (Figure 4.10). The chapter numbers are placed at the top of each "chapter box" to maintain clarity and make it easy for users to locate specific chapters within the visualisation. This design not only introduces a clear division between chapters and the corresponding storylines, but also avoids disrupting the narrative flow of the storylines themselves. The bookmarks, which I refer to as chapter boxes, aim to serve as navigational anchors or signposts.

FIGURE 4.9: A physical real-world bookmark provided inspiration to determine how to signify the separation between chapters. Credit: SJ at Pixabay

To textually enrich the visualisation, without overwhelming the user, an on-hover interaction is added. When a user hovers over a chapter box, a textual summary of the chapter appears (for an example see Figure 4.10). This ensures that users can gather insight into a particular chapter's contents without requiring them to leave the visualisation or lose focus on the overall storyline. It is also a non-intrusive design, as it allows the continuity of the storylines to remain intact, while giving users more granular control over how they interact with the narrative.

4.8 Designing the Social Dynamics Encodings

In the following subsections, I describe the topics covered in investigating how to visualise the social dynamics data, and the design rationale for progressing from static, to dynamic, to embedded dynamic social networks.

4.8.1 Understanding the Limitations of Static Network Visualisation

Traditional network visualisations are widely used in various domains to represent relationships and structures between entities, and are typically static in their representation; meaning, they show a network at a singular point of time. These visualisations typically employ nodes (also referred to as vertices) to represent actors or data points, and edges to depict the connections between them (Newman, 2010). Such networks can be directed or undirected, depending on whether the relationships between nodes have a directionality. Barabási and Pósfai (2016) explain that static networks provide a snapshot of the overall structure at a given moment, offering a clear depiction of how elements are interconnected, making them useful for social network analysis.

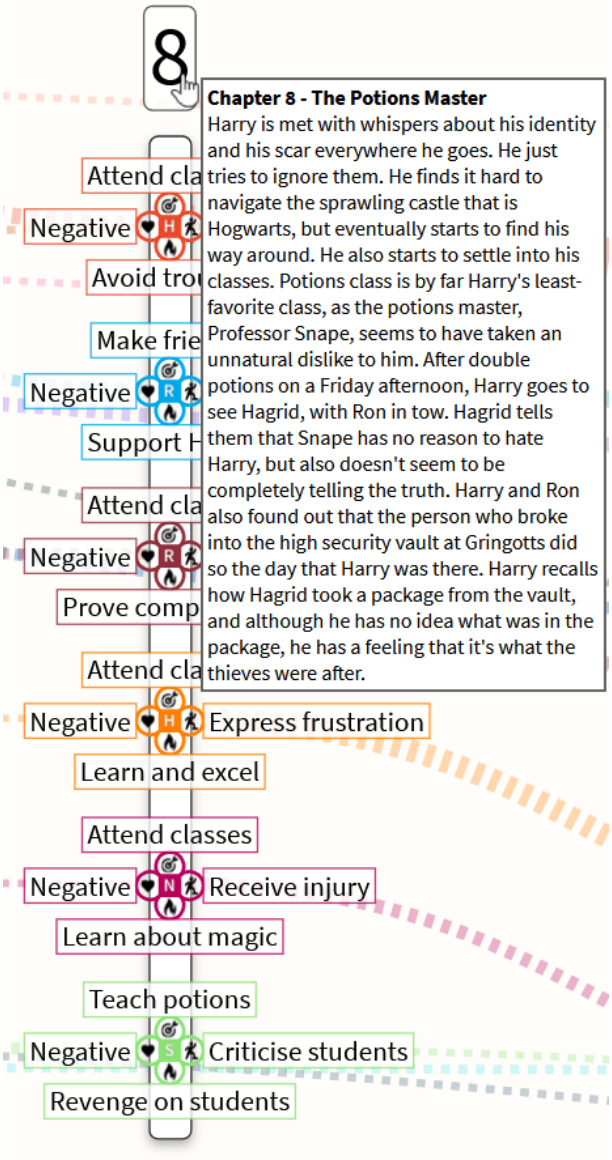

FIGURE 4.10: Chapter boxes employ a bookmark-inspired visual metaphor to delineate character states across chapters. An on-hover tooltip provides the chapter summary.

In static network visualisation, the positioning of nodes and edges plays a crucial role in the clarity and interpretability of the visualisation (Figure 4.11). Various layout algorithms, such as force-directed layouts, are employed to ensure that the nodes are well spaced, and that the edges reflect the underlying relationships. These layouts aim to minimise edge crossings and create a balanced distribution of nodes, enhancing the visual appeal and understanding of the network's structure. Static visualisations are particularly beneficial when a fixed overview of a network is desired, as they allow the viewer to examine the entire structure without the complexity of interactive or temporal elements (McGuffin & Balakrishnan, 2005).

Static visualisations, while informative, also come with limitations. Without the ability to interact or explore different aspects of the network in detail, users may struggle to discern important details. Furthermore, static networks do not easily reveal changes over time, which can be a

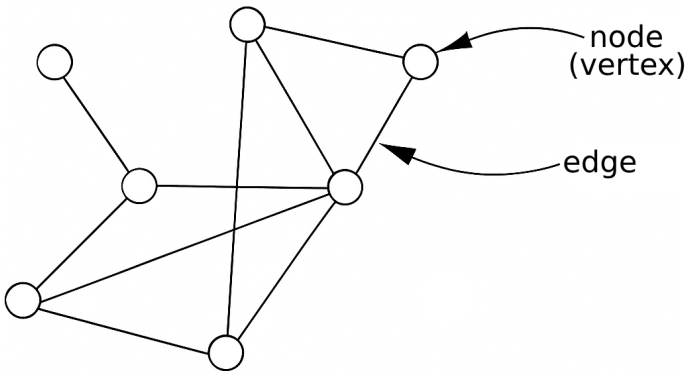

FIGURE 4.11: An example of a static network visualisation, highlighting the distinction between nodes – or vertices – and edges (the connections between nodes).

critical limitation in fields that require understanding dynamic relationships or evolving structures (Holme & Saramäki, 2012), such as the evolving nature of characters' relationships in a story.

4.8.2 Exploring Ideas for Dynamic Network Visualisation

Dynamic network visualisation extends static representations by incorporating changes in relationships over time. These visualisations are particularly valuable for understanding how networks evolve, revealing patterns such as the emergence of communities, shifts in connectivity, or the formation and dissolution of ties (edges) (Holme & Saramäki, 2012). Unlike static network visualisations, which present a snapshot at a single point in time, dynamic networks introduce a temporal component that reflects changes in structure, offering a richer perspective on network dynamics (Rossetti & Cazabet, 2018).

To effectively represent dynamic data, several visualisation techniques have been developed. One common method is to use animation, where the network is depicted at successive time intervals, allowing users to see how nodes and edges appear, disappear, or shift in their connections (Beck, Koch, & Weiskopf, 2016). This technique can provide insight into temporal trends but may also introduce cognitive challenges, as users must track changes across frames (Archambault & Purchase, 2012). An alternative approach is to employ timeline-based visualisations, where time is represented on an axis, and the evolving connections are plotted across that dimension (Burch, Beck, & Diehl, 2008). Both methods aim to highlight temporal changes in a network while preserving its overall structure.

Dynamic network visualisations come with distinct challenges, such as managing the increased cognitive load placed on users as they attempt to understand complex changes over time. Effectively visualising a changing network requires careful design choices that balance clarity and detail (Beck et al., 2016; Burch et al., 2008). While animations can provide an intuitive sense

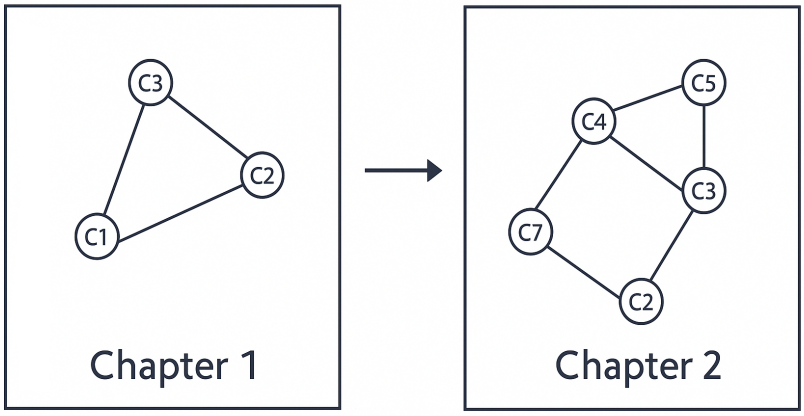

FIGURE 4.12: A design idea from when I was ideating on how to represent dynamic social networks across chapters. This method employs a similar approach to that of graph/data comics by Bach et al. (2016, 2017).

of network evolution, they can become overwhelming when networks are large or highly dynamic. Interactive elements, such as the ability to pause or filter the visualisation, can mitigate some of these challenges by allowing users to focus on specific timeframes or sub-networks of interest. Hence, dynamic visualisations provide a powerful approach to support exploring temporal changes, but they must be carefully designed to ensure accessibility and usability.

It was clear I needed to visualise the social dynamics inline with the temporal dynamics layer, however, how to do so became an issue when ideating design ideas. Building on a panel-based layout idea used in graph/data comics (Bach et al., 2016, 2017), I drew some ideas for how to represent the social networks along a time-dependent layout (Figures 4.12 and 4.13).

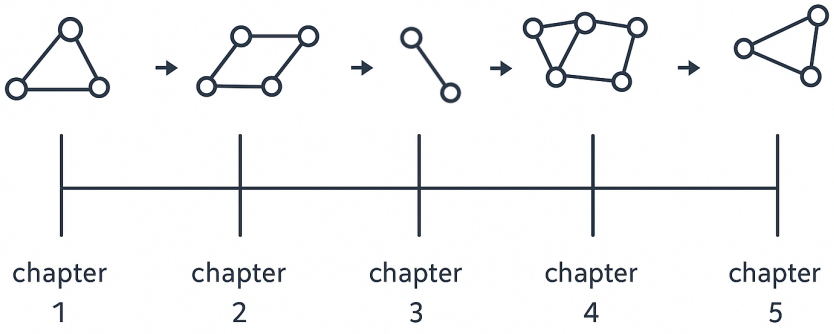

FIGURE 4.13: Another idea for how to represent dynamic social networks. Each network step is aligned to the timeline representation of the chapters.

Later, when I decided to adopt the storyline visualisation layout, I developed the idea of embedding the social networks at each chapter segment of the representation. However, this came with additional complexity, as network diagrams with straight edges can be difficult to arrange inside constricted layout containers.

4.8.3 Drawing Inspiration from *Thread Arcs* and *TimeArcs*

The *Thread Arcs* technique, developed by Kerr (2003), addresses the challenge of visualising social dynamics in email threads, where both the chronology of messages and the reply relationships must be represented. Traditional methods, such as tree diagrams, often focus solely on the hierarchical relationships between messages, neglecting the temporal order in which they are received. In contrast, *Thread Arcs* combine the sequence of message arrivals with the branching reply structure, providing a more comprehensive view of email conversations.

One of the key advantages of *Thread Arcs* is their ability to visualise both the message arrival sequence and reply relationships at the same time. This dual representation allows users to see the full context of a conversation, something that is often lost in traditional hierarchical visualisations. Furthermore, the technique ensures stability in the layout, even as the conversation grows. Messages remain in a consistent position, making it easy for users to return to specific points in the thread without confusion. This stability is particularly important when compared to tree-based visualisations, which often rearrange nodes as new messages are added, making it difficult to track the evolution of the conversation.

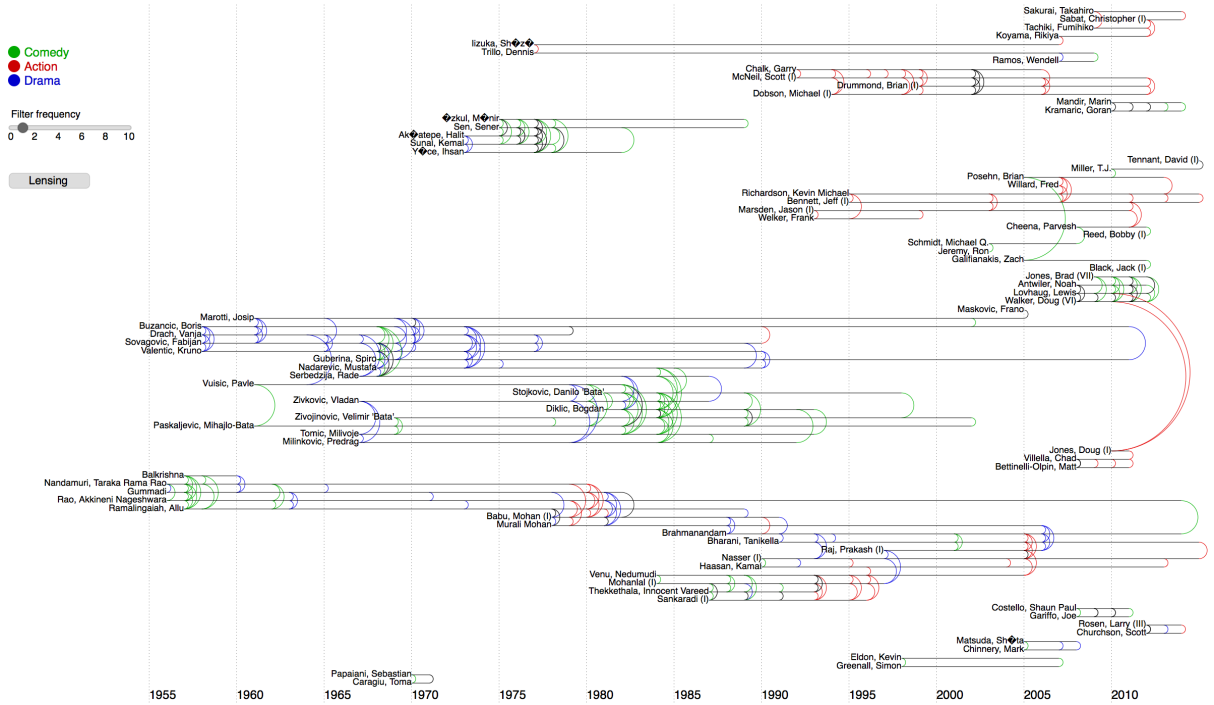

FIGURE 4.14: The *TimeArcs* visualisation by Dang et al. (2016) of the top 100 actors in movies rated 8 stars or higher in the IMDB database, between 1955 and 2014. This image was retrieved from the publicly accessible GitHub repository for the project (Creative Coding Lab, 2024).

TimeArcs, developed by Dang et al. (2016), extends the concept of arc diagrams to dynamic social networks where relationships between entities evolve over time (see Figure 4.14 for an example). This method is particularly effective in representing social dynamics in networks where connections fluctuate. *TimeArcs* merge force-directed layouts from multiple time points into a single visualisation, allowing users to observe how relationships and social groups

change over time. This temporal representation is critical in understanding social dynamics in contexts such as collaboration networks or co-appearance networks, where the connections between individuals or entities are not static.

One of the strengths of *TimeArcs* is its ability to reduce visual clutter by using force-directed layouts that minimise line crossings. In traditional node-link diagrams, visual clutter can make it difficult to trace relationships, especially in dense networks. *TimeArcs*, by bringing related entities closer together and using arcs to connect them, make it easier to follow these fluctuating relationships over time. This is particularly important when analysing social dynamics in large, evolving networks.

4.8.4 Integrating the Social Dynamics Encodings

Both *Thread Arcs* (Kerr, 2003) and *TimeArcs* (Dang et al., 2016) demonstrated how I would be able to leverage embedded arc diagrams to effectively represent social dynamics in contexts where relationships are either temporally sensitive or subject to change. These methods enhance user interaction and improve clarity when visualising complex, evolving social structures, offering significant advantages over traditional static visualisations.

In my design, I embedded a series of static social network graphs inside the chapter boxes, creating a visual framework that allows users to explore the social dynamics of characters throughout the narrative. Each chapter box contains a static representation of the social interactions occurring within that particular chapter, which were designed to be revealed when the end-user left clicks the encoding (Figure 4.15). This interactive element allows users to show or hide the networks as needed, which reduces the visual complexity of the layout when first introduced to the end-user.

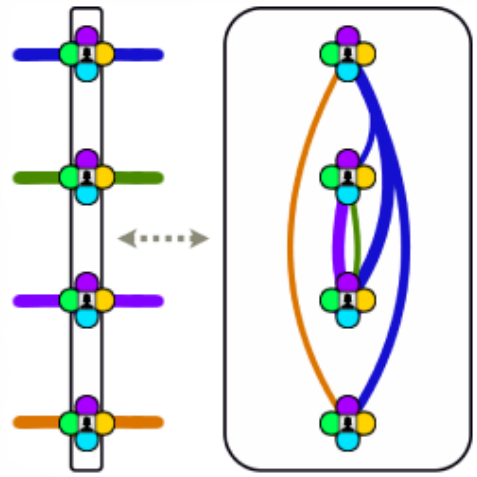

FIGURE 4.15: A digital mock-up I drew to conceptualise how the bookmark metaphor opens to reveal a social network inside a chapter.

By viewing the chapter boxes in succession, users can trace the unfolding of social dynamics over time, observing how interactions between characters develop, intensify, or diminish across different points in the story (Figure 4.16). When all chapters a character appears in are opened,

the sequential arrangement of social interactions provides a holistic view of the character's social dynamics.

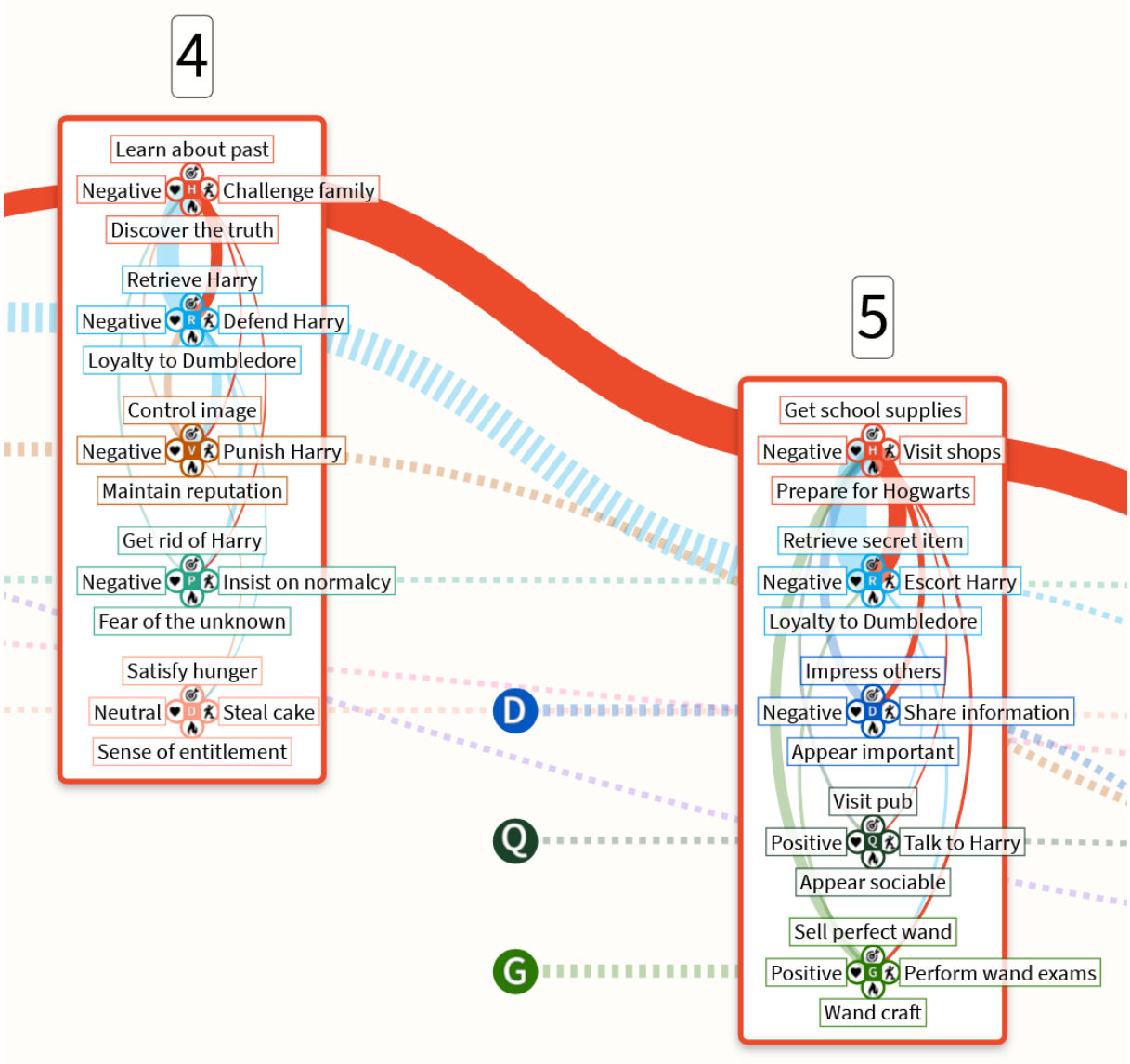

FIGURE 4.16: In this example, Harry Potter (H) is shown to socially interact with all characters except Dudley (D) in Chapter 4. In Chapter 5, the strength of his social interaction with Rubeus Hagrid (R) is stronger than in the previous chapter.

Hence, the design of the embedded networks serves a dual purpose. Nodes within the social network graphs not only indicate the presence of a character within a particular chapter but also represent that character's identity within the broader social network. This dual functionality allows for a more cohesive and interconnected visualisation, where each node functions simultaneously across multiple networks. By structuring the graphs in this way, I aimed to support users to easily follow a character's journey through the narrative and their interactions with other characters, without losing sight of the overarching social dynamics.

I computed the social network arcs into a wrap-around space-saving arrangement. I used the thickness of each edge to encode the frequency of conversations between characters, allowing

for the inference of dialogic influence or importance within the narrative. This visual encoding provides an additional layer of insight, helping users understand the weight and significance of certain interactions (Figure 4.16). To aid in interpretation, the edge colours are matched to the source's storyline, ensuring that the visualisation remains cohesive with the overall narrative. Furthermore, users can interact with the visualisation by left-clicking on the first node of a storyline or the internal square of a chapter node, which expands the view to highlight all chapters in which a character appears.

4.9 Designing the Personal Dynamics Encodings

The last step was to develop visual encodings for the personal dynamics data. These encodings were to be integrated with the storyline layout and the social network arcs.

4.9.1 Exploring Attributed Network Node Encodings

It is considered a major challenge to design effective visual metaphors to represent qualitative features of a large text corpora due to its multidimensional and unstructured nature (L. Shi et al., 2010). At this stage of the design process, I knew I wanted to represent the four attributes related to personal dynamics, but how to signify these per character in the social networks was a complex problem to tackle.

In network visualisation, encoding data on nodes, particularly in attributed networks, is essential for providing additional context and meaning beyond simple structural relationships. Attributed networks extend the basic node-link structure by associating nodes with specific attributes, such as demographic information, preferences, or other domain-specific data (Salathé et al., 2010). This enriched data enables more nuanced analysis, as users can explore not only how nodes are connected but also how their individual characteristics possibly influence the overall network structure. For example, in social networks, nodes may represent individuals, and attributes could include factors like age, location, or interests, which may reveal patterns to connections (Yang, McAuley, & Leskovec, 2013).

A common technique for encoding node attributes involves using visual properties such as colour, size, and shape. Colour is frequently employed to represent categorical data, allowing users to quickly identify nodes that share similar attributes (Borgatti, Everett, & Johnson, 2018). For instance, in a network of political affiliations, nodes representing individuals might be coloured based on their party affiliation, facilitating the identification of community structures or possibly even moral issues inherent within the network. Similarly, node size can be used to convey quantitative attributes such as the importance or influence of a node, with larger nodes representing entities with more connections or higher centrality scores (Freeman, 1978).

Beyond colour and size, other encodings can add further layers of meaning to node attributes. Shape, for instance, can distinguish between different types of entities within a network, such as organisations versus individuals in an organisational network (Battista, Eades, Tamassia, & Tollis, 1998). Additionally, transparency or opacity can be used to indicate uncertainty or

varying levels of confidence in the data, with more opaque nodes representing data points with higher certainty (Keim, 2001). Encoding attributes through multiple channels can enhance the visualisation, but it also introduces the risk of overloading users with too much information. Therefore, balancing visual complexity with clarity is a major consideration when designing network visualisations that encode additional data attributes.

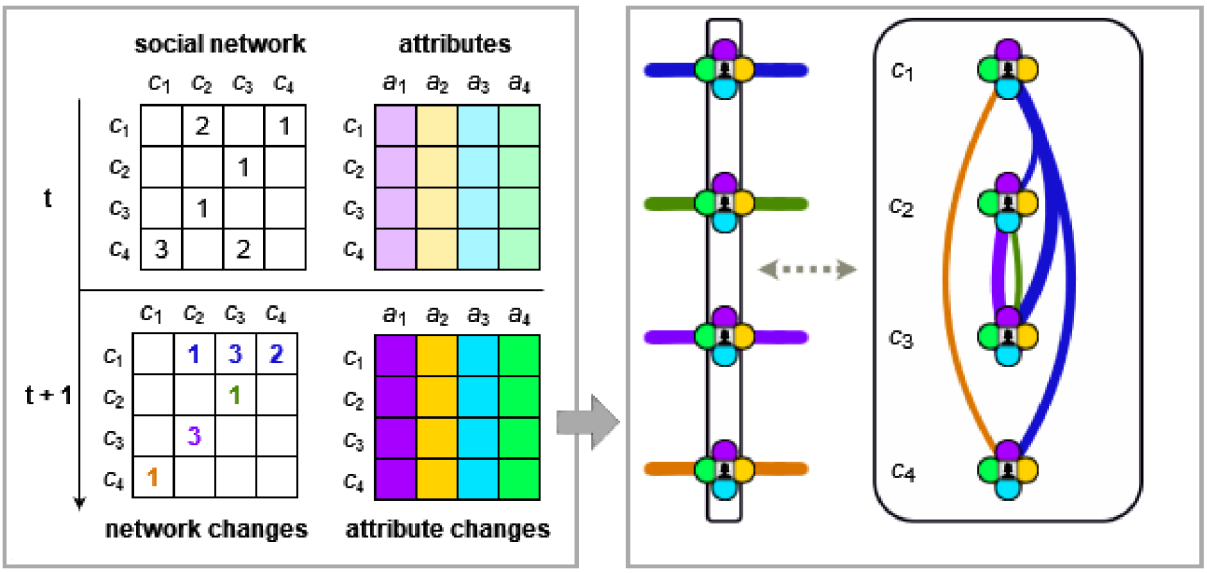

FIGURE 4.17: A design sketch I developed to consider how the clover-shaped glyph would encode both social network connections and show a change in personal dynamics attributes (character personal traits) at each time step (chapter).

Another key approach is the use of glyphs or composite visual symbols to represent multi-dimensional attributes. Glyph-based representations allow for the encoding of multiple attributes at once without cluttering the visualisation. For instance, in epidemiological studies, nodes may represent individuals, and each glyph may encode attributes such as health status, vaccination history, and exposure risk, providing a comprehensive view of individual attributes and their relationships within the network (Henry & Fekete, 2006). Figure 4.17 shows a mock-up I made to conceptualise how attributes would change at each time-step (chapter) while also undergoing network changes.

4.9.2 Experimenting with Chapter Node Segmentation and Icons

FIGURE 4.18: Three different methods for segmenting the attributed network nodes were tested.

In testing glyph designs to encode the four personal dynamics (goal, action, motivation, and sentiment) for character chapter nodes, I began by segmenting a circular node into four parts (Figure 4.18:A). This design, while simple and clean, quickly proved challenging in practical use. I found it difficult to keep track of individual characters, as the design lacked a clear

representation of character identity (see Figure 4.19). Without an identifying marker, it would become easy for users to lose sight of which character was being referenced, especially when multiple characters are displayed in the same visualisation. This limitation prompted me to reconsider the balance between simplicity and functionality.

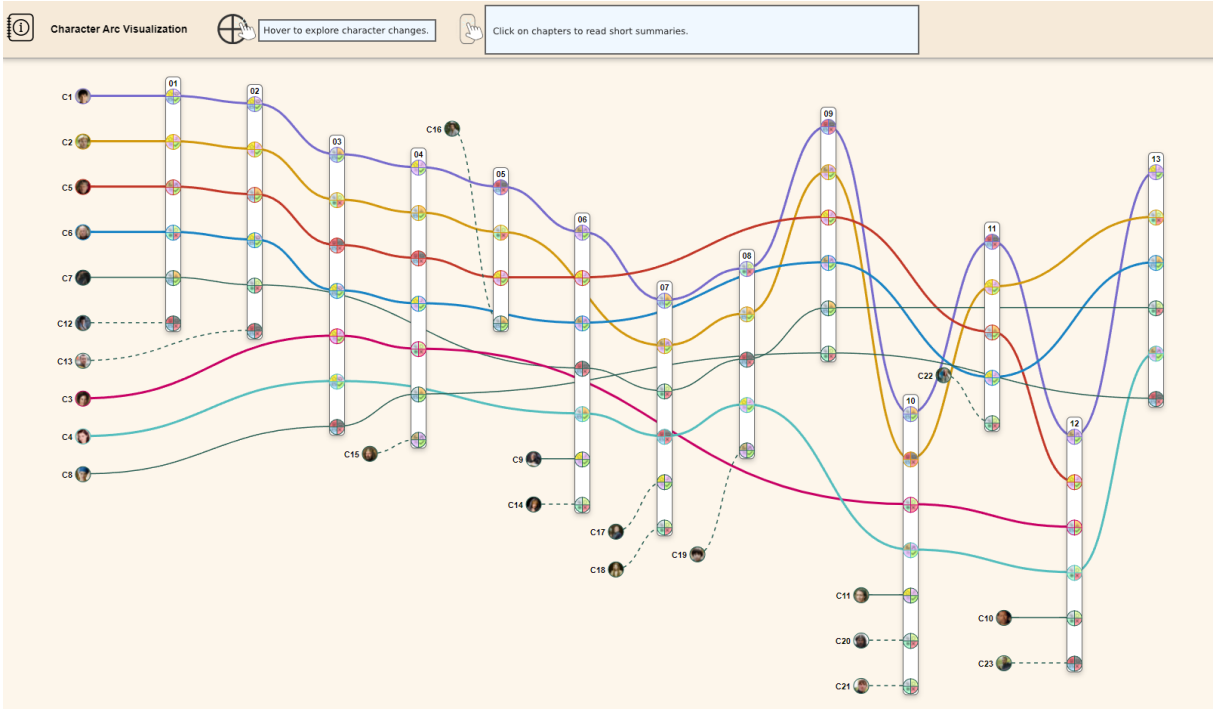

FIGURE 4.19: An early design prototype using the first node segmentation method. This made it difficult to keep track of characters. Placeholder images were used for the character introduction nodes.

I then experimented with a donut shape (Figure 4.18:B), embedding a character identity marker at the centre, which improved the ability to differentiate between characters. However, a new issue arose: the space available for displaying personal trait data was small and non-uniform. While the inclusion of a character identity was a step in the right direction, this design still lacked space to communicate the four character personal traits beyond a simple colour encoding.

FIGURE 4.20: Nature inspires art, and geometric art inspired the clover-shaped glyph design.

After further exploration and drawing inspiration from geometric shapes in art (Figure 4.20), I landed on the clover shape (Figure 4.18:C), also referred to as a quatrefoil. This design provided a more uniform amount of space, both for displaying the character identity and for representing the traits as icons or other shapes. The uniform layout allowed each trait to be easily visible and discernible (initially as icons), while the character's identity was centralised and clearly

marked. This combination of elements offered a balanced solution that addressed the challenges encountered in designs A and B, resulting in a more functional and visually accessible glyph for encoding. Additionally, the shape is aesthetically pleasing and eye-catching, which I hoped would help to direct the attention of the target end-users to the character appearances in the visualisation.

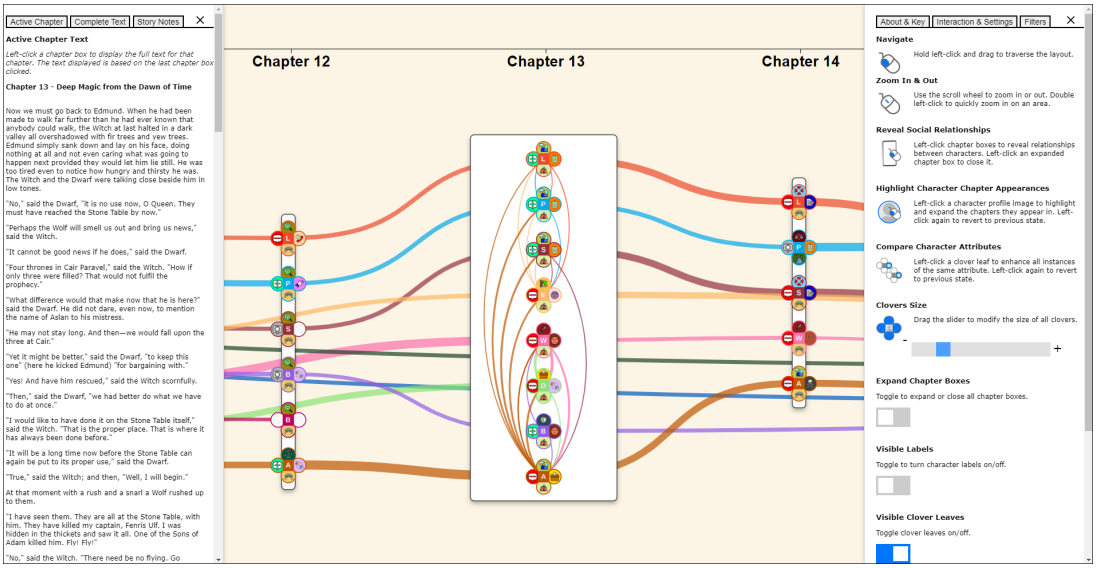

FIGURE 4.21: One design iteration used icons to encode personal dynamic traits. It became quickly apparent that – while visually interesting – the icons significantly impacted the efficiency of interpreting the attributes.

To represent the personal traits on the clover-shaped glyph, I first experimented with the application of icons (Figure 4.21), with an on-hover feature that textually shows the trait. Icons take up less size than their lexical equivalent (Kuicheu, Fotso, & Siewe, 2007), and despite initial recommendations against their use in visualisation (Tufte, 2001), humans also interpret images faster than abstract visualisation components when the resemblance between the image and what it signifies is strong (Freedman & Shah, 2002). Also, understanding the meaning of icons requires lower levels of visual literacy than interpreting abstract marks (Hegarty, 2011), and experiments in visualisation design show there is no uniform detriment when images are included as data representations (Byrne et al., 2015). This approach required the personal dynamics traits to be summarised at a high level, such as "Retrieve magic item", so that icons could be associated with reproducible elements. As I was determined to work out how to visualise text graphically, I decided to test this icon-based communication idea.

Despite the potential benefits described in the literature of using icons – and the time spent making it functional with textual descriptions – this method was panned by all colleagues and friends that it was tested on. It was, at first, considered intriguing, but ultimately, it failed to communicate textual data in the manner for which I was aiming.

Informal testing showed that this method, while visually interesting, relies on the user to either learn the meaning of the icons, or hover over them for more information, which incurs a significant cognitive load. Additionally, the data that *could* be displayed had to be constrained to

a set of icons, which is also a poor solution, as this limited the potential for nuanced personal trait descriptors.

4.9.3 Proposing a New Clover-Shaped Glyph for Attributed Nodes

In exploring how to answer the challenge of representing qualitative features of text (L. Shi et al., 2010), I retained the four-leaf clover-shaped glyph design (Figure 4.22), and affixed the personal dynamics traits (Table 4.3) as text labels directly to the "leaves".

In the final design (Figure 4.22), the central segment of the clover is used to signify a character's persistent identity throughout the narrative. The node representation is constructed of four elliptical paths surrounding a central square. The chapter nodes allow for the visual encoding of the personal traits as attributes, a_1, a_2, a_3, a_4, in a clockwise presentation.

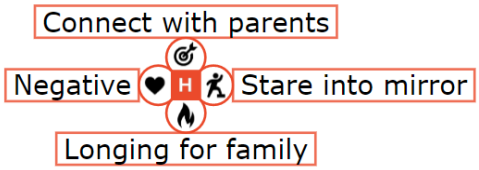

FIGURE 4.22: The clover-shaped glyph encodes four personal traits as node attributes in clockwise order: goal (a_1), action (a_2), motivation (a_3) and sentiment (a_4). These are enhanced through text labels affixed to the "leaves". The central square encodes the character's identity (c_n). With this design, I provided a visual association between the textual descriptions and sentiment data, and the character they correspond to in a given chapter.

The outside clover "leaves" function as a frame for the internal character representation (c_n) (their main initial), which aims to infer a visual association relationship. The icons were retained, but standardised to symbolise the traits (described in Section 4.9.4), functioning as a quick indicator of which trait each text label refers.

Both the icons and text labels are clickable to perform comparison tasks, where identical text descriptors affixed to characters in the layout are colour-inverted, making them higlighted in black with white text (for an example see Figure 4.23). Association of the traits as evolving character dynamics becomes clear as the user traverses the layout, as the character remains the same but the text labels change. The sequential presentation of the clovers along the x-axis of an individual storyline achieves the goal of effectively illustrating the personal dynamics of a character in the context of their temporal and social dynamics.

4.9.4 Designing Icons to Support Personal Dynamics Interpretation

In the design of the clover-shaped glyphs, each leaf represents a personal trait, however, remembering what these refer to can be difficult without a quick reference method. Hence, the goal of retaining the icons inside the clover leaves, while also attaching the text labels, was to provide non-expert users with a quick and visually clear way to interpret a character's most important traits at a given point in the narrative. In this process, I referred to work on iconic

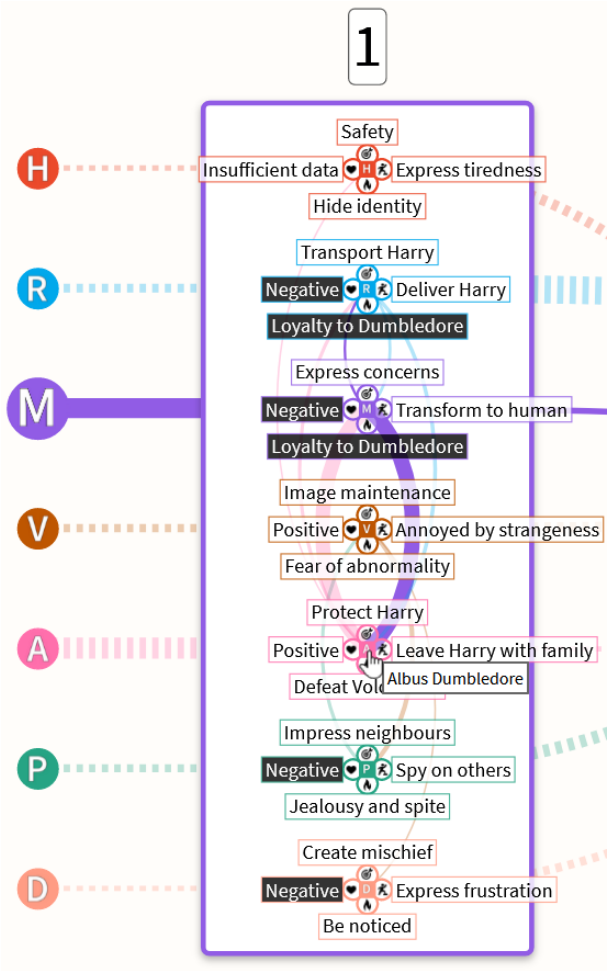

FIGURE 4.23: The Minerva McGonagall (M) has been clicked to explore her relationships in Chapter 1. Her strongest interaction is with Albus Dumbledore (A). She has a minor interaction with Rubeus Hagrid (R) too. Both M and R are negative in dialogue sentiment and they share the same motivation, "Loyalty to Dumbledore", but their goals and actions are different.

communication by Nakamura and Zeng-Treitler (2012), and designed a set of icons to suit the needs of the design:

- **Target for Goal:** The target icon was chosen to symbolise the character's salient goal. The target represents focus and direction, visually cueing users to the primary ambition or aim driving the character.
- **Person Stepping Upward for Action:** To represent a character's salient action, the person stepping upward was selected, illustrating an action in motion, which in this case represents a step to advancing their goal.
- **Flame for Motivation:** A flame icon was used to represent a character's salient motivation, signifying the inner drive or passion that fuels their actions.
- **Heart for Sentiment:** Lastly, the heart icon was chosen to symbolise the character's mean sentiment. As an easily recognisable symbol of feelings, the heart allows users to quickly understand that sentiment can indicate how the character is feeling.

Together, these icons form a cohesive and intuitive system that enables non-expert users to engage with the character's goals, actions, motivations, and sentiments at a glance. As an added layer of end-user support, an on-hover interaction was added to show a tooltip for what the icon symbolises.

4.10 Algorithm and Layout Technique

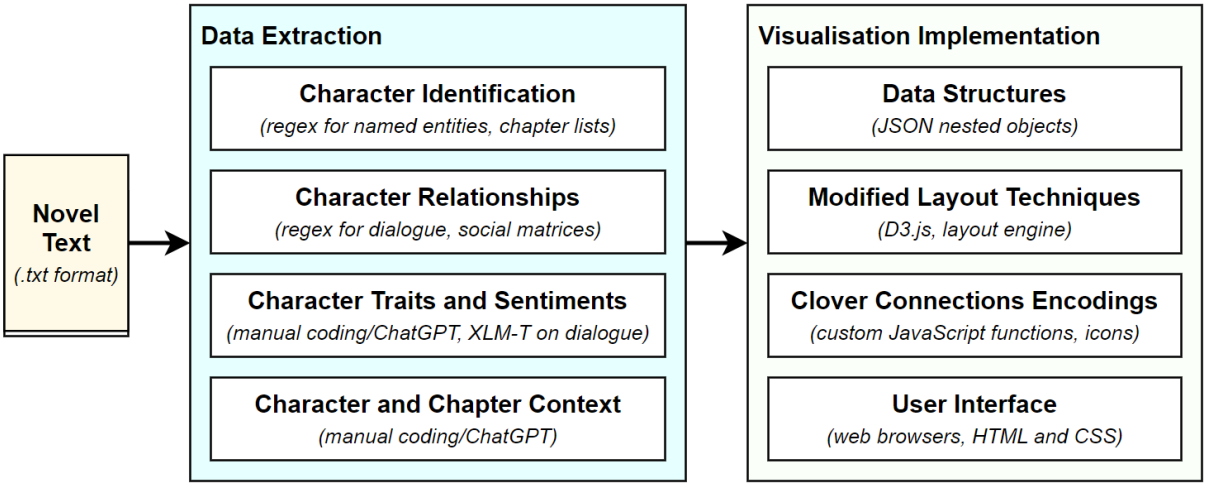

FIGURE 4.24: The technical implementation pipeline for Study I.

The innermost level of Munzner's model (Munzner, 2009) is the creation of an algorithm and its implementation to produce the visualisation. This stage focuses on the technical execution of the visualisation tool, where data must be processed, visual elements generated, and the user interface programmed. In order to accomplish this for my research, I made extensive modifications to a layout engine inspired by *Movie Narrative Charts* (Munroe, 2009). The original layout engine, designed for D3.js (Elvery, 2016), was adapted to suit the specific requirements of visualising narrative structures and character relationships within a non-expert context. This choice of visualisation framework is well-suited to my project due to D3.js's flexibility and extensive support for dynamic, data-driven visual elements in modern web browsers.

The modified layout engine I utilised is based on JLouvain (Sugar, 2015), an open-source JavaScript implementation of the Louvain method of community detection (Blondel, Guillaume, Lambiotte, & Lefebvre, 2008). The Louvain method is a powerful algorithm used for detecting clusters or communities within networks, which aligns with the need to visualise interconnected character relationships and evolving narratives.

The data structures used in this project are based on JSON, a lightweight format that allows for easy data exchange and parsing within the visualisation framework. At the core of the structure is a chapter-based nested model, which organises the narrative by chapter, ensuring that each character's appearances and personal attributes are contextualised. Social networks data is contained at the end of the file, where their sequencing reflects the same sequence of the novel chapters. Figures 4.27 and 4.26 show examples of the JSON structures.

```
var characterFoilSquare = ((Math.cos((90 - 135) * Math.PI / 180) * radius) + (Math.cos((180 - 135) *
Math.PI / 180) * radius));
var gTraits = gChar.append('g').attr("class", "quatrefoilTraits").append('g').attr("class",
function(d){return d.character.role + "traits";});
gTraits.selectAll("traits").data(function(d){
    var tmptraits = response.scenes[d.scene._index].characters[d.character.id].traits
    var tmparray = [];
    for (let trait in tmptraits){
        tmparray.push([tmptraits[trait], tmptraits.length, d.character.role]);
    }
    return tmparray;
    }).enter().append("path").attr('class',function(d,i){return d[2]+'SceneNode cloverLeaves ' +
    d[0].split(" ").join("");}).attr('d',function(d, i, j){
    if (d[0] == ""){
        return "M 0 0";
    }
    var numSegments = 4;
    var degree = 360/numSegments;
    var radianStart = (degree*i - 135) * Math.PI / 180;
    var radianEnd = (degree*(i+1) - 135) * Math.PI / 180;
    var cirX = (Math.cos(radianStart)*radius);
    var cirY = (Math.sin(radianStart)*radius);
    var start = ["M", cirX, cirY, "A", radius, radius].join(" ");

    cirX = (Math.cos(radianEnd)*radius);
    cirY = (Math.sin(radianEnd)*radius);
    return [start, "0 1 1", cirX, cirY, "Z"].join(" ");
})
.attr('fill',function(d, i){
    return 'url(#'+externalJson.images[i].name.split(" ").join("")+')';
    })
```

FIGURE 4.25: An iteration of the JavaScript function that draws the clover-shaped glyph, which I initially called a quatrefoil, hence the variations in the code.


```
"relationships": [
[
  {"source":"C2", "target":"C3", "type":"", "strength":"6"},
  {"source":"C2", "target":"C4", "type":"", "strength":"6"},
  {"source":"C2", "target":"C1", "type":"", "strength":"9"},
  {"source":"C3", "target":"C2", "type":"", "strength":"2"},
  {"source":"C3", "target":"C4", "type":"", "strength":"6"},
  {"source":"C3", "target":"C1", "type":"", "strength":"2"},
  {"source":"C4", "target":"C2", "type":"", "strength":"2"},
  {"source":"C4", "target":"C3", "type":"", "strength":"6"},
  {"source":"C4", "target":"C1", "type":"", "strength":"3"},
  {"source":"C1", "target":"C2", "type":"", "strength":"4"},
  {"source":"C1", "target":"C3", "type":"", "strength":"4"},
  {"source":"C1", "target":"C4", "type":"", "strength":"4"},
  {"source":"C8", "target":"C1", "type":"", "strength":"1"}
],
```


FIGURE 4.26: An example of how social interactions are stored for a chapter in the JSON.

The implementation of the visualisation interface was carried out using standard web technologies: JavaScript, HTML, and CSS. JavaScript was used to handle the dynamic aspects of the visualisation, controlling the interaction and rendering of data, such as generating the clover-shaped glyphs (Figure 4.25), while HTML provided the structural foundation of the web interface. CSS was used to style the presentation and ensure responsive design. The data are wrangled from JSON files, making it adaptable to accommodate potential changes to the data structures if different novel datasets have different visualisation needs. Figure 4.24 provides a high-level overview of the technical implementation pipeline.

Given that the visualisation is web-based, it is compatible with modern web browsers and can also be embedded on a webpage. This compatibility aims towards ensuring that the tool will be easily shareable and accessible for online communities, enhancing its potential for use in future in public-facing collaborative and discussion-based environments.

```
"characters" : {
    "C1" : {"prominence":"23",
    "traits":[
        "Visit Mr. Tumnus",
        "Discuss Narnia",
        "Make a friend",
        "Positive"
    ]},
    "C4" : {"prominence":"78",
    "traits":[
        "Impress the White Witch",
        "Share information",
        "Be spoiled",
        "Neutral"
    ]},
    "C7" : {"prominence":"55",
    "traits":[
        "Deceive Edmund",
        "Bestow gifts",
        "Capture humans",
        "Negative"
    ]}
}
```

FIGURE 4.27: An example of how character appearances inside a chapter, and their associated personal traits, are stored in the JSON.

4.11 Browser-Based Implementation and Menu System

The visualisation menu system was designed with functional features recommended by the domain expert, and to inform the end-user about the visualisation technique. Without this menu system, the technique stands alone as visualisation layout. While the core design effectively conveys the relationships and traits of characters, the absence of a menu with interactive features would limit the end-user's ability to explore, customise, and analyse the visualisation according to their needs or preferences.

The menu incorporates features such as a key, filtering options, zoom and scale controls, and tooltip options. To ensure the visualisation layout remains stable and unobstructed, the menu was implemented as a pop-out overlay on the side of the web page, activated by clicking the menu button designed to look like a book with an "i" on it to stand for "information". In the following sections, I describe each of the menu system's tabs.

4.11.1 *About and Key* Tab

The *About and Key* tab (Figure 4.28) provides an overview of the visualisation and its core components. It explains how the visualisation tracks the evolving journeys of characters in a novel, highlighting their appearances and interactions across chapters.

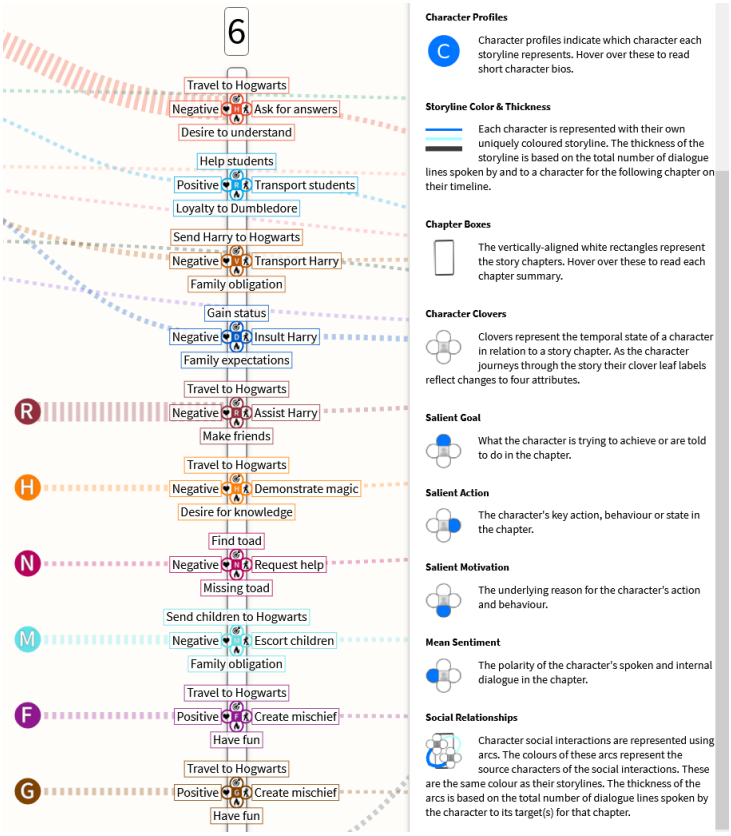

FIGURE 4.28: The *About and Key* tab explains the visualisation's purpose and the meaning of its visual encodings.

4.11.2 *Interaction and Settings* Tab

The *Interaction and Settings* tab describes how to interact with the visualisation and customise its display. It provides guidance on fundamental actions, such as left-clicking and dragging to navigate, using the scroll wheel to zoom, and interacting with specific elements to reveal relationships or highlight character traits. Additionally, users can adjust the size of clovers, expand or collapse all chapter boxes at once, and toggle the visibility of clover leaves. These features allow for a more tailored and exploratory interaction with the visualisation, enabling users to focus on particular aspects of the data or simplify the display for clarity.

4.11.3 *Filters* Tab

The *Filters* tab allows users to customise their view by filtering specific storylines and relationship arcs within the visualisation. This functionality enables a more focused exploration of character journeys and interactions, reducing visual clutter and tailoring the analysis to individual interests or tasks. Filtering is a widely recognised feature in visualisation tools, as it enhances usability and supports targeted analysis by allowing users to isolate relevant data (Heer, Bostock, & Ogievetsky, 2010).

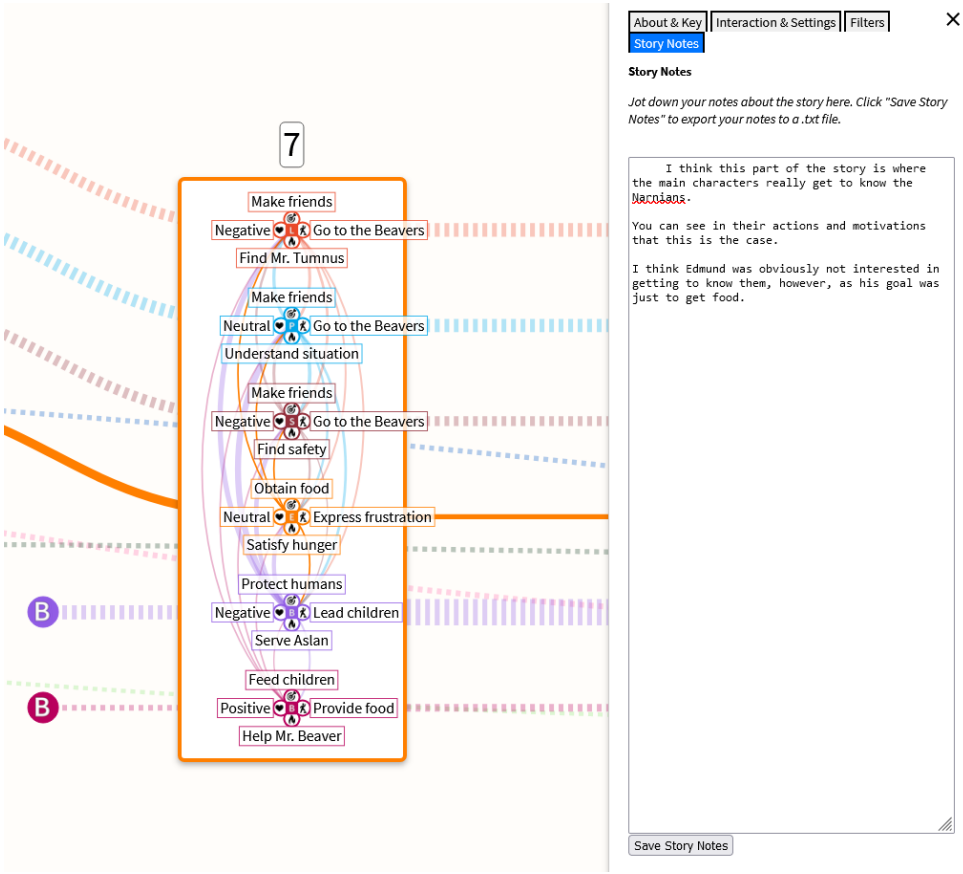

FIGURE 4.29: End-users have the ability to jot down notes about the data and export these notes to a *.txt* file.

4.11.4 *Story Notes* Tab

The domain expert suggested a "note-taking section ... that can be exported", which I implemented to export to a a *.txt* file (Figure 4.29). Note taking is also common during collaborative analysis (Mahyar, Sarvghad, & Tory, 2012), so I considered this inclusion may also support end-users within a discussion-based scenario.

4.11.5 *Read Chapter* Tab

A *Read Chapter* tab provided the ability to view the raw text when chapter boxes were clicked. However, the use of copyrighted literary works poses issues in releasing this version. Hence, it is removed from the Study I visualisations. In Study II, the tab was reinstated (see Section 5.9.2) as the novels visualised are in the public domain.

The intention of the *Read Chapter* tab is to provide access to the original source text, enabling users to verify the content represented in the visualisation or explore the textual details more deeply. This feature aligns with approaches seen in other literary analysis tools, where access to the underlying text supports validation and facilitates a more nuanced interpretation of the visualised data. Additionally, the domain expert noted that the "raw text" should be accessible in the visualisation tool.

4.12 Final Design Output: *Clover Connections* Layout Technique

The final output of Design Stage I is what I have coined the *Clover Connections* layout technique. This design emerged from the iterative process of exploring various visual encodings and assessing their ability to effectively represent character dynamics. The *Clover Connections* layout integrates temporal, social, and personal dynamics to provide a comprehensive view of character interactions and development throughout the narrative. By organising these elements into a cohesive visualisation, the layout aims to offer an intuitive and accessible way for users to engage with complex character personal data, relationships and storylines. This contributes towards the answering of the Study I Research Question, which is discussed in more detail in the Discussion chapter in Section 6.2.

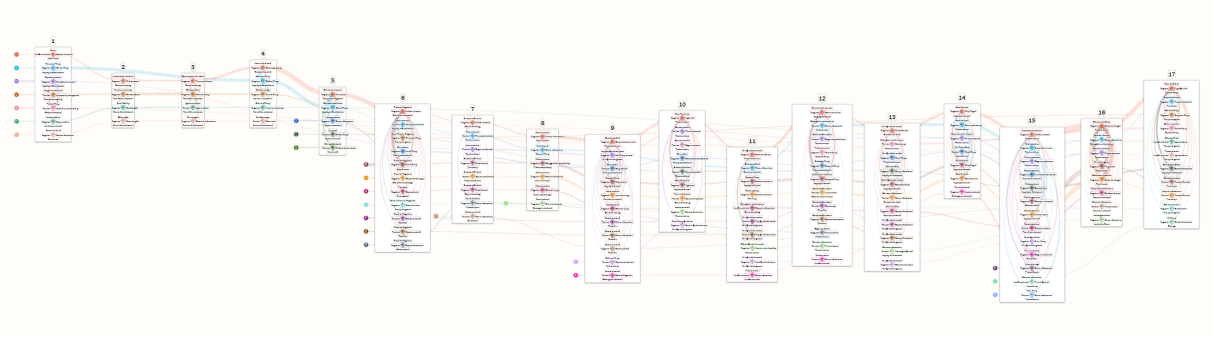

FIGURE 4.30: The overview of the *Harry Potter and the Philospher's Stone* visualisation.

The visualisations of *Harry Potter and the Philosopher's Stone*[1] and *The Lion, the Witch and the Wardrobe*[2] can be viewed online (see footnotes), which is recommended to gain a better understanding of the full experience of using the visualisations.

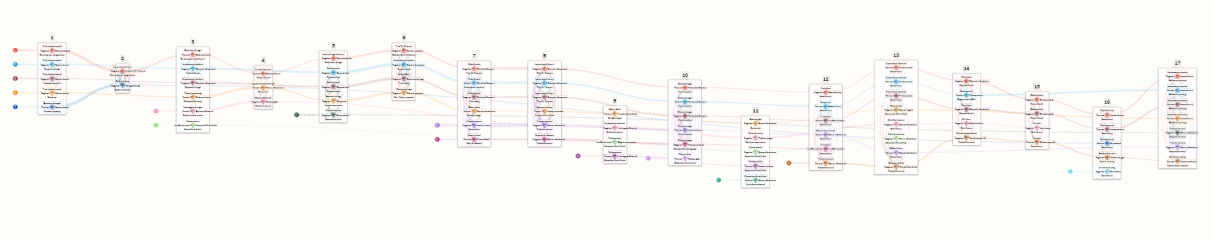

FIGURE 4.31: The overview of the *The Lion, the Witch and the Wardrobe* visualisation.

Concluding the first stage of the design process, I was now prepared to proceed to the next phase of the design and evaluation cycle: conducting Evaluation Stage I. This next stage aimed to assess the suitability of the visual encodings for representing the data, focusing on their clarity, usability, and effectiveness in communicating the character dynamics.

[1] *Harry Potter* vis: `https://natalie.house/study_i/novels/harrypotter/harrypotter`
[2] *The Lion, the Witch and the Wardrobe* vis: `https://natalie.house/study_i/novels/narnia/narnia`

4.13 Evaluation Stage I

Evaluation Stage I captures the first formal evaluation I conducted in this project. The *Clover Connections* layout was central to the study, with the primary goal of determining the design's suitability for a non-expert audience to conduct the general character analysis tasks (Table 4.2). The materials, procedure and questionnaire categories were inspired by those used in studies that successfully evaluated the readability of data visualisations of film scripts with non-experts (N. W. Kim et al., 2018; Watson et al., 2019). In Section 3.7.1 of the Methodologies chapter, I describe the evaluation process and materials in detail.

4.13.1 Participants

Participants were recruited through various networks, using a snowball/referral sampling method, where several initial participants recommended others they believed might be interested in the study. As the tasks were completed individually in separate sessions, there was no concern about participants influencing each other's responses. All participants were over the age of 18 and joined the study on a voluntary basis. They were classified as non-experts in literary analysis, having never engaged in the formal or professional analysis of literature.

None of the participants were recruited from IT-related courses or faculties within the university. Furthermore, participants confirmed that they did not engage in interpreting data visualisations as part of their professional roles, ensuring their non-expertise in both literary analysis and data visualisation interpretation. The participant pool represented a range of age groups, educational levels, and professional backgrounds.

This recruitment strategy was designed to capture a sample reflective of the diversity of the general public. After screening 14 eligible candidates, **10 participants (P1–P10)** took part in the evaluation.

4.13.2 Study Visualisations

As discussed in the Methodologies chapter, in Section 3.7.2, I anonymised the two visualisations for the study to mitigate familiarity bias. These versions can also be viewed online:

- *The Lion, the Witch and the Wardrobe* visualisation anoymised as **Visualisation A**[3]
- *Harry Potter and the Philosopher's Stone* visualisation anoymised as **Visualisation B**[4]

4.14 Findings

In the following sections, I present the findings from the evaluation, which include both quantitative task-based results and qualitative feedback.

[3]Visualisation A: `https://natalie.house/study_i/anonymised/vis_a/vis_a`
[4]Visualisation B: `https://natalie.house/study_i/anonymised/vis_b/vis_b`

4.14.1 Task Results

TABLE 4.4: The Task-Based Questions results.

Q#	Question Focus	Tasks Addressed	Correct
1	Locate Characters at the Start of the Story	T1, T2	80%
2	Locate Most Prominent Character	T1, T9	80%
3	Count the Characters in a Chapter	T1, T2	100%
4	Locate Character(s) that Appear Once	T1, T2	50%
5	Locate Character(s) that Appear in Every Chapter	T1, T2	100%
6	Locate Character(s) with Negative Sentiment in a Chapter	T1, T2, T6	100%
7	Locate a Character with a Recurring Motivation	T1, T2, T7	100%
8A	Identify a Character's Traits in a Chapter	T1, T2, T6	90%
8B	Determine Whether a Character's Sentiment Changes	T1, T2, T6, T7	100%
8C	Identify a Character's Strongest Relationship in a Chapter	T1, T2, T3, T4, T5	90%
8D	Identify a Character's Weakest Relationship in a Chapter	T1, T2, T3, T4, T5	80%
8E	Identify a Character with the Same Action as Another	T1, T2, T6, T7	100%
9	Identify the Main Character(s)	T1, T2, T8, T9	100%
10	Determine the Significance of the Visualisation Elements	All Tasks	N/A

I summarised the participants' Task-Based Questions results using descriptive statistics. For each task, participants' responses were evaluated based on accuracy, with a score of 1 awarded for a correct answer and a score of 0 given for partially correct or incorrect answers. Table 4.4 provides an overview of the focus for each question, the general character analysis task(s) (Table 4.2) addressed by the question, and the percentage of the 10 participants that successfully answered the question. Question 10 was not scored but is included in the table as part of the Task-Based Questions set.

As illustrated in Figure 4.32, the majority of participants successfully answered most questions. However, a notable exception was the question: "Which character(s) appear in only one chapter of the story?" (Q4), where five participants provided only partially correct responses. This raises a question as to whether the phrasing of the task itself may have caused confusion or whether participants felt satisfied after identifying just one or two characters, opting not to pursue a complete answer.

4.14.2 Qualitative Findings

I conducted a thematic analysis of the open-ended feedback to gain deeper qualitative insights into their experiences. Applying thematic analysis to the qualitative data offered a structured and systematic approach to understanding the participants' interactions with the visualisations – an example of the dataset is shown in Figure 4.33. This method allowed me to explore their experiences in more detail, uncovering not just the explicit feedback they provided, but also the

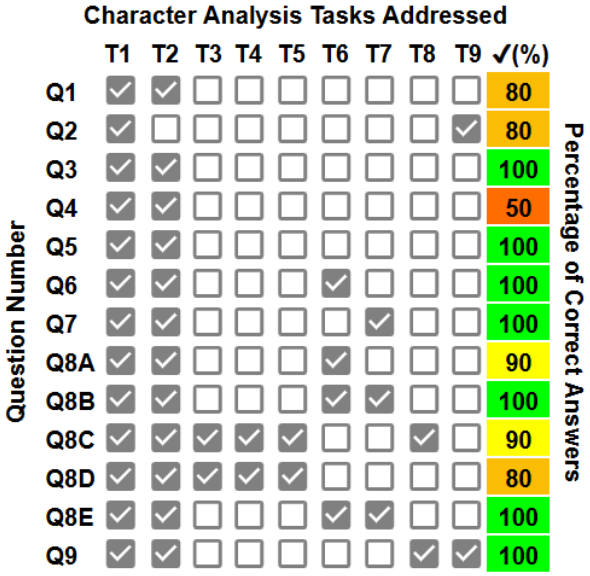

FIGURE 4.32: This question-task matrix provides a visual summary of which tasks were addressed by which questions in the questionnaire, and the percentage of the participants who answered each correctly.

underlying patterns in how they perceived and engaged with the visualisation design. Further details on the application of thematic analysis are discussed in the Methodologies chapter in Section 3.8.1.

The themes that emerged include: **Participants' Casual Reading and Book Discussion Experiences**; **Design Intuitiveness and Engagement**; **Challenges with Visual Complexity, Navigation and the Technical Implementation**; **Desire to Know More**; and **Reflections on the Design's Potential**. Each of these is discussed in more detail below.

	Q18		Q19		Q20		Q21	
P_ID	*When exploring the visualisation(s), what felt intuitive and/or engaging? Why?*	*Themes*	*When exploring the visualisation(s), what felt like a struggle and/or confusing? Why?*	*Themes*	*Which question(s) did you find the easiest to answer? Why?*	*Themes*	*Which question(s) did you find the hardest to answer? Why?*	*Themes*
1	Clicking a character and seeing them "cut through" the story. Having their path very clear is interesting. Seeing the details about the characters attributes was also interesting, but I think I would need to know more about the story to understand why they felt that way. Opening the chapters was also interesting, to see more quicky.	Clicking characters; Revealing information through interactions; Clear paths; Character attributes; Desire to know more; Opening chapter boxes; Quick access to information	Dragging the storyline was difficult at some points, it felt like moving around with a mouse was difficult. Some sections with a lot of overlapping details made things harder to read, but the ability to turn components off helped.	Dragging the layout; Visual complexity; Helpful filters	Questions about the main character/how often a character appeared. In the second vis it was much easier to tell that the top character was the main.	Main characters; Chapter appearances	Questions about characters who only appeared once, it was hard to find them while I was zoomed out, and moving was a bit difficult.	Minor characters; Navigating the layout
2	The way the characters were represented and their motivations, goals, actions, sentiments and social interactions were quite intuitive. It was also very intuitive to see which characters played significant roles in the story by the thickness of their plot line, as well as which chapters they were present in. Having the details about the characters' internal lives as well as how much they interacted with each other externally was very engaging and it was interesting to see how, for instance, a character's motivation would change over the course of the story. It was also very easy to tell when a character was first introduced into the story and how significant they were, depending on how their plot line looked and where it ended.	Intuitive visual representations; Clover motif design; Determining character significance; Character attributes; Character social interactions; Attribute changes; Character introductions; Storyline beginning and end	Longer plots are slightly harder to navigate just because it involves zooming in and out and then going to the sides to get further down the story, but once I got used to how it worked that became less of an issue.	Navigating the length of the layout; Requires time to learn	The questions about character motivation, goals, actions and sentiments, as well as questions about when a character entered a story or which chapters they were present in. The visual representations of character motivations, etc. as well as where the characters are in the story itself are all very easy to follow.	Locating attributes; Chapter appearances	The questions regarding which social interactions, just because it was hard to tell which line referred to whom when the colours were similar.	Distinguishing between similar coloured lines in social interactions
3	The whole breakdown is very satisfying. Seeing them deconstructed with a basic foundation really simplified understanding the flow.	Novel decomposition; Satisfying experience; Simplified flow	Wanting more information.	Desire to know more	The counting questions. Obvious answer.	Counting tasks	Similarities between characters	Finding similarities between characters in different novels
4	The colour coding made it very easy to follow. I was ale to access information very quickly. The Key also assisted in allowing me to find information as a quicken paced.	Easy to follow colour coding; Quick access to information; Informative key	Having to pull the screen back to count the characters.	Zooming out to conduct counting tasks	How many characters in a chapter. It was very easy just to count them. Also assessing character information	Chapter appearances; Counting tasks; Locating character attributes; Comparing character attributes	Comparing both visualisation characters, and having to go back and forth.	Finding similarities between characters in different novels
5	The linking between chapters is great and it feels like following a journey with winding roads	Clear paths; Shape/representation of the storylines	The influence each character has is hard to figure out. It seems like it would be pretty full on with a full book, like something with 100 chapters.	Difficulty interpreting precise value from line thickness; Concern about use of the layout for longer novels	The ones where you determine which chapters they appear in are pretty simple	Chapter appearances	The one where I had to find where the motivation was the same	Locating character attributes; Comparing character attributes
6	After a couple of minutes I found it very intuitive. Hovering over the chapter to get the tooltip is very intuitive. The clovers are really intuitive and the icon helped me remember what they meant. When you click on an attribute it highlights the others, so I can tell in Vis A that Marc, Alisha and Ralph were exploring a house to find something fun but they had a bad experience, all three of them. I like that it's vector graphics, so I can zoom as far as I want and it doesn't lose fidelity.	Contextual tooltips; Clover motif design; Memorable icons; Attribute highlighting; High fidelity graphics on zoom	Some the hovering doesn't work every time. It feels a bit buggy. It looks a bit busy and some things don't work when I expect them to. I have to find the right spot to click, so if I click in the middle of a chapter and it works, then I click elsewhere and it doesn't I think it has no context. There is also a lot to learn, so for someone not familiar with speed reading a menu it could take a while. Although, I didn't read all the text. I think the instructions are written really well.	Interaction bugs; Visual complexity; Requires time to learn; Overburdened by text in menu; Well written instructions	Once I knew what the question was asking, they were easy to answer and find the answer in the visualisation.	Questions that match visualisation tasks	Question 9 took me a while to wrap my head around it. I was wondering what I was comparing here. The way it was written took some time to understand, but then it was relatively easy to answer.	Question phrasing

FIGURE 4.33: A sample of the dataset, for which themes were applied in correspondence to participants' insights into the visualisation usability and experience.

Participants' Casual Reading and Book Discussion Experiences

Three participants have been members of book clubs or casual writers' groups, and one participant had engaged in discussions about novels in online spaces. The majority of the participants gained experience discussing novels in school. The most common barriers to effectively relaying their perspectives on novels were having low confidence in their personal interpretation and forgetting details of the text.

One participant (P2) articulated their preference for casual reading.

> "I have read a number of novels in a book club setting, and I found that reading and discussing them in a group context that was not entirely academic was quite enlightening, as it allowed me to interpret the texts more freely and apply their sentiments more personally." (P2)

This mirrors the insights into casual readers' engagement with literature in Section 2.2 of the Literature Review chapter.

And to the question regarding barriers to relaying personal perspectives, P2 continued this line of thinking:

> "The main barriers to effectively relaying my perspective, especially in a school setting, was that I was not very invested in the texts themselves and was given little reason to have a strong perspective on them or an opinion on their themes. This was especially prominent in the texts that had set themes or when the teachers told us how we should interpret certain things and did not allow us to develop our own perspectives freely." (P2)

Overall, participants expressed an appreciation for opportunities to discuss novels in less formal settings, such as book clubs or online spaces, where they felt more freedom to share personal interpretations. The described challenges associated with discussing or analysing literature in academic environments (such as high school), demonstrated that prescribed interpretations and rigid themes can create a barrier to a non-exert's sense of engagement with a text.

Design Intuitiveness and Engagement

Participants consistently found the interactive nature of the visualisation intuitive and engaging, particularly the ability to click on characters and see their attributes and storylines. P1 commented:

> "Clicking a character and seeing them "cut through" the story. Having their path very clear is interesting ... Opening the chapters was also interesting." (P1)

The colour-coded storylines enhaced interpretation of the characters' distinct identities:

> "The colour coding made it very easy to follow. I was able to access information very quickly." (P4)

The visual clarity in following a character's path through the novel was highlighted as a strength. Participants found it easy to identify key characters and determine their significance in the story, particularly when the prominence encoding (storyline thickness) was more obvious:

"It was very intuitive to see which characters played significant roles in the story by the thickness of their plot line." (P2)

Multiple remarks were made about engaging with the storyline presentation, such as remarking that the " linking between chapters is great and it feels like following a journey with winding roads" (P5), and pondering on how "the shape of the story, or each character's story, invites you to follow it." (P7)

P3 made a specific remark that points to the benefit of the singular layout design:

> "The whole breakdown [provided by the visualisation] is very satisfying. Seeing them [the characters] deconstructed with a basic foundation really simplified understanding the flow." (P3)

In support of this, P2 confirmed that:

> "Having the details about the characters' internal lives as well as how much they interacted with each other externally was very engaging and it was interesting to see how, for instance, a character's motivation would change over the course of the story." (P2)

Comments made by P6 expressed a high sense of engagement with the design, noting its potential for supporting fans whom engage in writing about characters:

> "I can get a real sense of the story and who is the main character. I can figure out the relationships based on this data presented ... I could use this to write about the characters ... This would really enrich the whole lore and understanding of the story, having this as a legend to help understand the interactions and relationships between them." (P6)

Participants provided a range of final reflections on their experience with the visualisation, showcasing both its strengths and potential broader applications. Many praised the tool for its ease of use and the depth of information it provided, with P2 noting:

> "The visualisation was very easy to use for the most part and I can see it expanding its features even further after this." (P2)

The comprehensive nature of the visualisation was frequently highlighted. P8 summed it up as:

> "Packed with information... very comprehensive and hence very useful to learn a huge amount about the novel. It's well laid out, and the use of colour helps to follow the information and understand it." (P8)

Challenges with Visual Complexity, Navigation and the Technical Implementation

While the visualisation was considered engaging, many participants struggled with navigating the length and complexity of the layout. Long storylines, overlapping details, and difficulty zooming in and out to manage large sections of the visualisation created challenges for multiple participants. This complexity could make it hard to keep track of some characters and manage understanding their interactions in densely populated sections, as "some sections with a lot of overlapping details made things harder to read" (P1). While I did not observe many of the participants actively using filters, P1 did note that "the ability to turn components off helped".

P10 made a suggestion to overcome the issue of navigating while also capturing a desire to see the story in its totality:

> "It would be good to be fed the information in smaller pieces, but at the same time, I'm not sure how you could then see the full narrative." (P10)

This comment captures an ongoing design challenge in this project, which is to present a comprehensive overview of the many characters' journeys in a novel, while also making the information accessible and straightforward to comprehend. In response to this challenge, there is the obvious need to test alternative layout designs or implement features that can reduce its visual complexity when desired.

Accessibility measures, such as for colourblind users, were also suggested, as was the ability to "have it that the names [of characters] are always visible" (P8). In the next iteration, the ability to toggle character names on/off needs to be added. To address both of these issues, I initially added the ability to toggle character names on or off along their entire storyline. This involved mapping the name in white text along the storyline curve, as shown in Figure 4.34. Later, in Study II, this was changed to having the character names be added in close proximity to their chapter nodes (see an example in Figure 5.10), as contrast issues between the white text and lighter storylines made some names difficult to discern.

FIGURE 4.34: To remediate issues with character identification and colourblind user accessibility, I implemented the names of characters along the length of their storylines.

P6 and P10 expressed the desire to have pictorial representations of the characters. P10 explained:

> "I'd like to see actual pictures of the characters – that would have helped me with my memory and recalling who they are and [to] more easily isolate the information." (P10)

Interestingly, this conflicts with a remark made by the domain expert that it is not a good idea to represent characters with images (located in the transcript in Appendix A). The feedback from participants points to a need to consider incorporating images into visualisations targeted at non-experts, as ultimately, their experiences as end-users dictates the usefulness of the design. In response to this feedback, I modified the implementation to support the use of character images on character introduction nodes – see Figure 4.34 for an example.

Some comments, also pointed to technical fixes being required to improve the interaction experience:

> "Some of the hovering doesn't work every time. It feels a bit buggy. It looks a bit busy and some things don't work when I expect them to. I have to find the right spot to click." (P6)

This was an issue with on-hover elements not being removed from their location fast enough after fading to transparent, which created an invisible barrier to clicking interactive elements for less than a second. I was able to remediate it after the running of the sessions.

Desire to Know More

Multiple participants expressed a desire for additional context regarding the overarching story and other narrative elements to support improved understanding of the character appearances in the chapters. P10 summarised this desire:

> "The goals, actions etc. seem to impact the groups that get formed, but without more context about the actual story it's hard to really say beyond that." (P10)

And P1 had a similar view:

> "seeing the details about the characters' attributes was ... interesting, but I think I would need to know more about the story to understand why they felt that way." (P1)

P3 echoed these sentiments, with a succinct request for "more information". This desire also aligns with a barrier to recollection of read novels that P9 described experiencing, where they "tended to forget some of the description used for the settings".

Of course, this desire may have also sprung from the anonymisation of the visualisations, making the texts completely unfamiliar to the participants. Nevertheless, these findings demonstrate that when texts are unfamiliar the visualisation in its current state lacks the depth of textual enrichment required to effectively contextualise the characters' journeys.

Also of note was confusion regarding the sentiment data in the characters' personal dynamics (P9):

"I found the sentiment field a little confusing, are they expressing negative sentiment towards the characters they're interacting with or just generally expressing their feelings on the current situation." (P9)

This ambiguity regarding the use of positive, neutral or negative sentiment underscores the need to contextualise this data in a more intuitive manner, aligning with how non-experts perceive emotions in relation to characters. Additionally, clarification of what this data is summarised in relation to needs to be added to the key, as the current description states: "The polarity of the character's spoken and internal dialogue in the chapter"; possibly appearing too formal in its explanation.

Reflecting on the Design's Potential

In the prior experience survey, participants were asked: On a scale of 1 to 7, with 1 being "not at all confident", and 7 being "completely confident", rate the level of confidence you would have in discussing the features and appearances of all the characters in a novel you have read and are quite familiar with. At the end of the study, participants were asked the same question again with the addition of: if you had this visualisation to support you. The mean ratings were 2.8 and 5.75 respectively, indicating that participants felt there would be an increase in their confidence if using the visualisation to support information recall. While this was speculative, it demonstrates promise for the visualisation to function as a useful reference point in casual book discussions, which is the planned focus of the next evaluation stage.

In addition to this, participants described an array of usage scenarios for which the design may be suited, including online or in-person book clubs (P1, P6, and P10), explaining a novel to younger or "less experienced" audiences (P2), as a memory aid or academic instructional tool (P1, P2, P3 and P4), using it to "verify a "right" or "wrong" interpretation" of a story (P8), or to "help prepare a talk [about the characters]" (P1).

The visualisation may be useful in teaching, however, the representation of the personal dynamics data is only suited to settings where these traits are agreed upon. To support different interpretations of characters, there needs to be a method of editing the subjective textual data, while retaining the structural elements of the text, such as appearances. With such a feature, anyone, from casual readers to educators, could use the visualisation to share their different perspectives on character's appearances in the same reusable format.

Lastly, participants expressed enthusiasm for integrating the tool with other technologies or revisiting it for further use. P6 shared an intriguing idea, based on the premise of constructing a story idea using the visualisation as a template:

> "I think it's awesome. I had no idea what I'd be looking at, and I'm blown away. I'd love to feed this back into AI and get it to write a story." (P6)

4.14.3 Evaluation Stage I Summary

Overall, the positive comments from the participants underscore the visualisation's versatility, its ability to facilitate an enjoyable and insightful experience, and its potential for broader applicability beyond the scope of the study. In the next iteration, the visualisation layout will be improved with increased spacing between visual elements and more filtering options to reduce visual clutter.

I also determined the need to implement an alternative, more simplified layout, or a way to expand and retract storyline distances between chapters when comparing the personal and social dynamics between them. Lastly, I planned to make contextual enhancements to the visualisation, enriching it with additional textual data relevant to both supporting the understanding of characters' journeys and to the interests in literature of casual readers.

4.15 Conclusion

In conclusion, Study I was instrumental in defining and laying the foundations for the development of an interactive, web-based visualisation of character dynamics in novels, specifically aimed at non-expert end users. Through the study, I was able to identify key challenges when dealing with complex literary data. These insights informed the creation of a user-friendly interface that simplifies the representation of character dynamics while maintaining the depth necessary for meaningful exploration.

By focusing on non-expert users, the study also highlighted the importance of intuitive visual encodings that make the exploration of character information accessible, even to those without a background in literary analysis. The iterative design process allowed for experimentation with different visual metaphors, such as clover-shaped glyphs, chapter boxes, storylines and social network arcs, which ultimately shaped the interactive elements of the final visualisation technique coined *Clover Connections*.

The results of the evaluation study demonstrated the effective elements of the visualisation and areas in need of improvement, setting the foundation for the next phase of research, which will involve collaborative use of the visualisation with real datasets. One of the most effective aspects was the intuitive interaction design, particularly the ability to click on characters and follow their paths through the narrative. This feature made the visualisation engaging for participants, allowing them to quickly identify characters, view their personal traits, and explore character interactions. The use of a prominence encoding on character storylines also helped users to differentiate major from minor figures in the story.

However, the study also identified several areas that require improvement to ensure the visualisation is fully usable in a collaborative environment. Navigation difficulties were a common theme, with participants struggling to manage long storylines and crowded visual sections. These usability issues could hinder group discussions, where the ability to quickly and efficiently navigate the visualisation is essential for smooth collaboration. Improvements are needed to enhance usability for a group setting, where participants may need to reference specific characters or interactions quickly during discussions. The next chapter, Study II, addresses these issues in preparation for the final evaluation.

Chapter 5

Study II: Evaluating the Visualisation for Casual Discussion and Analysis

5.1 Introduction to the Study II Chapter

Study II builds on the findings from Study I, continuing into the second design and evaluation cycle. This includes making changes to the visualisation technique and menu system to reflect the qualitative feedback provided by participants in Evaluation Stage I (Section 4.14.2). It addresses the enhancement of visualisation's usefulness by enriching it with additional context, including plot and genre elements, and using the technique to visualise another four novels. A book-club scenario focus group evaluation is conducted at the conclusion of the study to explore how non-experts integrate visualisations of both read and unread novels into casual book discussions.

5.1.1 Study II Research Question and Objectives

Study II Research Question: How do non-experts in literary analysis integrate character-centric literary visualisations into casual book discussions?

Study II Research Objectives:

- Add additional contextual elements to the layout technique to create a more holistic reference point for supporting non-expert discussion and analysis
- Enhance the visualisation and menu system to optimise usability and visual appeal
- Build four test datasets using novels from different genres
- Define participant recruitment inclusion and exclusion criteria to ensure the collected insights align with the project goals and target audience
- Develop and administer a suitable evaluation methodology for testing the visualisation in a live discussion scenario
- Analyse findings from the evaluation to draw conclusions and determine future work

5.2 Design Stage II

In Design Stage II, I describe the continued development of the *Clover Connections* visualisation technique, focusing on the rationale behind the design choices and the trade-offs considered in refining the visualisation. The goal during this phase was to further optimise the visualisation tool, addressing specific feedback from Evaluation Stage I while incorporating additional functionality to support a more comprehensive analysis of character dynamics. Each design decision was carefully weighed to balance usability, functionality, and the depth of insights provided, ensuring the tool remains accessible to non-experts.

Design Stage II employs the same design processes, frameworks and non-expert user design supports as used in Design Stage I, outlined in the Methodologies chapter in Section 3.5. At the core of the approach is the use of Munzner's nested model (Munzner, 2009) as a method of structuring the design steps, guiding the process of further characterising the domain, abstracting new data, designing additional visual encodings and interations, and improving the technical implementation. Further investigation into casual readers' engagement with genre also helped to shape deeper understanding of the literary domain and challenges in the literary visualisation design pipeline.

5.2.1 Updating the NEUVis Data-Visualisation Schematic

The NEUVis schematic template (Gough et al., 2016) was originally completed during Study I (Table 4.1) to scope the work. To briefly recap, this process was instrumental in clarifying the research goals and considering how the visualisation could best support non-expert users in regards to these goals. It guided decisions regarding the data to be visualised and the visual representations that would be most effective in mapping that data for casual readers, ensuring the design would be both accessible and informative.

As the project evolved, so too did the schematic – the below schematic shows updates which are bolded to reflect the evolution of the project.

5.3 Enriching the Visualisation Layout with Contextual Elements

The qualitative feedback gathered from Evaluation Stage I (Section 4.14.2) provided valuable insights into areas requiring usability enhancements and underscored a strong desire among participants for improved contextualisation of character appearances. These findings revealed certain limitations inherent in the visualisation's character-centric design, particularly its inability to deliver the enriched textual context typically found in resources such as wikis. Participants expressed the desire for the visualisation to integrate broader narrative elements, enabling a more comprehensive and interconnected view of the story.

Building on these insights, I explored strategies to enrich the visualisation layout by incorporating settings, key events, and plot functions. The aim was to augment the narrative context

TABLE 5.1: The NEUVis schematic (Gough et al., 2016) updated in Study II to refine the scope of the work.

Part	**Attribute**
Part 1	**Data**
Type (attributes)	Qualitative, quantitative, dynamic, **text**, **numeric**, **relational**, **ordinal**, **objective**, **subjective**.
Dimensionality (attributes)	2D, high-dimensional.
Establishment (relevance)	Facilitating access to complex unstructured data that are difficult to organise and categorise.
Applicability (relevance)	Informational aspects and new insights may be formed, **recollection**, **clarity**, **understanding**, **appreciation of literature**.
Acquisition (attributes)	Structure and organisation of visual elements, meaning of visual elements, useful data, **significant text inclusions**, **contextual markers**.
Part 2	**Visualisation**
Goals (relevance)	Accessible singular reference point, supports individual or shared viewing, **discrete discussion support**.
Interface (interaction)	Interactive elements, emotive imagery, static elements, **integrated menu system: data editing, filtering, alternative layout, increase or reduce context**.
Construction (interaction)	Narrative pathways, exploratory navigation, familiar metaphors, **custom glyphs**, **icons**, **engaging imagery**.
Context (relevance)	Individual use, shared use, in-person or online, public-facing, **live discussion support**, **co-located use**.
Communication (relevance)	Digital discussion artefact, non-experts with non-experts.
Responses (interaction)	Validated, corrected, emotional, surprised, critical, **shared understanding**.

without compromising the cohesive and holistic representation of character data. This enhancement process sought to balance the simplicity of the character-centric approach with the depth required to support meaningful literary discussions.

The following subsections detail the rationale behind these additions, and the broader implications for supporting casual literary analysis and discussion.

5.3.1 Settings

Settings are foundational to storytelling, situating characters within specific times and places and shaping the narrative's tone and atmosphere (Bal & van Boheemen, 2009; Tuan, 1977). By visualising settings, I sought to provide users with a clearer representation of where and when events occur, helping them track shifts in time and space and understand their impact on the characters. This may be particularly valuable in novels with highly dynamic settings, where multiple changes in environment influence character dynamics.

Additionally, settings often carry symbolic weight, contributing to the narrative's emotional and thematic depth (Booker, 2004; Forster, 1985). By incorporating settings into the visualisation, I aimed to encourage users to reflect on how specific locations shape character development and storylines. I considered how this enriched contextual understanding could help non-experts connect spatial dynamics with broader narrative themes, making their engagement with the text more nuanced and comprehensive.

The Evaluation Stage I findings (Section 4.14.2) included feedback from one participant who noted their previous difficulties in recalling the settings of novels they had read. Incorporating settings into the visualisation aims to address this challenge to aid improved recollection of a read novel, and also to enhance discussions by providing a clearer framework for understanding the relationship between characters and their environments.

5.3.2 Key Events

Key events are pivotal moments that drive the story forward and define the relationships between characters and their environments. I decided to include them in the visualisation to highlight significant plot points, as they provide readers with a clearer sense of the narrative's structure and progression (Chatman, 1978). This may be especially useful for novels with intricate plots or multiple subplots related to different characters.

Feedback from participants in Evaluation Stage I (Section 4.14.2) demonstrated a desire to know more about why characters have the personal traits they do (per chapter), and how the formation of character social interactions occur in relation to the context of the story. Encoding key events in relation to character appearances may help to provide this much needed context.

Additionally, summarising a narrative through its key events enhances recall and comprehension of the story (Mandler & Johnson, 1977). Hence, by making key events explicit, the visualisation can support both a detailed understanding of individual chapters and a holistic view of how the plot unfolds.

5.3.3 Plot Function

Building on the incorporation of settings and key events, I explored the addition of plot function as a way to contextualise each chapter's contribution to the overall narrative. Plot function refers to the structural role each chapter plays, such as introducing conflicts, building tension, or resolving storylines (Abrams, Abrams, & Harpham, 2012; Booker, 2004; Forster, 1985). The inclusion of data related to this element aims to provide users with a clearer understanding of how chapters work together to construct a cohesive narrative.

Findings from Evaluation Stage I (Section 4.14.2) informed this inclusion. One participant noted that the visualisation could help them write about characters by functioning as a "legend" to understand their roles in the story. Informal feedback from colleagues during demonstrations further supported this idea, suggesting that visualising the construction of a story could give users a "meta view" of the narrative. This perspective could inspire non-experts to analyse

how individual chapters interact to form compelling stories, offering insights into narrative techniques that align with their own creative goals.

Many book fans share not only their interpretations of novels or book series but also their own creative works built from pre-existing characters and settings. This type of writing, known as fan fiction, is widely shared on public platforms such as *Archive of Our Own* (Archive of Our Own, 2024), and reflects a form of "textual poaching" (Jenkins, 2013). Historically, fan fiction has been dismissed in formal academic contexts as less legitimate than professional literary pursuits (Jenkins, 2013). This is perhaps why existing literary analysis tools appear to rarely consider fan fiction writers as part of their target audience. However, as discussed in Section 2.5, several character-centric literary visualisation tools have been designed for professional writers (Hoque et al., 2022, 2023).

For this project, the inclusion of plot function is intended to provide a simplified representation that caters to a casual reader audience. By visualising the structural roles of chapters, the tool may provide an accessible entry point for users to engage with the underlying mechanics of storytelling, which could support interpretation or inspire new creative directions. In this way, the visualisation design seeks not only to broaden access to literary analysis but also to validate the practices of book fans as legitimate forms of narrative engagement.

5.3.4 Considering Other Contextual Elements for Broader Impact

While the inclusion of settings, key events, and plot function expanded the visualisation's narrative scope, it became evident during this ideation phase that tailoring the design to reflect the distinct characteristics of specific genres could even further enhance its utility. Genre plays a significant role in shaping the expectations and experiences of readers, particularly within casual reader communities that frequently gravitate towards popular genre fiction series. Recognising this, the next phase of the design investigation focused on understanding how to integrate genre-specific elements to provide a richer, more tailored context for users. This step aimed to abstract key features unique to genres and investigate how these could be visualised to support interpretation and discussion.

5.4 Characterising Non-Experts' Engagement with Genre

Genre is a major area of investigation and intense analysis in literary studies, as it provides a framework for understanding how texts conform to or deviate from established conventions. For experts in literary analysis, genre offers a way to categorise, critique, and interpret texts based on their adherence to or innovation within specific genre traditions. Scholars often analyse how genre shapes narrative structure, character archetypes, thematic development, and reader expectations, engaging with complex theories of genre evolution and hybridity (Frow, 2014). Genre theory itself has a long and detailed history, with scholars such as Frye (1957) and Todorov (1975) contributing to understanding of how genre influences the construction of meaning within literature. Experts in literary analysis explore the subtleties of genre, examining how authors manipulate genre conventions to challenge or reinforce cultural narratives

(Frow, 2014). This type of detailed genre analysis is critical for understanding how texts engage with broader literary traditions and cultural contexts, making genre a foundational concept in literary scholarship.

Interestingly, when I interviewed the domain expert in Study I (see the transcript in Appendix A), they remarked that in the formal literary analysis of genre, "the focus is on studying different themes", but that there is "definite bias against studying 'genre fiction'". To clarify, the domain expert mentioned that in works considered 'literary fiction', such as *Pride and Prejudice* by Jane Austen (Austen, 1813), the study of genre uncovers themes, such as good and evil, in "shades of grey", whereas "in a fantasy novel [a form of genre fiction], the concept of good and evil is very obvious". As established in Section 2.2 of the Literature Review chapter, casual readers are often passionate about works of genre fiction. While they, of course, can still engage with literary fiction, there has been less focus on analysing the elements of genre fiction in formal literary studies (Jenkins, 2013), which the comments from the domain expert appeared to confirm.

Perhaps because, for genre fiction, genre elements may be considered more surface-level. Casual readers tend towards using genre as a way to navigate the vast world of literature, helping them to determine what books to read, and guiding the selection of texts that appear familiar to them, or will align with their preferences (Felski, 2011; Radway, 1991; Storey, 2018). For casual readers, genre might serve primarily as a contextual indicator, signalling whether a novel is likely to involve romance, mystery, or fantasy elements (Radway, 1991), and setting expectations for what to the text is likely to contain (Beghtol, 2001). They may recognise the basic tropes or conventions of a genre, but are less likely to engage with the underlying structural or thematic complexities that scholars investigate (Jenkins, 2013).

This contrast between expert and non-expert engagement with genre highlights an important distinction between the ways those reading for different purposes experience texts (Jenkins, 2013); which potentially influences how they analyse them too. For example, the engagement with genre in fan discussions is often focused on the enjoyment of familiar patterns, such as the hero's journey in a fantasy novel or the romantic relationships in a love story (Jenkins, 2013; Pianzola et al., 2020), rather than a critical examination of the genre and its broader implications in literature.

In summary, isolating and encoding genre elements within the visualisation may offer casual readers an enhanced framework for understanding and discussing genre fiction, in a manner that appeals to their engagement with genre. To explore this idea, it was necessary to investigate specific genres and identify which elements are most conducive to, and relevant for, a non-expert targeted literary visualisation.

5.4.1 Selecting Genres for the Study

The process of selecting genres was a crucial step in shaping the design and evaluation of the *Clover Connections* layout. This section outlines the considerations and decision-making process involved in determining which genres to focus on. The selection was not simply a matter

of preference but rather the result of weighing several key factors. These included exploring different design pathways, assessing the ability to locate of genre representations in a text, and evaluating the appeal of certain genres to non-expert users. Additionally, as the designer, my own familiarity and interest in certain genres played a role in refining the selection process.

Design Pathways

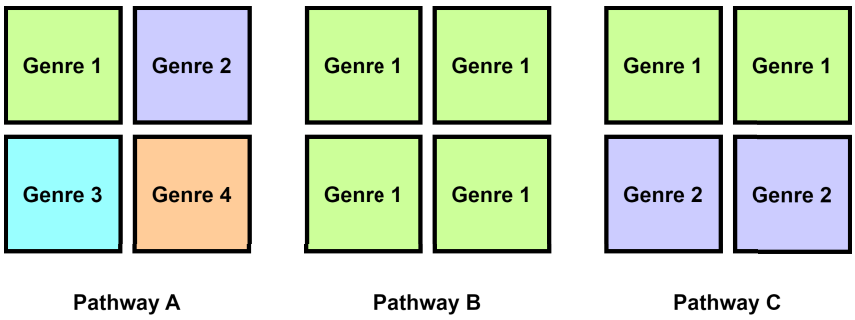

FIGURE 5.1: Possible configurations for selecting genres to visualise. Each design pathway has its own strengths and limitations.

When considering how to integrate genre elements into the visualisation, I had three feasible design pathways, each offering distinct advantages and limitations. The choice of pathway would significantly impact the comparative analysis of character data across multiple novels and genres, as well as the overall flexibility of the visualisation tool. Ultimately, I had to balance my goals for genre comparison with the practical constraints of time and dataset preparation.

Pathway A (Figure 5.1: Pathway A) involved visualising four novels, each from a different genre. This approach would have allowed me to explore a broad range of genre conventions and how they influence the representation of character data in various literary contexts. However, the major limitation of this pathway was the inability to compare novels within the same genre. Genre conventions play a critical role in shaping narrative and character dynamics, and without the ability to compare novels from the same genre, I would have missed the opportunity to observe how genre-specific elements influence character visualisations in a consistent way. While this pathway offered variety, it lacked depth in genre comparison.

Pathway B (Figure 5.1: Pathway B) focused on visualising four novels from the same genre. This pathway would have allowed me to conduct a deep dive into refining the visualisation tool for a specific genre, optimising how the *Clover Connections* layout could best represent character dynamics within one type of literary framework. Such an approach would have provided valuable insights into genre-specific design challenges and potentially resulted in a highly tailored visualisation for that genre. However, one of the overarching goals of this research was to ensure that the visualisation technique could be reusable across different genres. By limiting the scope to a single genre, I would not have been able to test the versatility of the layout or examine how effectively it could be adapted to other genres.

After weighing the strengths and limitations of these two pathways, I made a compromise and arrived at Pathway C (Figure 5.1: Pathway C), which involved visualising four novels from

two genres (two novels per genre). This pathway struck a balance between breadth and depth. By focusing on two genres, I could explore genre differences while also ensuring that the visual encodings will be flexible enough to apply to multiple texts within each genre.

I haved documented this decision process to demonstrate that every choice made in the design process has a ripple effect on the entire project. These choices shape not only the scope and depth of the analysis but also the usability, adaptability, and effectiveness of the final visualisation tool. By thoroughly examining the impact of each decision, I ensure that the design process remains transparent and systematic, with each step building upon the last to support the overall objectives of the research.

Possible Genres

Each genre has conventions, some of which are difficult to define (such as diction differences across genres) while others are readily classifiable (such as direct mentions of genre elements in the text). The existence of subgenres, and the overlap of some genres, makes it an enormous task to accurately classify what to capture and display for the end-users. Additionally, consensus is difficult to arrive at when constructing typologies in the literary domain (Beghtol, 2001). Hence, the work performed here aims to establish initial ideas on how to capture different genres in a standardised but flexible manner that would allow encoding in a visualisation, and provides rationales for why I chose to focus on the two genres I ultimately selected.

I first narrowed the scope of my investigation to ten popular genres. Of course, there are more, but as I was only selecting two to visualise, I considered ten a substantial amount to begin my inquiry. For each of the ten genres, I researched their general conventions and located example novels to help contextualise understanding. High level summaries of the general conventions are located in Table 5.2.

The conventions of different genres are highly varied, each bringing unique characteristics that define them. Some genres, such as pastoral, require careful consideration of what truly makes them distinct. In pastoral fiction, themes of rural life, harmony with nature, and the contrast between urban and rural settings are not always as immediately obvious as plot-driven elements in other genres (Gifford, 1999). The subtlety in conveying the simplicity and purity of pastoral life demands a more thoughtful approach to identifying its markers in a text, requiring understanding of elements like narrative tone.

On the other hand, certain genres are more self-explanatory. Romance, for instance, has straightforward conventions, such as the focus on relationships, emotional conflicts, and the progression of romantic love (Regis, 2003). These elements are relatively easy to identify for most readers, and would not necessarily require as much investigation as to how to show these features in a visualisation. For example, the concept of a relationship can be modeled using a social network, and different edge encodings could signify relationship types.

I also recognised that some aspects of certain genres were already perceivable in the visualisations, even before adding specific genre conventions. For example, drama is often supported

TABLE 5.2: Popular genres and some of their conventions.

Genre	**Conventions**
Science Fiction	Futuristic settings, advanced technology, space exploration, alternate realities (James & Mendlesohn, 2003).
Romance Fiction	Focus on relationships, emotional conflicts, romantic love and marriage (Regis, 2003).
Fantasy Fiction	Magical elements, mythical creatures, quest narratives, alternate worlds (Attebery, 1992).
Historical Fiction	Set in the past, real historical events or figures, period-specific details (De Groot, 2009).
Thriller Fiction	High stakes, suspense, twists, danger, often involves a protagonist in peril (Palmer, 1978).
Horror Fiction	Supernatural elements, fear, unsettling atmosphere, horror tropes like ghosts or monsters (Carroll, 2003).
Detective Fiction	Detective protagonist, focus on investigation, clues, red herrings, and suspects (Scaggs, 2005).
Adventure Fiction	Exciting journeys, danger, physical challenges, exploration, and survival (Zweig, 1999).
Drama Fiction	Emotional conflict, intense character development, and real-life issues (Hornby, 1986).
Pastoral Fiction	Idealised nature, rustic life, contrasts with urban settings, and simple living (Gifford, 1999).

naturally by the visualisation of emotions and character evolutions, which are central to the genre (Hornby, 1986).

In contrast, genres such as detective fiction and science fiction present much more textually defined and recognisable conventions not currently representable by elements of the *Clover Connections* technique. Detective fiction, with its emphasis on investigation, clues, suspects, and the detective as the protagonist (Scaggs, 2005), offers elements that appear conducive to data abstraction. Science fiction's conventions are relatively identifiable too, with its core elements, such as sophisticated technologies or trips across space (James & Mendlesohn, 2003), often explicitly mentioned.

Hence, for this design study I selected **detective fiction** and **science fiction** to focus on for data abstraction and encoding.

5.5 Selecting Novels for the Study

In Study I, the two novels I used are not in the public domain. While these novels provided valuable content for evaluating the design and functionality of the visualisation technique, their copyright status presents several challenges, particularly in regards to releasing the visualisations online with the full texts. When working with copyrighted texts, there are legal

restrictions that limit how much of the original material can be shared or reproduced within a literary visualisation, even under educational fair use provisions (Regan, 2011). This creates a significant hurdle, especially for projects that rely on detailed textual analysis and need to offer users access to the source material to verify the data.

To remove the potential of legal infringement entirely as a factor, I decided to use novels that are in the public domain for the second phase of my research. By working with public domain texts, I am able to share the full text within the visualisation itself, providing users with much needed context. Furthermore, using public domain works eliminates the legal restrictions that previously limited the sharing and reuse of the visualisations, making it possible to open-source the datasets for future research and collaboration.

This shift highlights the importance of aligning texts chosen during the design process with broader goals such as accessibility and open-source availability. While copyrighted works offer rich material for analysis that is likely familiar to many book fans, their limitations can hinder the expansion of the project. By focusing on public domain texts, I am able to enhance both the visualisation's functionality and its potential impact on the wider research community.

5.5.1 Detective Fiction Novels

In the following subsections, I provide an overview of the detective fiction novels selected for the study, highlighting their significance as emblematic works of the genre.

A Study in Scarlet by Arthur Conan Doyle

A Study in Scarlet (A. C. Doyle, 1888), written by Sir Arthur Conan Doyle and published in 1888, was the first novel to introduce the world to the characters: Sherlock Holmes and Dr. John Watson. This novel marked the beginning of one of the most famous detective duos in literary history. Doyle's creation of Sherlock Holmes laid the foundation for the modern detective genre, combining elements of logic, analysis, and crime-solving. The novel features an intriguing structure, which includes a sudden shift in Part 2 to a backstory in the American West, presenting an interesting case study for encoding settings and plot function into the visualisation. Additionally, the legacy of Sherlock as a character became a model for detectives in later works, making this novel highly emblematic of the detective fiction genre.

The Mysterious Affair at Styles by Agatha Christie

The Mysterious Affair at Styles (Christie, 1920), written by Agatha Christie and published in 1920, was the first novel to introduce the character Hercule Poirot, one of the most iconic detectives in literature. Christie's novel was directly inspired by the works of Arthur Conan Doyle, particularly his Sherlock Holmes stories, which set the standard for the detective genre. Like Holmes, Poirot relies on his intellect and observational skills to solve the central mystery of the novel, but the structure and writing styles differ greatly. Christie's admiration for Conan Doyle's methodical approach to crime-solving is evident in the novel, with Poirot employing logical deduction to unravel complex clues, but the novel is much denser in its presentation of

characters and its number of dialogue lines, providing a large amount of social interactions for visualisation.

5.5.2 Science Fiction Novels

In the following subsections, I present the rationales for selecting the science fiction novels used in the study, highlighting their contributions to the genre and their embodiment of key science fiction tropes.

The Stainless Steel Rat by Harry Harrison

Harry Harrison, known for his novel *Make Room! Make Room!* (which was adapted into the film *Soylent Green*), wrote a series of novels centred around a character called the Stainless Steel Rat, also referred to as Slippery Jim diGriz. The first novel in the series, *The Stainless Steel Rat* (Harrison, 1957), is regarded as a seminal work in science fiction. This novel introduces readers to a clever and morally ambiguous science fiction anti-hero, whose adventures blend crime, satire, and futuristic elements. The series became a cornerstone of Harrison's career, showcasing his talent for combining humour and social commentary within a science fiction framework. I selected this novel as I was aware of the influence of Harrison's works on the genre, and also considered that it might be an enjoyable read.

The Time Traders by Andre Norton

The Time Traders by Andre Norton was first published in 1958 (Norton, 1958). It is a classic of science fiction that combines time travel with space exploration. The novel introduces a secret government agency using time travel to counter an alien threat, blending Cold War-era themes with science fiction. Norton's protagonist, Ross Murdock, is a criminal recruited for a dangerous mission that takes him into both the past and future, where he must confront advanced alien technologies. Norton's work is notable for its exploration of time travel as a tool for both historical discovery and military strategy. As one of the first prominent female authors in science fiction, Norton paved the way for future writers by integrating complex character development with innovative science fiction concepts, making *The Time Traders* an important text in the science fiction genre.

5.5.3 Additional Considerations for the Selection of Novels

I also made other considerations for which novels to use based on the two factors discussed below.

Diversity of Authors

In selecting the works for this project, I ensured diversity in authorship by including two female authors (Agatha Christie and Andre Norton) and two male authors (Arthur Conan Doyle and Harry Harrison), reflecting different perspectives and narrative styles within the detective and science fiction genres. My selection of authors ensures a balanced representation of gender and

may highlight the varied ways in which both male and female authors have shaped these two genres, which ultimately influences the types of data to be extracted and the experience of the visualisations' end users.

Lack of Prior Familiarity with Novels

This time around, I had no prior familiarity with any of the texts I selected, aside from a general knowledge of the characters Sherlock Holmes and John Watson in *A Study in Scarlet* and the character Hercule Poirot in *The Mysterious Affair at Styles*. Working with novels I was not previously familiar with brought a fresh perspective to the design process. It allowed me to engage with the text and characters in the same way that a non-expert reader might, without preconceived interpretations.

5.6 The Design Challenge of Visualising Genre

Abstracting and extracting data for the visual encoding of "genre" presents a uniquely challenging problem due to its multifaceted nature. Unlike character appearances or key events, which can be directly identified in textual data, genre is typically treated as a layered concept encompassing different themes and stylistic elements. These elements are often implicit, overlapping, and open to interpretation, making them difficult to quantify or represent visually without losing nuance. Furthermore, genre operates at both a macro level (defining a work's overall categorisation) and a micro level (manifesting in specific chapters, character tropes, or plot devices) (Felski, 2011; Frow, 2014; Radway, 1991; Storey, 2018), requiring a careful balance to approaching ideation on its visual representation.

5.6.1 Book Genre Visualisation

Weber (2007) introduced a novel application of text visualisation, using colour coding to represent parts of speech, aiming to analyse text structure, genre, and writing style. Each part of speech is assigned a distinct colour – verbs in red, nouns in black, adjectives in green, and so on – reflecting their role in creating a text's rhythm and style. By generating "text-images," this method highlights overuse of specific word types, such as nouns or adjectives, and promotes dynamic writing by emphasising verbs. The colour-coded visualisations differentiate text genres, with scientific texts displaying darker patterns due to nominalisation and narrative texts exhibiting lighter, more dynamic patterns due to a higher presence of verbs. The study demonstrated the method's effectiveness through comparisons of German scientific and fictional texts, where the colour patterns revealed distinct stylistic tendencies inherent to each genre. The visualisations provide immediate feedback on sentence structure, enabling writers to identify troublesome phrases and improve clarity and engagement.

H. Kim and Park (2013) addressed the challenge of visualising genres by identifying genre-specific textual features. They processed a corpus of 4,000 digital books to create an Overall Word-Frequency Dictionary (OWFD) and constructed Genre Word-Frequency Dictionaries (GWFDs) for four genres: fantasy fiction, science fiction, philosophy, and classical literature.

By comparing these dictionaries, they identified "extraordinary words" unique to each genre, compiling them into a Genre-Identity Dictionary (GID). The visualisation method employed unique colour assignments – orange, purple, blue, and yellow – to represent the four genres. Words in the GID were visualised as ellipses, with higher-frequency words depicted as longer and brighter shapes. Dominant genres were emphasised through foreground layering, while less prominent genres were subdued using blurring and lower layers. This approach allowed viewers to intuitively identify key genre characteristics and overlaps within a text. To further illustrate genre relationships, the authors used curves to connect words from the same genre, with curvature and intensity reflecting genre similarity. By prioritising dominant genres and reducing visual noise for secondary ones, the method provides representation of complex genre compositions, making it useful for book recommendations and personalised exploration.

A more recent creative use of visualisation to depict reader's personal preferences was uncovered in the literature. *The Knitted Personal Library* study (Hinze, Vanderschantz, Sijnja, Rogers, & Cunningham, 2022) explored the physical data visualisation of genre, book-length and acquisition as a knitted shawl in order to provide a physical artefact as a conversation starter on one's personal library. Similar to the aforementioned studies, colour is used to represent genre by assigning distinct identities to each genre category. The researchers identified 52 potential genres from eBook platforms (Audible, Inc., 2024; Google LLC, 2024) and reduced them to 21 categories. A colour wheel was then used to assign colours to these genres, often reflecting existing associations – for instance, blue for business and technology, red for fiction, yellow for self-improvement, and green for creativity. These colour associations were integrated into both the digital and knitted prototypes. While the aim was to maintain a logical flow between similar themes, the authors thoughtfully reflect on how their colour scheme relies on Western perceptions of genre and may not universally apply across cultures.

5.6.2 Musical Genre Visualisation

There are many examples in the literature of musical genre visualisation (Castillo & Flores, 2021; Holm & Siirtola, 2012; Liang & Willemsen, 2021; Panda, Namboodiri, & Roy, 2021), which appears to be one of the more focused areas of genre visualisation. The accessibility of musical genre metadata and user library data makes it a practical domain for analysis and visualisation, contributing to its prominence in the literature. The following papers were reviewed to gain insights into how visualisation researchers in other fields have addressed the challenge of encoding genre.

Holm and Siirtola (2012) explored methods for visualising musical genres to make music exploration intuitive and engaging for the general public. The researchers tested four different approaches – colours, icons, fonts, and avatars – for visual encoding, evaluating their effectiveness through a series of online surveys and user studies. Each method aimed to map genre metadata, such as tempo, mood, and style, into visual elements that would resonate with end-users. The findings revealed that while single-dimensional methods, such as colours, were less effective due to cultural variability, multi-dimensional methods like combining colour and icons, were the most effective. The research informed the design of music recommendation

interfaces, showing that visually engaging methods can enhance user interaction and inspire exploration of music.

Panda et al. (2021) treated audio files as analogous to text documents by segmenting them into short clips and extracting Mel-Frequency Cepstral Coefficients (MFCCs) as features, which were clustered into "musical words" using k-means clustering. The topic model identified latent topics representing genre mixtures, and these were interpreted using genre annotations from the dataset. The resulting visualisations included probabilistic genre labels displayed as doughnut charts and progressive genre representations that tracked genre proportions over time.

Liang and Willemsen (2021) explored how interactive visualisation and mood control can support users in discovering new music genres. A bar chart and a contour plot were evaluated alongside mood control sliders that allowed users to adjust recommendations. The study found that the contour plot, which combined scatter and density plots to represent user preferences, genre profiles, and recommended tracks in a single graph, was perceived as more informative and helpful compared to bar charts. Their results suggest that pairing transparent, informative visualisations with interactive controls enhances users' understanding of recommendations and encourages exploration of unfamiliar music genres.

Castillo and Flores (2021) devleoped a web-based application for music genre classification and timeline visualisation. The tool visualises classification results in real-time, using stacked area charts to represent genre probabilities over the timeline of the music video being played. Their work provides insights into genre classification challenges, such as overlapping genres and the absence of a standardised genre taxonomy for musical genres; reflective of the major issues in book genre visualisation.

5.6.3 Ideating and Experimenting with Genre Encodings

Most of the examples in the literature discussed in previous sections point to a common approach to visualising genre at the macro level, that is, to define a work of literature or music's overall categorisation – typically identifying these with distinct colours. While this is useful for conducting intertextual analysis of literary works, it provides limited insights at the micro level into specific genre elements that appear in the context of character appearances within a singular text.

Early explorations in my own work also experimented with associating colour with aspects of genre, but at the macro level. For example, in detective fiction, the use of a red storyline for a murderer to symbolise blood and a black storylines for victims to symbolise their inevitable deaths. However, these approaches risked being too prescriptive to one genre, negating the generalisability of the layout. Additionally, this removes the value of the distinct identity colourations in the storyline visualisation layout.

An alternative approach I ideated on was to use line patterns to encode genre-specific character roles. Experimenting with line patterns increased the visual complexity of the layout, particularly in chapters with overlapping storylines or dense character interactions. Additionally,

character storylines already employ a dashed line effect when not highlighted. Introducing additional line patterns, such dots or graphical effects, could become cognitively cumbersome for users, especially in genres with large casts of characters. This would require memorisation of another encoding for character storylines, which already also use line thickness to indicate character prominence. Hence, the practical integration of this idea was limited by the need to prioritise clarity and usability within the character-centric layout.

I also considered incorporating iconography alongside storylines, with small, thematic icons placed at key nodes or transitions. For instance, a magnifying glass could represent key investigation points in detective fiction, while a rocket or planet could signal moments of interstellar travel in science fiction. However, due to the chapter-based presentation of the layout, experimentation with this idea resulted in the realisation that these moments always occurred inside the confines of a chapter, introducing visual clutter around character chapter nodes.

Hence, I developed the idea of creating genre-specific contextual markers as a subtler approach to contextualise for genre, but not to make it the focus of the visualisation technique in order to ensure its generalisability across different texts. A contextual marker is any sign, symbol, or piece of information that adds meaning or situates something within a specific context. These markers can provide cues that help people understand the relevance of something. Unlike previous explorations, this approach aimed to ensure genre elements complement rather than dominate or alter the existing visualisation approach, which is to provide an overview of the characters' journeys. This idea would mean that genre elements function as part of the anchoring framework that contextualises character journeys, like the chapter boxes, and would simply summarise a relevant mention in the text, like the character personal traits.

In pursuit of this idea, I began by identifying one key, defining element for each genre. The goal was to abstract a typifying feature that could be incorporated inside or alongside the chapter boxes, signifying a distinctive aspect of the text's respective genre while maintaining a connection to its characters. For detective fiction, I chose to highlight clues, and for science fiction, I focused on advanced technologies.

Clues for Detective Fiction

Clues are a major feature of the detective genre, where the plot typically revolves around the gradual revelation of information that, in combination, leads to the solution of a mystery (Knight, 1980, 2017). In detective novels, readers often perceive the detective piecing together seemingly unrelated facts to solve a crime or mystery (Scaggs, 2005). By focusing on clues in the visualisation, I aimed to support users in reviewing how and where clues appear throughout the narrative. Since writers of detective fiction are encouraged to make clues accessible to the reader (Dine, 1928), I sought to replicate this accessibility within the visualisation, making key clues more visible and summarised for users.

Advanced Technologies for Science Fiction

For science fiction, I focused on advanced technologies, which I identified as a core theme within the genre. Science fiction often centres around advanced technologies such as space travel and artificial intelligence, which influence the ethical dilemmas and societal questions explored in the genre (Gunn, 2006). I intended for the visualisation to highlight these technologies, which are not simply background details but pivotal components driving the genre's exploration of utopian and dystopian futures (James, 1994). By incorporating advanced technologies into the visualisation, I aimed to provide users with concrete textual representations that form part of a broader thematic lens, encouraging reflection on how these technologies shape and define the fictional world.

5.7 Contextual Data Types and Abstraction

With each of the contextual elements determined – settings, key events, plot function, and the genre-specific clues and advanced technologies – I developed distilled descriptions to guide the extraction of these data types, similar to those for the personal dynamics data types described in Study I, Section 4.4.3. These data descriptions are shown in Table 5.3.

TABLE 5.3: Definition of plot and genre elements used in the visualisation.

Element	Description
chapterPlotFunction	The significance and/or purpose of the chapter within the overall narrative in terms of its construction.
chapterKeyEvents	Significant incidents or occurrences that drive the plot forward.
chapterSettings	Specific locations and/or time periods in which the events of the chapter take place.
salientClues	The clues discovered, including items, people, and events of interest, with concrete representations in the text.
salientTechnologies	The advanced or futuristic technologies mentioned with concrete representations in the text.

5.8 Designing the Contextual Data Visual Encodings

Visualising contextual elements alongside character dynamics aims to enhance non-experts' ability to interpret the holistic narrative. The objective of this design phase was to integrate these elements in a way that remains accessible to casual readers while enriching their understanding of the story. Achieving this balance required careful consideration of how to visually encode plot and genre elements within the existing character-centric layout.

While several design ideas were explored, the final approach emerged from the development of an early design sketch – shown in Figure 5.2 – which illustrates the concept of affixing all plot and genre elements directly to the chapter boxes. This decision aligns with insights discussed in Section 5.6.3, which highlighted that a number of genre elements (particularly those with

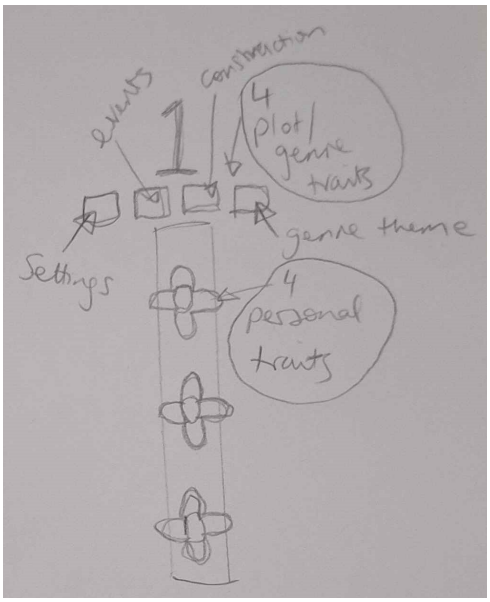

FIGURE 5.2: The final sketch of the design for encoding the contextual data at a chapter-based level prior to testing its technical implementation.

physical representations in the text, such as clues and advanced technologies) are tied to the chapters where they are explicitly mentioned, in contrast to overarching themes or tones that may span multiple chapters (or even books). This realisation, similarly, rang true for settings and key events too, and the intention of the plot function context was already established to be useful as a per chapter encoding. As such, affixing these elements to the chapter boxes provided a logical and intuitive way to represent their contextual significance in alignment with each other.

The decision to encode four contextual elements as chapter-based traits, mirroring the four personal traits per character, was informed by several other considerations. This design builds on the broader theme of enriching the structural properties of the text – such as character appearances, chapters, and social interactions – with textual summaries. By doing so, the design aims to make it immediately clear that elements represented by icons are tied to accompanying textual descriptions, enhancing their interpretability. Interactively, the visual encodings function as on-hover elements to display textual summaries of their respective element data. Recent research suggests that increased textual context does not cognitively overwhelm users (Stokes et al., 2023). Rather, thoughtfully integrated textual data can support users' cognitive processes, providing a backdrop for interpreting character dynamics.

Moreover, cognitive research has shown that working memory can reliably manage around four chunks of information at a time (Cowan, 2001). While this does not guarantee an optimal user experience, consistency in the number of traits across characters and chapters is intended to reduce cognitive load and establish familiarity, enabling users to transition seamlessly between these two levels of story detail. This approach also aligns with principles of scene coherence, which suggest that individuals naturally process a limited number of distinct elements to form a coherent understanding of complex information (Cowan, 2001). This approach aims

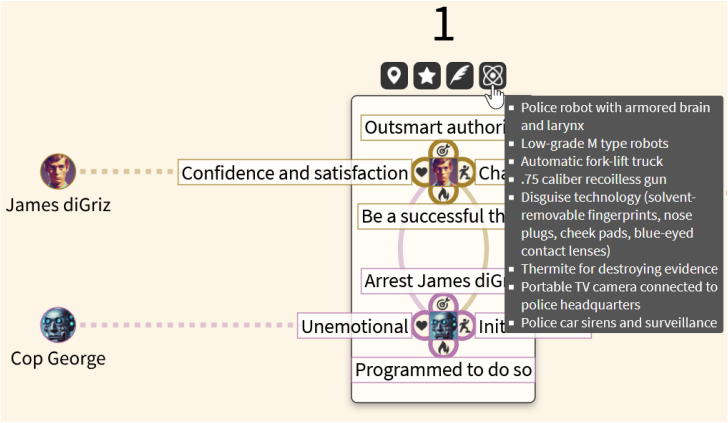

FIGURE 5.3: The list of the advanced technologies mentioned in chapter 1 of *The Stainless Steel Rat* (Harrison, 1957).

to ensure that the visualisation technique accommodates varying user needs, offering depth for those who wish to explore narratives in detail without detracting from the accessibility for casual exploration.

Each of the different on-hover contextual markers are symbolised through a set of intuitive icons. These icons were designed to align with common visual metaphors that casual readers may recognise, enhancing their interpretability, as per iconic communication guidelines (Nakamura & Zeng-Treitler, 2012).

- **Pin for Settings:** The location icon, often depicted as a pin or marker, was chosen to represent the settings within the novel.
- **Star for Key Events:** The star icon was used to symbolise key events in the story. Just as stars often represent important or celebrated moments, this icon highlights the significant turning points in the plot.
- **Quill for Plot Function:** To represent plot function, the feather quill icon was selected as a nod to the act of writing and narrative structure. The quill symbolises the underlying mechanics of the plot – how it is crafted and unfolds.
- **Footprints for Clues:** The footprints icon was chosen to symbolise clues for novels of the detective fiction genre. Footprints evoke the idea of following a trail, guiding users through the discovery process as characters uncover important information.
- **Atom for Advanced Technologies:** Finally, the atom icon represents advanced technologies for novels of the science fiction genre. Widely recognised as a symbol of science and physics, the atom has long been associated with technology and nuclear energy, making it an apt representation of the innovative and futuristic themes central to the genre.

An example of activating a contextual marker to view advanced technologies is shown in Figure 5.3, while one that features clues is shown later in Figure 5.8.

5.9 Layout and Menu System Enhancements

In response to the qualitative feedback provided in Evaluation Stage I (Section 4.14.2), the visualisation layout technique and user interface underwent several enhancements. These included changes to improve usability, such as general layout improvements and updated aesthetics, and additional menu system features to support improved textual engagement and data editing.

5.9.1 Improved Aesthetics and Element Spacing

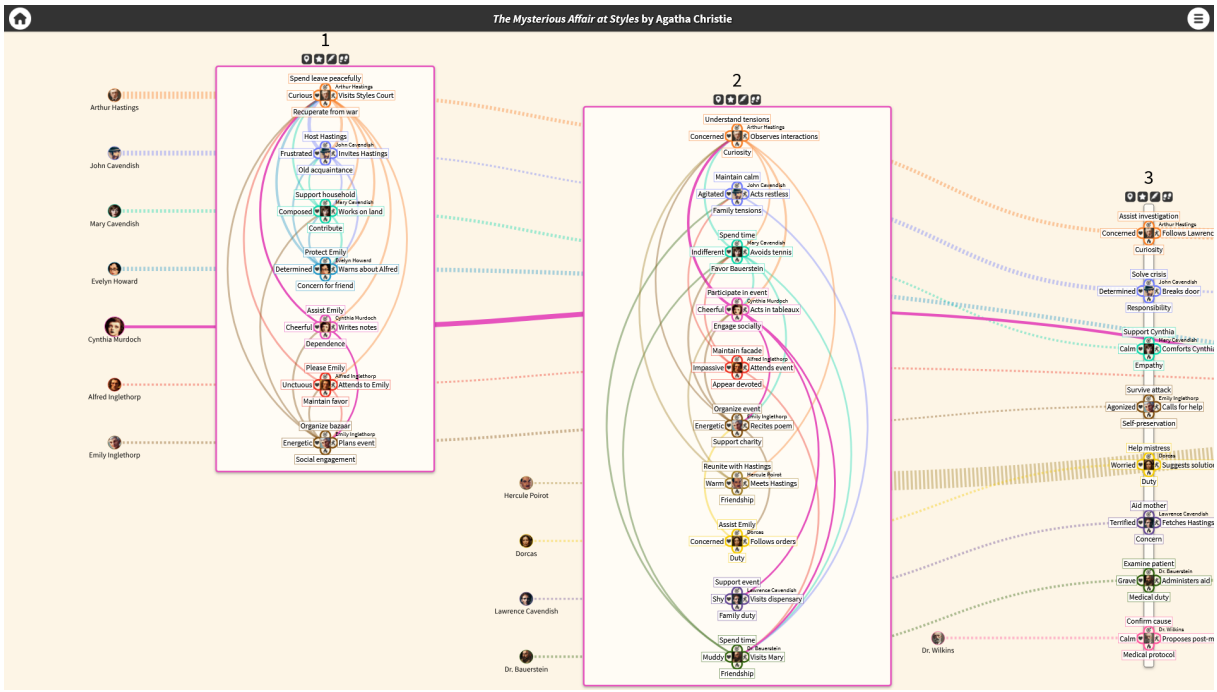

FIGURE 5.4: The end-user can toggle character labels on in the visualisation menu's *Settings* tab to make it easier to identify characters in more densely populated chapters. Additionally, persistent character labels were added to storyline introduction nodes.

The total experience of an interface involves more than its usability, as aesthetics and the pleasure of using it also both play critically important roles for end-user engagement (Norman, 2013). To enhance the aesthetics of the visualisation, I first focused on giving it a more "book-like" feel, modifying the colours to reflect those associated with traditional printed literature. For example, I have used a parchment-coloured background to evoke the feel of aged or classic paper, creating a warmer and more visually inviting interface that may better resonate with casual readers who enjoy the aesthetics of books (see Figures 5.4 and 5.5). I also added a slight drop-shadow and dragging function to the menu so that it would resemble a piece of white paper – like a note laid on the interface – that can be moved around when viewing the visualisation elements. This also creates a better visual distinction between the menu and the background of the visualisation.

I continued to refine the overall colour scheme by introducing more contrasting colours, such as dark grey backgrounds for the on-hover tooltips, and opting for jewel-like tones for the character storylines. These adjustments ensured the colours remained distinct while offering a softer, less abrasive aesthetic compared to the original design. Key to all of these changes was the introduction of greater contrasts between the background, visualisation, and tooltip elements, as higher contrasts enhance user focus and improve the differentiation of key elements (Li, Wu, Zhu, & Zhou, 2023).

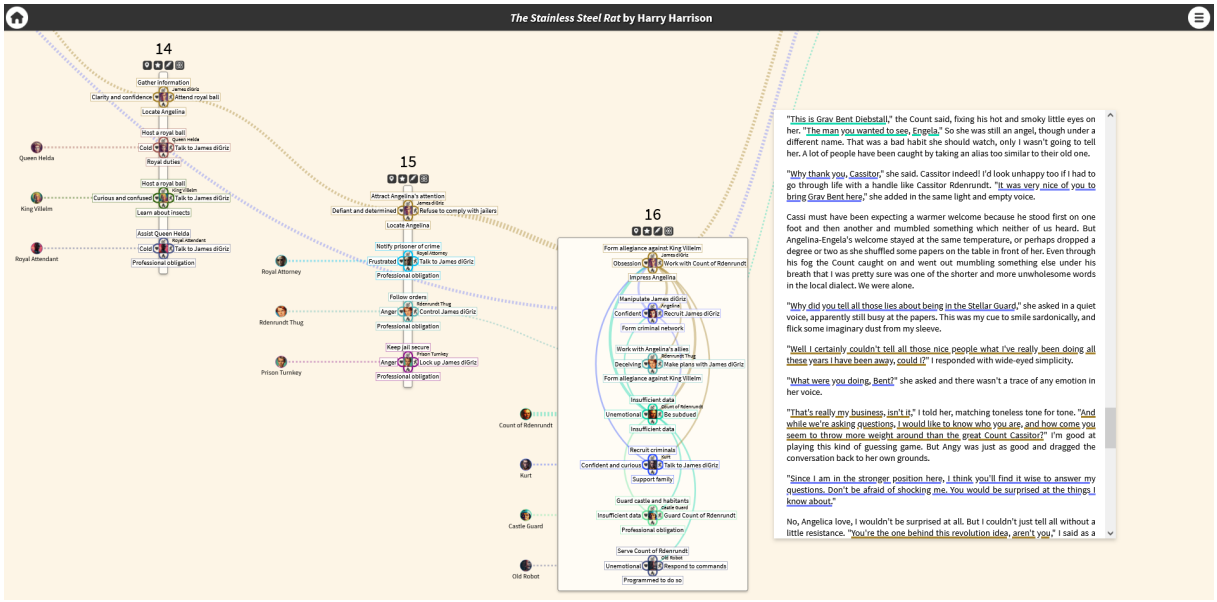

FIGURE 5.5: The overall aesthetics of the visualisation experience were revised in this design iteration, and a dragging functionality was added to the menu pane.

Moreover, in response to the qualitative findings from Evaluation Stage I (Section 4.14.2), layout optimisations were made to improve the usability of the visualisation. I increased the spacing inside the chapter boxes and adjusted the curvature of the social interaction arcs to reduce overlap and minimise visual clutter in more densely populated chapters. The optional character labels where changed to be shown close to their respective chapter nodes (see Figure 5.4 for an example), as improving the proximity of related information can enhance both information processing and recall (Ware, 2008). Additionally, persistent character labels were added to the storyline introduction nodes.

Another enhancement was made to the clover-shaped glyphs. These were increased in size and their outlines made slightly bolder to improve visibility in the visualisation overview. Finally, I added a title bar to the top of the user interface, and redesigned the *Key* tab elements to create like-for-like representations of the visualisation elements (Figure 5.6). The original key (Figure 4.28) contained sketch-style versions of the visualisation elements, which could make it difficult to create a direct association.

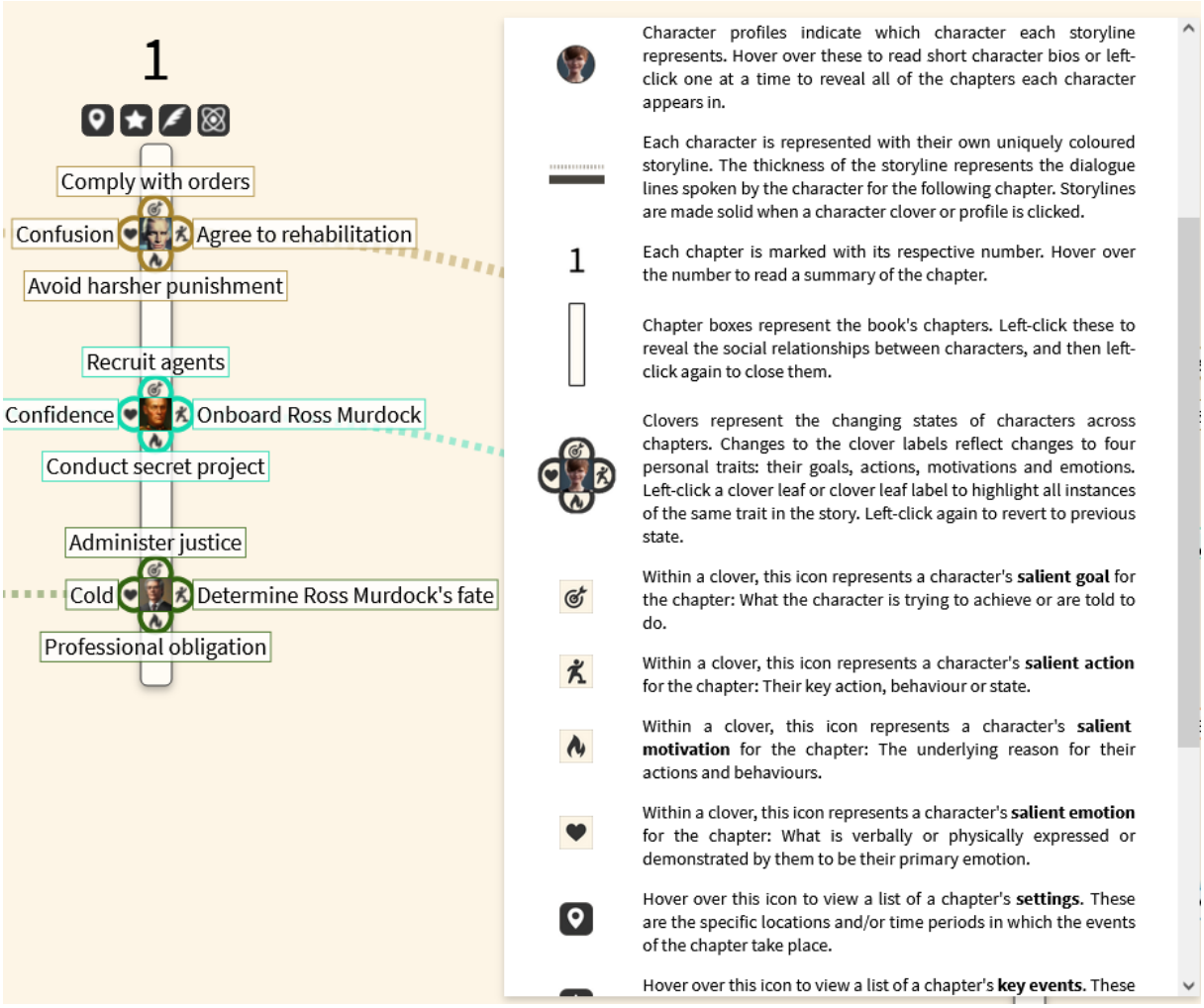

FIGURE 5.6: The visualisation key was updated to provide like-for-like illustrations of the visualisation elements, remediating issues with the original sketch-based style.

5.9.2 Quotes Highlighting in the *Read Chapter* Tab

The *Read Chapter* tab was reinstated in this version, as the use of novels in the public domain mitigated the issue of displaying the full text of copyrighted works.

I developed a simple tool (the script is shown in Figure 5.7) that reads in the character dialogue lines from the CSV files (made available on my GitHub[1]) and applies HTML ** tags with a CSS style with the character's storyline colour as an underline on their respective quotes.

The quotes highlighting feature visually connects characters' spoken words in the full chapter text to their corresponding storylines in the layout (Figure 5.5 shows an example). By underlining quotes with the same colour as their character's storyline, it is possible to see a direct visual association between their dialogue and their chapter appearances. In eBook visualisation studies with casual readers, providing a visual association between character appearances and the

[1] `https://github.com/nataliehouse/noveldialogues`

```python
import csv
import sys
import json

#python .\spanscanner.py csvfilename jsonfilename outputfilename

if "?" in sys.argv:
    print(sys.argv[0] + " RawLinesCSV JSONtoModify JSONOutputFile")
    sys.exit(1)

if "-h" in sys.argv:
    print(sys.argv[0] + " RawLinesCSV JSONtoModify JSONOutputFile")
    sys.exit(1)

if len(sys.argv) < 4:
    print(sys.argv[0] + " RawLinesCSV JSONtoModify JSONOutputFile")
    sys.exit(1)

print(sys.argv)

# Step 1: Read the CSV file
search_terms = []
with open(sys.argv[1], 'r') as csvfile:
    reader = csv.reader(csvfile)
    next(reader)
    for row in reader:
        if len(row) >= 2:
            search_terms.append((row[0], row[1] , row[2]))  # (term, style)

# Step 2: Read the target file
with open(sys.argv[2], 'r') as file:
    json_data = json.load(file)


scene_dict = {scene['id']: scene for scene in json_data.get('scenes', [])}

for chapter, term, style in search_terms:
    print(chapter)
    scene = scene_dict.get(chapter)
    scene["fullchaptertext"] = scene["fullchaptertext"].replace(term, f'<span class={style}highlight>{term}</span>')

# Step 4: Save the modified content
with open(sys.argv[3], 'w') as file:
    json.dump(json_data, file, indent=4)
```

FIGURE 5.7: Python script used to develop a simple tool for scanning dialogue lines from the CSV files and applying an underline to them.

text was perceived to enhance understanding (Coleman & Hinze, 2017; Hinze et al., 2018).

This also provides textual evidence for the frequency of character social interaction, creating a unified view of textual and structural data. I consider it may be particularly useful for identifying key moments of characters' influence over others to understand the significance of their interactions.

It is important to note that this feature was introduced just *after* Evaluation Stage II (Section 5.12), driven by findings that participants actively searched for quotes in the text (Section 5.14.4). I included it here as it forms part of the description of the current state of the design.

5.9.3 Simplified View

To address the feedback in Evaluation Stage I regarding issues with navigation and layout complexity (Section 4.14.2), a toggleable simplified view (Figure 5.8) was introduced. This view removes the character storylines and their algorithmic arrangement, leaving only the chapters aligned in order. By focusing solely on chapter progression, this view offers a clean and minimalistic representation, ideal for users who might find the full layout overwhelming.

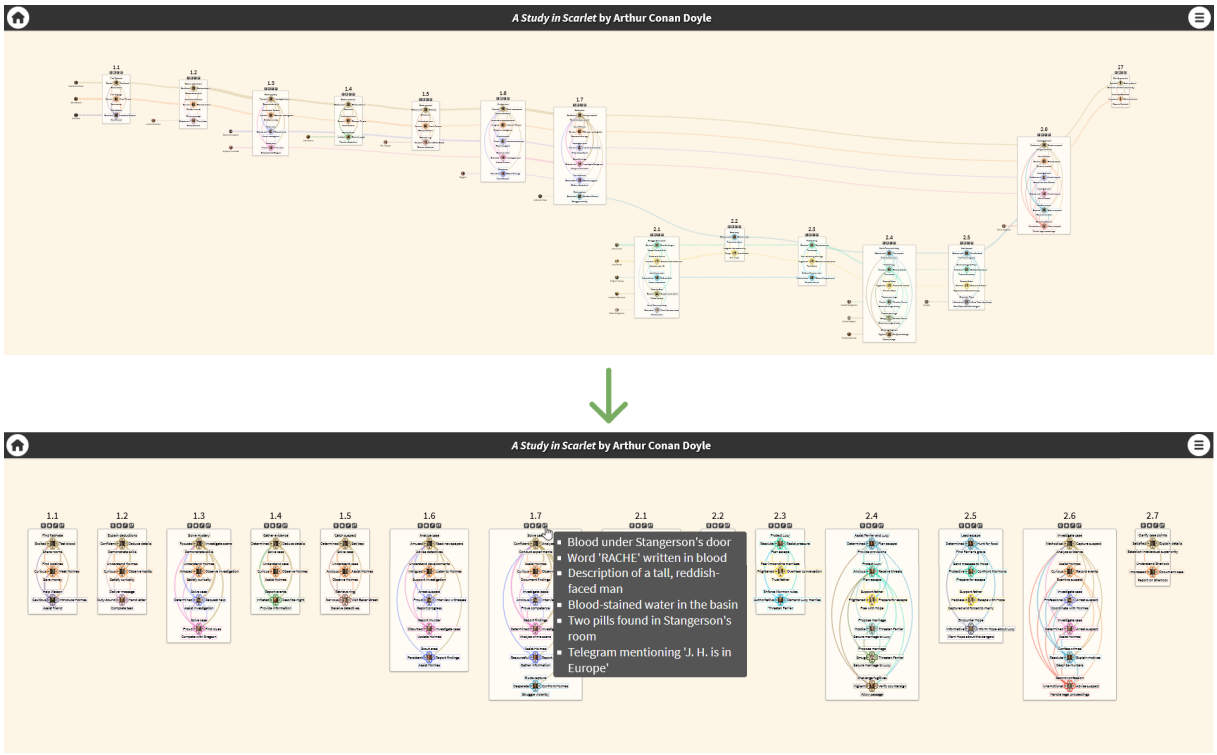

FIGURE 5.8: An example of the change between the storyline view and simplified view of the *A Study in Scarlet* visualisation. The toggle to switch between the views is located in the *Settings* menu tab.

The simplified view toggle – located in the *Settings* menu tab – allows users to switch seamlessly between the detailed storyline and simplified layouts, providing flexibility to accommodate different preferences and tasks. For example, casual readers may prefer the simplified view for an initial exploration of the text, while those who enjoy following the individual paths of characters might find more enjoyment in using the storyline view. This toggleable feature ensures that the visualisation is accessible to a wider range of users, including those less familiar with slightly more complex visual encodings.

5.9.4 *About This Book* Tab

An *About This Book* tab was added to the menu (Figure 5.9) in response to the desire expressed in Evaluation Stage I for more context regarding the story (Section 4.14.2). For each book visualised, it includes the book cover, details about the author, the context in which the novel was written, and a short blurb.

A book's cover and blurb are often the first elements a potential reader encounters, playing a significant role in engaging readers and encouraging them to pick up the book. The cover functions as a visual representation of the novel content, themes or characters, providing cues as to what it contains. Studies in publishing and marketing suggest that an effective cover can create an emotional connection, sparking curiosity and aligning with readers' genre preferences (Baverstock, 2015). For casual readers, the cover serves as an immediate, accessible invitation to explore further, which may influence their decision to read the book (Baverstock, 2015).

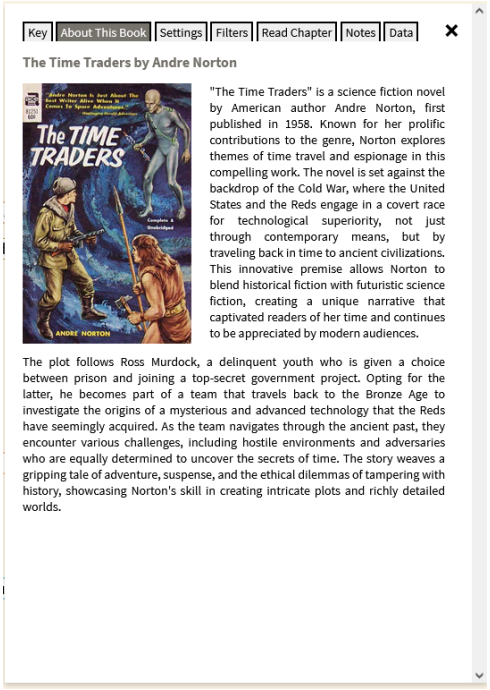

FIGURE 5.9: The *About This Book* tab opened in the visualisation menu provides information about the visualised novel.

In tandem with the cover, the blurb offers a concise summary crafted to engage the reader without revealing too much. A well-written blurb highlights key elements of the story, giving readers just enough information to hook their interest while raising questions that provoke curiosity. Blurbs often play a persuasive role, helping readers decide whether a book aligns with their reading preferences by offering a glimpse into the narrative style, central conflicts, and emotional tone of the novel (Moody, 2007). During this design stage, I considered how for casual readers, the blurb can act as a guide to the visualisation, setting expectations and making the book more approachable by summarising its essential elements in an engaging way. This may then set the scene for deeper engagement with the visualisation itself.

5.9.5 *Data* Tab

I added a data editing form to the menu (Figure 5.10) to support end-users to modify or update the AI-generated textual data, if they so desire. This enhancement aims to allow for more personal summary generation, as users can tailor the presentation to suit their perspectives and discussion outputs. I rationalise the integration of this feature in response to the need for greater interpretative flexibility when engaging with data that has been subjectively interpreted from a novel. This feature allows users to modify the character personal dynamics and other textual summaries – including the newly added contextual markers – giving them the freedom to adjust the visualisation according to their personal interpretation of the narrative. The intention behind this enhancement was to empower users to actively engage with the data, reflecting their own insights and interpretations of character relationships, motivations, and actions; as personal interpretation is central to casual readers' engagement with literature (Hartley & Turvey, 2002; Pianzola et al., 2020; Rebora et al., 2021). This reflects reader-response

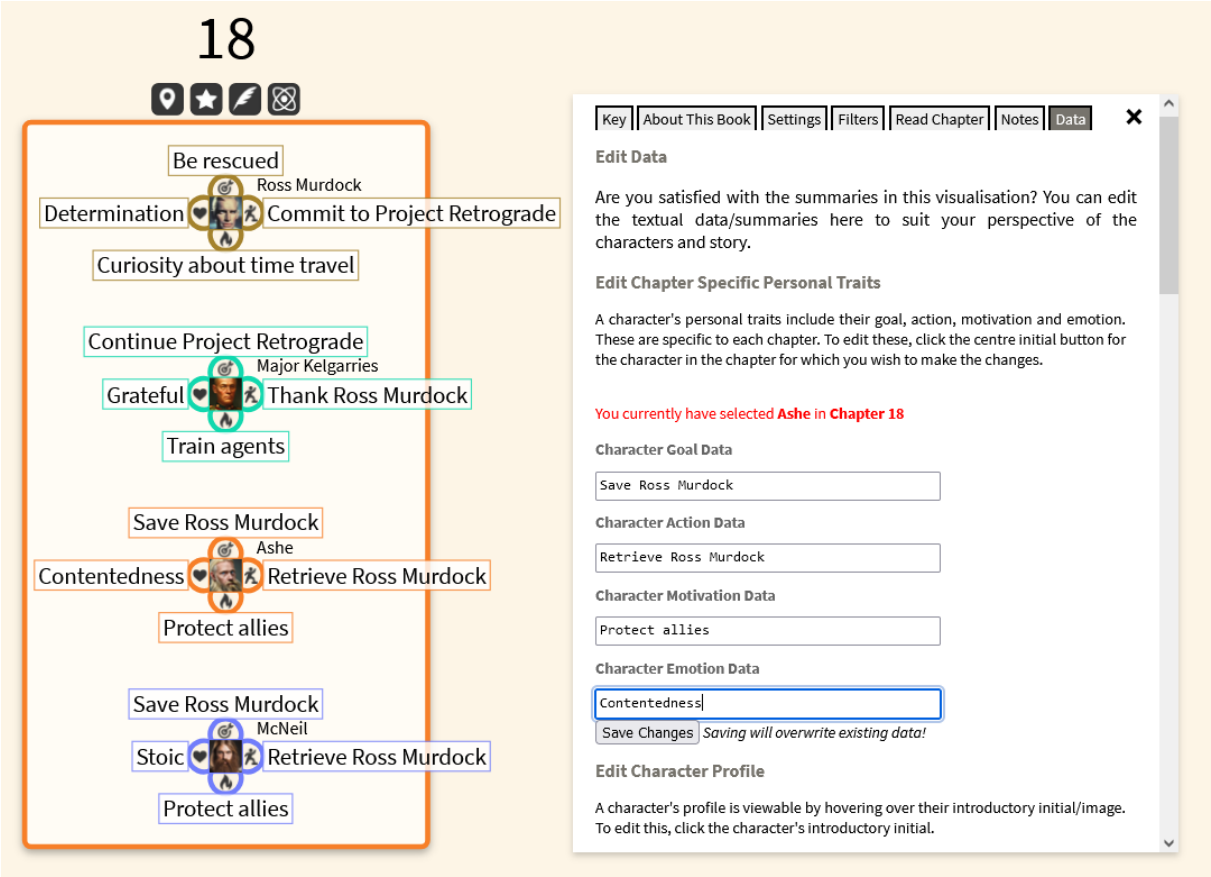

FIGURE 5.10: The *Data* tab in the visualisation menu allows end-users to edit all textual data in the visualisation.

theory, which highlights how readers actively shape the meaning of a text through their personal engagement with it (Iser, 1978). With this addition, the visualisation design recognises and supports the role of the reader in co-creating meaning, as this is negotiated between the reader and the text (Fish, 1980).

This addition also supports a participatory approach to literary visualisation in collaborative settings. Reading groups or online communities can modify the data to reflect a consensus on textual features or use the changes as a basis for debate. Any modifications can be downloaded as a JSON file directly from the menu. Looking ahead, I plan to expand this feature by allowing users to upload JSON files to replace visualisation data and to generate shareable links for personal interpretations. These additions aim to foster multiple interpretation sharing within online communities, enhancing the visualisation's capacity for collaborative engagement.

5.10 Technical Implementation

The technical pipeline at this stage was similar to that of Study I (Figure 4.24), however, in Study I, the focus was on character dynamics data. In this study, contextual markers were added, adding a new layer of data generated using ChatGPT. The number of elements in the visualisation that directly visualise textual data points/summaries is shown in Table 5.4. This

is a high amount of character-centric and contextual narrative information integrated into a singular visualisation layout, which reflects an initial goal of creating a textually enriched visualisation of characters in novels.

TABLE 5.4: The visualisation elements that display AI-generated textual data.

Textual Data Element	**What the Element Summarises in the Visualisation**
Character profiles	Short descriptions of the characters and their roles in the story.
Chapter summaries	Short summaries of what happens in each chapter.
Personal traits	Characters' salient goals, actions, motivations, and emotions per chapter.
Settings	Specific locations and/or time periods in which the events of each chapter take place.
Key events	Significant incidents or occurrences that drive the plot forward in each chapter.
Plot function	The significance and/or purpose of each chapter within the overall narrative.
Clues	The clues discovered in each chapter, including items, people, and events of interest (detective fiction datasets only).
Advanced technologies	The advanced technologies mentioned in each chapter (science fiction datasets only).
About This Book tab	The novel's author, significance, genre, and a short blurb.
Character goals	What the character is trying to achieve or are told to do in a chapter.
Character actions	The character's key action, reaction, behaviour or state in a chapter.
Character motivations	The reason for the character's goal and/or action in a chapter.
Character emotions	The character's most prominent, persistent or key emotion displayed in a chapter.

In terms of scalability and ease of implementation, the visualisation remains costly, as transferring the structured JSON outputs into the final JSON file is still required. However, this effort results in a richly detailed representation of the characters – both major and minor – including their transformations, social interactions, and the evolving narrative dynamics that provide context to their appearances. This limitation, and the opportunities it presents, are expanded on in the Discussion chapter in Section 6.7.3.

I made one adjustment to the character personal dynamics data, and that was to revise *meanSentiment* to *salientEmotion*. This change addresses feedback from Evaluation Stage I (Section 4.14.2), where dialogue sentiment polarity was found to be a confusing representation for character emotion. While *meanSentiment* aimed to quantify emotional tone, it often oversimplified the complexity of a character's emotional state. By focusing on the dominant emotion expressed by a character in a chapter, *salientEmotion* provides a more nuanced and contextually accurate representation of character dynamics when viewing their evolution. Additionally, ChatGPT's ability to summarise emotions from text streamlines data extraction, as the personal dynamics data prompt can generate all four personal traits (Appendix C). To reflect this update,

the data description now reads: "The character's most prominent, persistent, or key emotion displayed in the chapter"; which is also what is supplied in the prompt.

5.11 Contextually Enriched Character-Centric Literary Visualisations

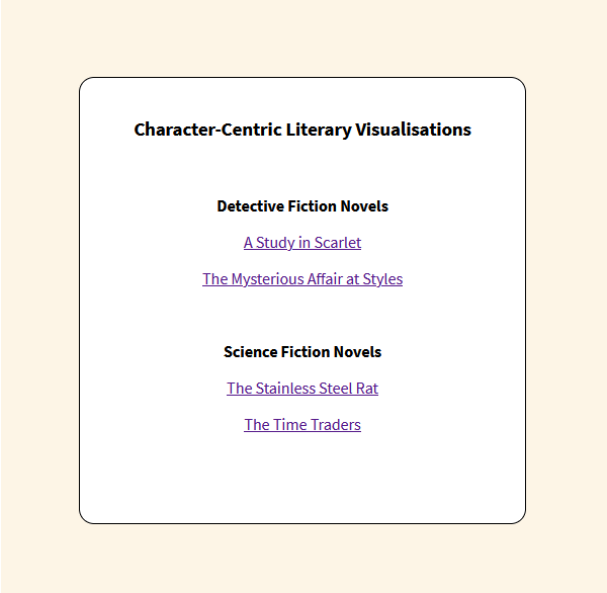

FIGURE 5.11: The visualisation landing page used in Evaluation Stage II to host access to the four study visualisations.

The final design outputs of Design Stage II were four new novel visualisations, using the full texts from Project Gutenberg (Project Gutenberg, 2024) to create the datasets. For Evaluation Stage II (Section 5.12) the visualisations were hosted on a simple portal to ensure the participants were focused only on the visualisations (Figure 5.11). I have since made the visualisations available to experience and explore in detail online:

- *A Study in Scarlet* visualisation[2], shown earlier in Figure 5.8.
- *The Mysterious Affair at Styles* visualisation[3], shown in Figure 5.12.
- *The Stainless Steel Rat* visualisation[4], shown in Figure 5.13.
- *The Time Traders* visualisation[5], shown in Figure 5.14.

5.11.1 Informal Demonstrations of the Visualisations

Prior to Evaluation Stage II, I received informal feedback through casual demonstrations of the visualisations at both the university and among my personal connections. These interactions provided positive reinforcement that the design was aligning with my goals, as the updated visualisations were received well.

[2] *A Study in Scarlet* visualisation: `https://natalie.house/study_ii/asis`
[3] *The Mysterious Affair at Styles* visualisation: `https://natalie.house/study_ii/tmaas`
[4] *The Stainless Steel Rat* visualisation: `https://natalie.house/study_ii/tssr`
[5] *The Time Traders* visualisation: `https://natalie.house/study_ii/ttt`

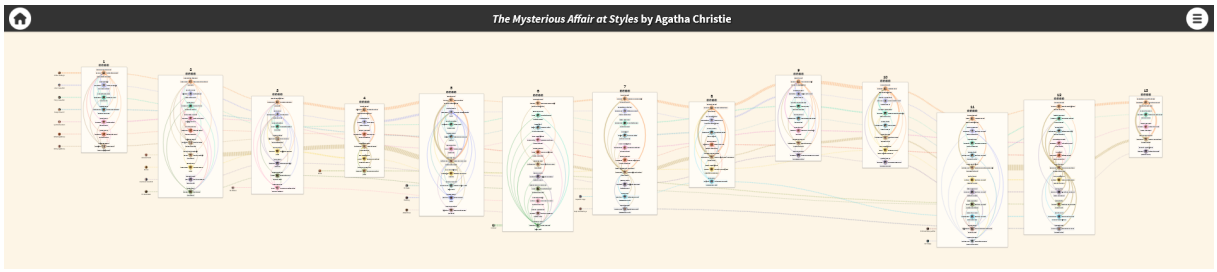

FIGURE 5.12: The overview of the *The Mysterious Affair at Styles* visualisation.

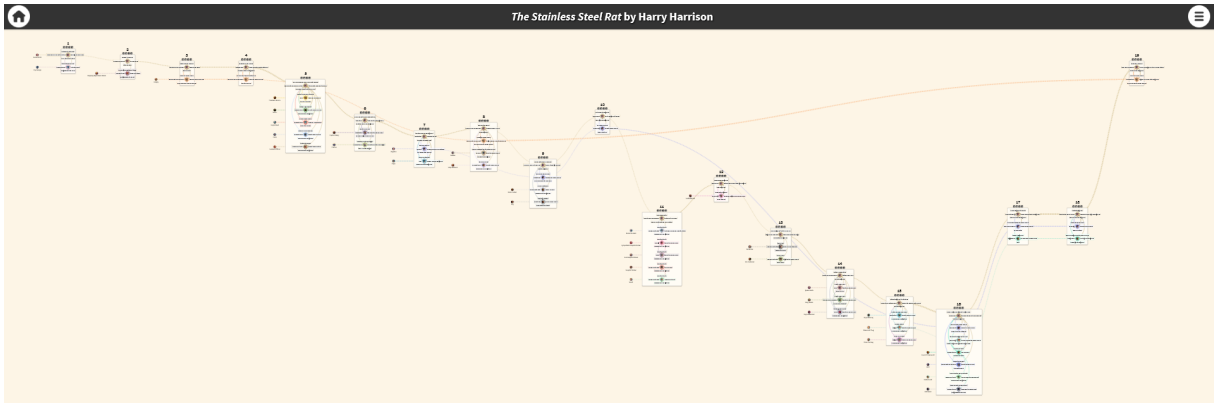

FIGURE 5.13: The overview of the *The Stainless Steel Rat* visualisation.

The informal settings allowed me to gauge whether the visualisation technique was intuitive and if it encouraged engagement with the novels among casual end-users. Encouragingly, the visualisations naturally became a focal point for discussing the characters and narratives. Most people used a visualisation to explore character identities, remark on the overall structures of the novels, and to pose questions regarding how the datasets were populated with so much textual detail.

After these interactions, I considered the visualisations ready for the second formal evaluation, where it would be used in focused discussion sessions.

5.12 Evaluation Stage II

Evaluation Stage II captures the second formal evaluation I conducted in this project. The *Clover Connections* layout was again central to the study, but this time the primary goal was informed by the Study II Research Question (Section 1.5), which seeks to understand how non-experts in literary analysis intergrate character-centric literary visualisations into casual book discussions. To answer the question, I devised a book-club scenario focus group methodology with a supplementary experience questionnaire. The complete methodology and its procedure, including the grounded theory analysis approach used to analyse the data, are described in detail in the Methodologies chapter in Section 3.9.1.

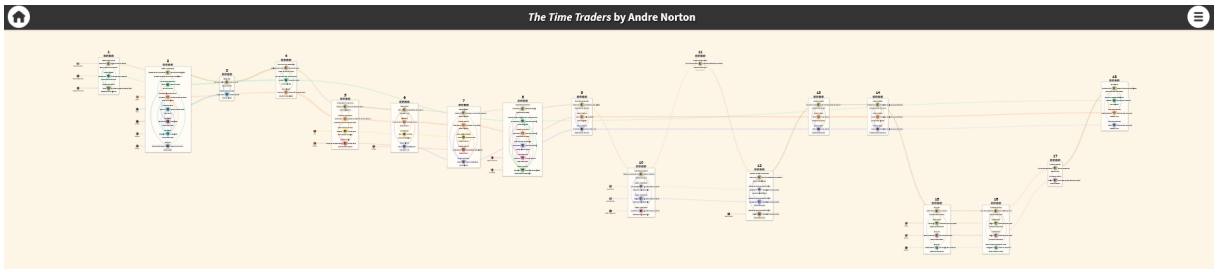

FIGURE 5.14: The overview of the *The Time Traders* visualisation.

5.12.1 Participants

Burns et al. (2023) identified core issues regarding participant recruitment in non-expert targeted visualisation evaluations. The primary concern for many published studies is that inclusion and exclusion criteria were not clearly defined in relation to the purpose of the visualisation. Hence, I defined the following inclusion and exclusion criteria to govern participation recruitment and selection for the evaluation.

Inclusion criteria:

- Has attended, or is interested in attending, a book club
- Committed to reading an entire novel
- Would enjoy discussing novels and characters with others

Exclusion criteria:

- Expert in literary analysis
- Student or professional in a field related to information visualisation

Similarly to Evaluation Stage I, I used a snowball/referral sampling method in order to conduct targeted participant recruitment.

The inclusion and exclusion criteria significantly impacted participant recruitment, compounded by the challenge of coordinating availability. For example, some individuals who were available but not particularly interested in reading a novel were excluded, while others with strong interest and relevant book club experience were unable to commit the necessary time. This highlights a key challenge in non-expert studies: balancing participant interest, availability, and suitability within the constraints of the research design. Interestingly, this reflects a similar issue encountered when recruiting experts for visualisation evaluations (Elmqvist & Yi, 2012), which was discussed in the Literature Review in Section 2.10.3, suggesting that strict inclusion and exclusion criteria are a common limiting factor.

This challenge suggests that non-expert literary visualisation studies might benefit from engaging with predefined user groups – such as designing for an existing book club or online community group – and adopting a co-design framework to align with their specific shared goals and interests. However, to ensure generalisability of the visualisation design across various reference and recall scenarios, a co-design approach was avoided.

Ultimately, 18 people in total were confirmed suitable to participate in the study, two of which later ceased their interest. 16 people were then provided with further information, from which 13 participants confirmed their availability. All participants were recruited on a voluntary basis.

5.12.2 Participant Groups and Pilot

Three of the 13 partcipants opted out before I began running the sessions, but after having confirmed attendance and willingness to read the novel. I questioned whether this was due to the pressure of reading a novel prior to the study, but did not pursue this inquiry so as to ensure they did not feel guilted or pressured into participating.

Instead, I adapted my approach in response to this challenge, and decided to test the visualisations with different group sizes. Figure 5.15 illustrates the allocation of the **10 participants (P1-10)**. Four of the 10 participants (P1, P6-8) had prior exposure to the original version of the visualisation technique (used in Study I), but none of the participants had seen the visualisations of the four novels used in the study. Because of their prior exposure, P6, P7 and P8 were placed in the same group so as to avoid potential influence on participants completely new to the visualisation technique.

TABLE 5.5: Group allocations and IDs for participants in Evaluation Stage II.

ID	Group	Literary Discussion Experience
P1	Pilot	Informal Gatherings; Book Clubs or Reading Groups; Secondary Education
P2	Group A	Informal Gatherings; Secondary Education
P3	Group A	Informal Gatherings; Book Clubs or Reading Groups; Secondary Education; Tertiary Education
P4	Group A	Informal Gatherings; Secondary Education; Tertiary Education
P5	Group A	Online Forums or Social Media; Secondary Education
P6	Group B	Online Forums or Social Media; Informal Gatherings; Book Clubs or Reading Groups; Secondary Education
P7	Group B	Book Clubs or Reading Groups; Secondary Education
P8	Group B	Informal Gatherings; Secondary Education; Tertiary Education
P9	Group C	Informal Gatherings; Book Clubs or Reading Groups; Secondary Education
P10	Group C	Informal Gatherings; Secondary Education

A pilot study was conducted with P1 to test and refine the approach. The outcomes demonstrated that the visualisations could be seamlessly integrated into discussions, justifying the continuation of the method. However, the original questionnaire was deemed overwhelming, prompting a redesign to reduce the time required for participants to complete it. Further details on these adjustments are provided in the Methodologies chapter in Section 3.9.3.

5.12.3 Demographics

In the post-discussion questionnaire, participants were asked: *In which settings have you participated in discussions about novels with others in the past?* (Q1); this is tabulated in Table 5.5, along with participant IDs and their assigned groups.

The participants' occupations span a diverse range of fields, such as architecture, information technology, advertising, management, engineering, stay-at-home parenting, medicine, hospitality and finance. Participants consented to including this information. Professional fields are mentioned here for transparency in response to the findings of Burns et al. (2023) that non-expert visualisation studies often recruit from a single field or academic institution, or do not report the participants' backgrounds or occupations at all. Additionally, the participants represented a balanced distribution of genders.

5.12.4 Meeting Room Setup

In preparing the room for Evaluation Stage II, I experimented with different setups to ensure that the visualisations could be integrated into the discussions without significant technical and physical barriers. Initially, I tested using a large screen to display the visualisations, hoping that this setup would allow participants to engage with the content collectively. However, I soon realised that this configuration could potentially create a physical and psychological distance between the participants and the visualisations. I considered that the large screen could make it harder for participants to interact closely with the data, possibly hindering the natural flow of discussion as they viewed the screen across the room.

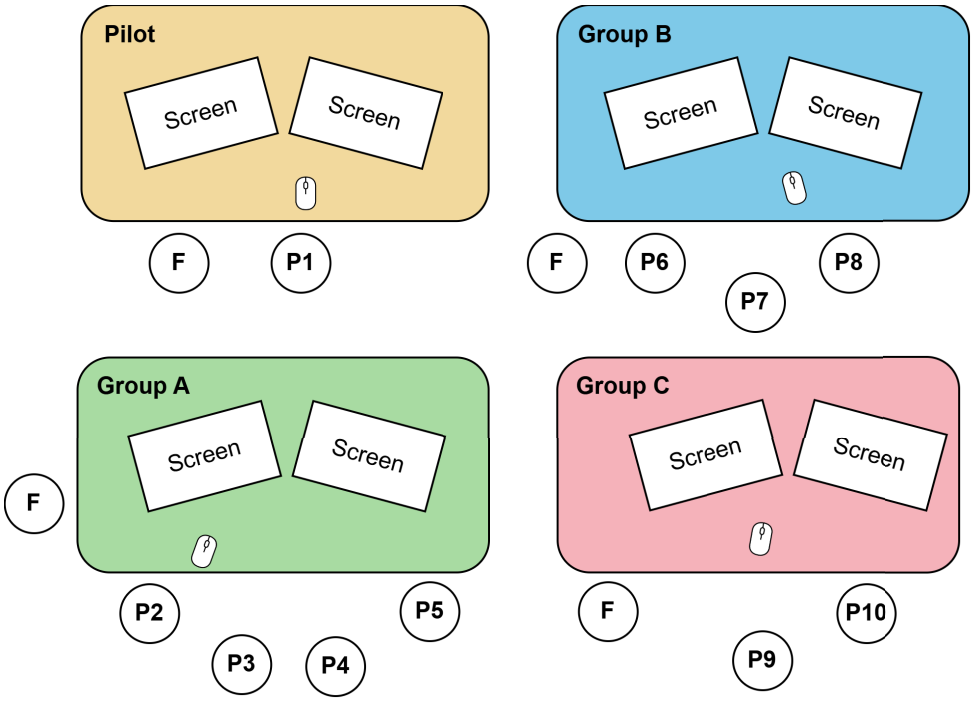

FIGURE 5.15: In each session, the participants were seated in front of two screens with one wireless mouse to share control of the visualisations. The facilitator (F) sat to the side.

After reconsidering the setup, I tested using screens placed directly in front of where participants would be seated, introducing a second screen to enable side-by-side comparison of different visualisations which I hoped would give participants a clearer way to engage with multiple visualisations simultaneously. This configuration felt more aligned with how non-experts in book club settings would access digital tools (likely using smaller screens or tablets rather than large projector-sized displays). By replicating the more intimate and accessible technology setups that casual readers might use in their own environments, I aimed to replicate a more realistic, non-expert user experience.

The final room configuration involved two screens – a laptop and attached monitor – to support side-by-side visualisation comparisons. A wireless mouse, connected via Bluetooth, allowed for easy navigation and interaction with the visualisations and could be passed around without interruption of a wire. A Bluetooth keyboard was also available, but placed to the side during most of the sessions. This keyboard was required if participants desired to edit the data. Each session was hosted around a long meeting table, providing ample space for the participants to engage with the setup. Figure 5.15 provides a visual representation of how participants were seated in each group in relation to the setup and facilitator.

Chairs were arranged along one side of the table, in a slightly curved formation, allowing participants to either face the screens directly or turn towards each other for discussion. This layout provided flexibility, enabling participants to focus on the visualisations during moments of analysis and then easily shift their attention to one another when engaging in conversation.

Once all participants were seated, the session commenced in accordance with the book-club scenario focus group methodology designed for the study. For a detailed explanation of the methodology, including its structure and administration, refer to Section 3.9.2 of the Methodologies chapter.

5.13 Data Analysis and Coding Process

After each session, I began the data analysis and coding process. This was conducted in line with Charmaz's constructivist grounded theory approach for qualitative data analysis (Charmaz, 2006). To revisit the rationale and data used for the grounded theory analysis method, see Section 3.10.2 of the Methodologies chapter. This section presents insights into the questionnaire results and coding process, which subsequently inform the qualitative findings.

5.13.1 Quantitative Post-Discussion Questionnaire Results

The quantitative data collected from questions 2 to 20 of the Post-Discussion Questionnaire (discussed in Section 3.9.3) provides valuable insights into participants' experiences with the visualisations and the accompanying discussion process. The questions were rated on a 7-point semantic differential scale, where a score of 4 indicates a neutral response, scores above 4 indicate positive evaluations, and scores below 4 represent negative responses.

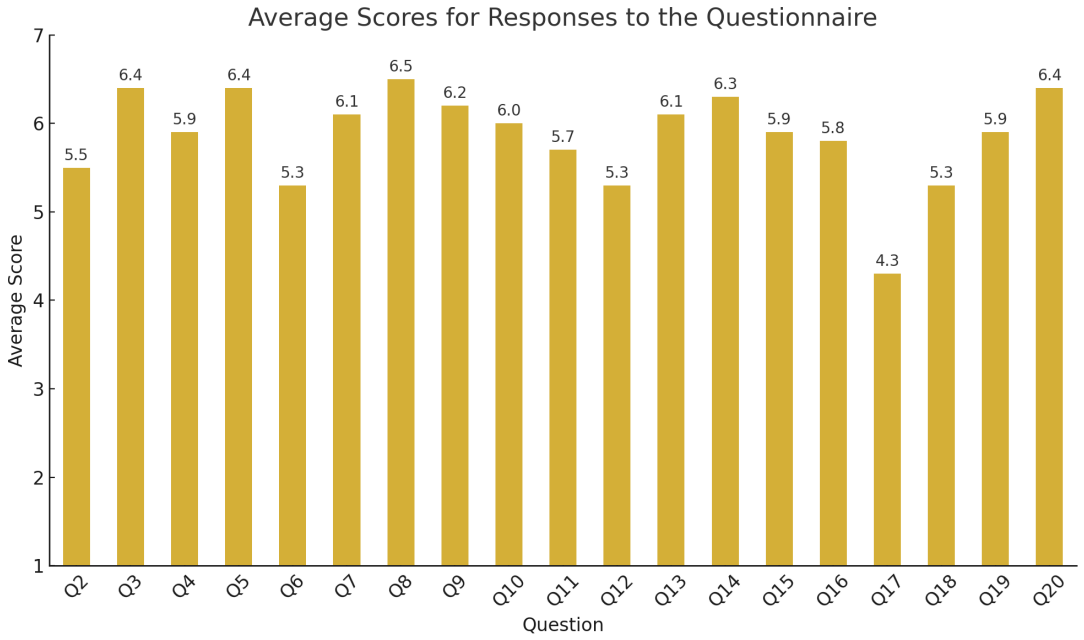

FIGURE 5.16: The average scores for the 10 participants' responses to Q2-20 in the Post-Discussion Questionnaire.

TABLE 5.6: The Post-Discussion Questionnaire results for Q2-20.

Q#	**Question Focus**	**Average Answer Range**	**Score**
2	Enjoyment of Reading ASiS	Slightly Enjoyable - Enjoyable	5.5
3	Completeness of Visualisation	Mostly Complete - Very Complete	6.4
4	Visual Perceptibility of Data	Somewhat Easy - Mostly Easy	5.9
5	Accuracy to Novel	Mostly Accurate - Very Accurate	6.4
6	Familiarity with Graphs	Somewhat Familiar - Mostly Familiar	5.3
7	Usefulness for Discussion	Mostly Useful - Very Useful	6.1
8	Support for Recollection	Mostly Effective - Very Effective	6.5
9	Aesthetic Appeal (Attractive)	Mostly Attractive - Very Attractive	6.2
10	Data Appeal (Engagement)	Mostly Engaging	6.0
11	Impact on Discussion Flow	Slightly Positively - Mostly Positively	5.7
12	Improving Novel Insights	Somewhat Helpful - Mostly Helpful	5.3
13	Influence on Collaboration	Mostly Positively - Very Positively	6.1
14	Comparison to Traditional Aids	Better - Much Better	6.3
15	Usefulness (Other Visualisations)	Somewhat Useful - Mostly Useful	5.9
16	Engagement (Other Visualisations)	Somewhat Engaging - Mostly Engaging	5.8
17	Locating Info Compared to ASiS	Neutral - Somewhat Easier	4.3
18	Comparing Visualisations	Somewhat Easy - Mostly Easy	5.3
19	For Selecting a Book to Read	Slightly Better - Better	5.9
20	Enjoyment of Visualisations	Mostly Enjoyable - Very Enjoyable	6.4

Overall, the results show a generally positive reception across multiple aspects of the visualisation, including its completeness, visual clarity, usefulness, and impact on discussion and collaboration. Notably, questions related to the visual appeal and effectiveness in supporting recollection received particularly high scores.

Table 5.6 presents a summary of each question's focus, the average range of responses given for each question, and the average score. Figure 5.16 offers a visual overview of these average scores, illustrating the consistently positive feedback from all 10 participants. The full questionnaire, as delivered to participants, is included in Appendix B, and Table 3.7 lists the complete set of original questions for reference.

Specific insights into how the quantitative and qualitative questionnaire responses correspond with the rest of the collected data were developed during the coding process.

5.13.2 Transcribing

After each session, I first reviewed the questionnaire responses, which helped later to further contextualise the participants' discussion transcripts.

I then began transcribing the data to capture participants' narratives in full detail. This process was an important first step, as it allowed me to immerse myself in the data, noticing nuances and patterns that might have otherwise gone unnoticed. As I cleaned the verbatim transcriptions, I also made notes/memos to factor in contextual elements such as pauses, intonation, and vocal emotional reactions (like "Ah!"). Charmaz (2006) emphasises the role of the researcher in co-constructing meaning with participants, and thus, my transcription process was not only about recording codes related to spoken words but also about interpreting how participants made sense of their experiences through triangulation with the other collected data, such as the written observations and screen recordings (see Section 3.10.2).

5.13.3 Open Coding

Following transcription, I applied open coding to break down the data into discrete open codes. The constructivist approach to open coding allowed me to remain flexible and open to what the data revealed, without being constrained by preconceived categories. I used line-by-line coding to engage with the data closely, generating initial codes that reflected participants' actions, interactions, and meanings. Often, one line would have multiple relevant codes applicable to it. This task was particularly exploratory, focusing on understanding what participants were saying and the processes they engaged in, rather than interpreting too deeply at this stage.

5.13.4 Memos

Throughout the coding process, I used memos as a way of documenting my thinking and reflections on the emerging codes. Memo writing helped me articulate insights about the data and the coding process. These memos help track the development of codes but also to reflect on my role as a researcher and how my own interpretations shaped the emerging analysis.

A	41:14	P4	didn't have the mental capacity to store everything. I think the clues really came back, like in, yeah, probably like this part, like 2.6 were like, oh, here's the grand reveal. Like, if you kind of were now following Jefferson Hope, like back in London, and he had a... oh, yeah, he had like a monologue part, I think, in this in the book, right. And then that part was when all the clues like fell into place for me. The first part, I really didn't retain that much of the clues. Yeah. Or like arranged in my head. Yeah.	P4 considers that readers do not have the mental capacity to store all the clues and must therefore be simply taken along for the ride	Acknowledges mental overload; Low recollection; Cognitive overload; Visualisation supports recollection; Difficulty arranging the information inside the mind; Visualisation organises information; Too many clues to keep track of mentally
A	41:54	P5	Yeah.		
A	41:57	P5	Yeah, can't say that, I would have liked reading it that I knew much. Like, part two was quite pivotal to figuring it out. So like, from part one I didn't mind it, because I felt kind of like, I'm in Holmes, sorry, you know, in Watson's shoes. So it's not like, I was experienced in this and he wasn't experienced. And you can see here, he was curious, he was anxious. He was intrigued, like he didn't necessarily know,	P5 uses the character traits to establish his point	Referring to personal dynamics to make a point; Describing characters with their emotions
A	42:25	P5	as the case evolved, it's kind of clear that it's a murder, two guys, blood on the wall, like it's probably, you know, revenge or serial killer type. So you kind of know that it's definitely a murder and there's more to it. And then, like P4 mentioned, there's some like, the ring and things like that, that kind of take you down different paths. But it's not clear to you until you start part two, then part two, as soon as like, you're kind of brought into this Mormon community, you know, okay, potentially, like this is going to be linked, and they're going to be the bad guys. And as Lucy is kind of key to it, like she is probably going to be involved in it quite significantly. So I kind of got at that point, what was going to happen and that it was going to be connected to those murders in London.		Describes detective case evolution; Clues development; Clue reveals; High data familiarity; High interpretive confidence; Technical proficiency; Characters as key or secondary players
A	43:11	P5	And then kind of followed through and turned out to be the case. But what's interesting, I suppose is around the investigation, and then the relationship at the end in terms of Holmes and Watson kind of like, you know, Watson finishing his first case, potentially, and		Protagonists' relationships discussed in detail; Protagonists' relationships considered central to the plot
A	43:28	P5	and I guess what it says here impressed	P5 refers to character's sentiment to make a point	Refers to character emotion to make a point; Visualisation integrated into discussion; Discussion flow
A	43:31	P5	and probably wanting more, and like to be part of more cases like that. So I think ultimately, can't say that I knew it was going to be about a Mormon murder revenge, kind of revenge killing, or anything like that. Sorry, I could be aware that it was going to be about a revenge or something along those lines, but could not have known anything about, kind of, the reasons behind it.		Reflection on personal interpretative ability; Interpretive confidence; Casual domain knowledge; Questioning ability; Self conscious
A	43:52	P5	And that motive. And who did it until those characters were introduced in part two, and then slowly, kind of 2.3, 2.4, 2.5, was all kind of obviously revealed.	P5 refers to the chapters as they are labelled in the visualisation, not by their actual chapter titles	Counting chapters; Listing chapters
A	44:04	Facilitator	P2?		Discussion flowing
A	44:10	P2	I reckon I'm very similar to everyone else. I think, for me, it was like, Sherlock's got this. Like he knows everything already. He's going to figure it out. So like, yeah, maybe, and the other thing I was just thinking then, I'll see where he was talking... Maybe if the clues were a bit more explicit, like, maybe we're just too dumb, in the 21st century, or whatever. It's like, if the clues had been like, he wrote Mormon in blood on the wall, when it went to like,		Locating character relationships; Relationships discussed in terms of dialogue; Social dynamics accurate; Desire for explicit clues in the text; The visualisation makes the clues explicit; Low interpretive confidence; Reflection on personal intelligence
A	44:11	P3	Ha ha ha.		Laughter
A	44:12	P4	Ha ha.		Laughter
A	44:40	P2	Or whatever, when part two kicked over, I would have been like, definitely this dude. Like, you know what I mean, and just right from the start, I would have seen that connection. But yeah, P5's right, it's definitely going to be revealed. I was like, I'm happy to just come along for the ride and not really investigate the clues myself to try and figure out what they are. And just sort of let it be revealed.	P2 refers to a point made by P5, showing that the conversation is flowing and there is a continuation to points being made; P2 explains that he as a reader is happy to take a passive role and not attempt to solve the mystery	Casual language used to describe characters; Discussion flow; Agreement with other participants; Passive reader; Going with the flow; Allowing clues to be revealed; Clues not analysed when reading

FIGURE 5.17: Portion of the transcript for Group A's discussion of the read novel.

5.13.5 Refining Open Codes

As I collected more data, I continuously revisited and refined my open codes, allowing for more abstract and higher level concepts to emerge. As sessions were coded, I compared these codes with existing codes from previous sessions, merging similar codes and refining others to better capture the complexity of participants' experiences. This ongoing process of constant comparison ensured that the analysis remained grounded in the data while evolving to reflect broader concepts captured among all the discussion sessions.

Figures 5.17 and 5.18 show examples of the transcripts for the different components of the discussion session. The last column in each example shows the codes assigned during the open coding phases, which were continually refined as new data were added. The column to the left of this was used to document notes, written observations and screen interactions related to the same timestamp.

5.13.6 Focused Coding

I then worked to group related codes into more focused codes. This allowed me to explore the relationships between open codes, categorising how certain actions or concepts were related. However, a significant amount of overlap emerged during this process, as certain codes appeared across multiple contexts, making it challenging to distinctly allocate them to a single axial code. Rather than forcing rigid distinctions, I embraced this overlap, recognising that the fluid nature of the data reflected the complexity of participants' experiences. This phase

B	11:03	P7	Science fiction, Harry Harrison, from the 1960s.		Remarks on genre, author, year written
B	11:18	P7	Ah, an antihero.		Domain knowledge; Character archetype - antihero
B	11:19	P6	[reading from the menu] Harrison's writing is infused with humor and satirical elements. A light hearted and thought provoking exploration. So it sounds enjoyable.		Reading the About This Book Aloud; Sharing the visualisation; Forming an opinion based on the blurb
B	11:20	P8	Hmm.		Passive agreement from quiet participant
B	11:21	P7	Yeah.		
B	11:36	P6	Yep, I like the sound of that one.		
B	11:38	P6	It'd be something different to what I would normally read.	P6 remarks that the visualisation has made her consider a novel that is different to what she would normally read	Visualisation sparks interest in a novel that a participant would not typically read
B	11:41	P7	Pretty short chapters!	P7 looks at the full text and discovers the chapters are quite short	Reviewing the Full Text helps to determine book length; Desire to know the length of the novel; Reading time is a factor in book selection
B	11:45	P7	Might be a quick read?		Hopeful for a quick read; Casual reading
B	11:49	P7	That works for me.	P7 prefers a quick read (shorter novel)	Establishing a preferred novel
B	11:52	P7	All right, so that's a science fiction one.		
B	11:57	P7	Lots of different technology throughout. Advanced surgical techniques, robot controlled surgeries, sounds pretty good.	The technology descriptions entice P7 into reading the novel	Reading Advanced Technologies aloud; Advanced Technologies feature makes the book sound interesting
B	12:08	P6	It does.		Interest in the novel based on the Advanced Technologies feature
B	12:21	P7	What's the last one? The Time Traders.		High technical proficiency; Fast change of primary visualisation; Ease of comparing two visualisations
B	12:27	P7	How many chapters is this?		Desire to know length of novel
B	12:28	P6	Can we have a look at the summary?	P6 wants to read the About This Book before looking at the visualisation	Integrating the visualisation into the discussion; Asking another participant to navigate the visualisation; Passive viewing; Engaged but not driving the visualisation; Desire to read the About This Book tab
B	12:29	P7	Yep.		Group dynamics; Group consensus; Group cohesion; Respectful collaboration

FIGURE 5.18: Portion of the transcript for Group B's exploration of the unread novels.

helped to highlight central phenomena while allowing for flexibility in how codes were conceptualised. By focusing on relationships between codes, I built a more cohesive theoretical framework, acknowledging that participants' experiences often intersected across multiple dimensions. The overall process resulted in the refinement of 27 focused codes to report on.

5.13.7 Categories

I then proceeded to identify core categories that would form the backbone of the emerging theory (Figure 5.19). The 27 focused codes were grouped under six overarching categories – **Adopting the Technology**, **Collaborating with Others**, **Interpreting Visual Encodings**, **Consulting Textual Data**, **Drawing on Domain Knowledge**, and **Reacting Emotionally** – to structure the reporting of the findings. While overlap between codes persisted, each code is reported within its most relevant category, providing a comprehensive yet accessible account of participant engagement.

Figure 5.19 visually summarises the overlap between focused codes among different categories, reflecting the complexity of the phenomena under investigation and the constructivist grounded theory analysis approach's emphasis on honouring the depth and diversity of participant perspectives.

The overlap demonstrates the fluidity of the constructivist approach to grounded theory analysis, where repeated interaction with the data reveals interconnected patterns and evolving

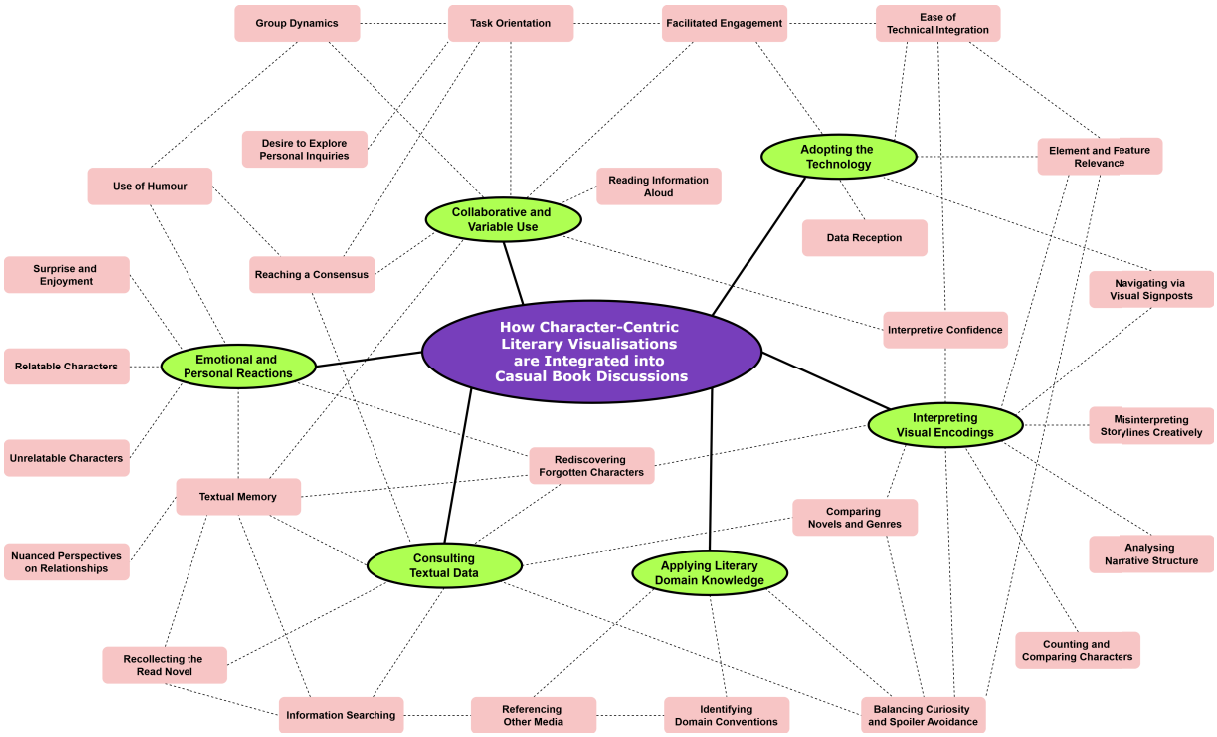

FIGURE 5.19: This diagram shows the organisation of the focused codes (pink) into categories (lime ellipses), where overlaps across multiple categories reflects the complexity of the phenomena under investigation.

interpretations through the co-construction of meaning. The overlap also highlights the complexity of participant behaviours and the multifaceted ways in which the presence of character-centric literary visualisations influence casual book discussions.

5.14 Findings

The final stage in my analysis involved synthesising interpretation of the codes and categories into a cohesive grounded theory to report on. As is integral to the constructivist grounded theory analysis of data (Charmaz, 2006), I did not aim for an objective theory but rather a co-constructed understanding that reflected both participants' experiences and my own interpretations. These categories and focused codes are discussed with supporting evidence from the data in the following sections.

5.14.1 Adopting the Technology

Codes discussed in relation to the category of Adopting the Technology include: Facilitated Engagement, Ease of Technical Integration, Element and Feature Relevance, and Data Reception.

Facilitated Engagement

The discussion prompts were designed to encourage participants to engage with the visualisation in a manner consistent with prompts commonly employed in book clubs. This approach

aimed to integrate the technology seamlessly into the discussion format, minimising disruptions while facilitating its use. However, the open-ended nature of the prompts meant their role in directing participants toward *specific* elements of the visualisation was not consistently achieved. Instead, the prompts frequently acted as a catalyst for broader reflections, enabling participants to explore their own interpretations and determine independently when and how to engage with the visualisation.

For example, P4 experienced difficulty interpreting the prompt "How did the interactions between characters impact how the events unfolded?" (DP2 in Table 3.6). This required the facilitator to adjust the phrasing to better suit the discussion's informal atmosphere and support participant understanding. The revised prompt was delivered in a more conversational manner:

> "Were there any relationships that sort of stood out to you as like, 'this is a good relationship' or 'this is a weird relationship'?" (Facilitator)

This adjustment underscores the challenge of balancing the structured requirements of evaluation with the need to preserve the relaxed, collaborative dynamic typical of book club discussions. While structure was essential for ensuring methodological rigour, maintaining an informal tone was equally important for fostering participant comfort and encouraging authentic engagement with the technology. In the feedback section of the questionnaire, P4 highlighted the positive impact of this balance:

> "Really well organised session, and participants were made to feel at ease and can openly provide their thoughts." (P4)

The prompts functioned both as a guide for engaging with the visualisation and as an entry point for broader participant-driven exploration. This suggests that while the prompts provided structure, their primary value lay in enabling open-ended interpretation, which allowed participants to engage with and adopt the technology at their own pace and according to their individual perspectives. This highlights the need for carefully designed prompts and facilitation techniques that promote the adoption of visualisation tools in informal, discussion-based contexts, ensuring that they are both accessible and effective for participants with varying levels of comfort.

Ease of Technical Integration

Participants' varying levels of technical proficiency influenced their ability to integrate the visualisation into discussions. Those less comfortable with the technology often depended on others for navigation, yet still engaged actively with the tool's role in the discussions. For instance, P9 frequently relied on P10 to navigate the visualisation rather than taking control themselves, giving directions to P10, such as, "Scroll down, scroll out." Other participants, like P4 and P6, required additional time to locate specific details. In these cases, they often set expectations before navigating:

> "I'll just find where it is." (P6)

Conversely, participants such as P1, P2, P5, and P7 seamlessly integrated the visualisation into discussions, using it effectively to anchor their points with minimal disruption to their thought processes. For example, P2, while navigating, engaged the group by saying, "Can you guys remember at the start of 2.1?" before swiftly locating the relevant chapter to support their point. This kind of integration aligned closely with the envisioned use of the visualisation but reflected a higher level of technical proficiency, akin to my own.

Interestingly, participants with stronger textual memory, like P8, used the visualisation sparingly, while others, such as P9, found it challenging to align the tool's use with the discussion flow. Despite these challenges, most participants eventually adapted their approach, aligning their thoughts with the visualisation once the necessary information was located. This demonstrates that, even with an initial learning curve, the visualisation effectively supported literary discussions.

Despite demonstrating ease in using the visualisation system during the study, P2 noted in the freeform feedback (Q21) that increased familiarity with the interface would enhance its value:

> "I feel like once I became more familiar with the user interface of the data vis, it could become a valuable tool to enhance a discussion." (P2)

While P4 suggested that a more detailed demonstration could have eased the initial challenges:

> "Would have loved a more detailed demo from the facilitator." (P4)

Overall, the visualisations were rated as having positively impacted flow and quality of the discussions, as reflected in the questionnaire results for Q11, which gained an average score of 5.7 out of 7. However, lower individual scores suggest that the visualisation still has room for improvement in terms of its ease of technical integration.

Element and Feature Relevance

The menu system was predominantly utilised to access the *About This Book* tab and to locate details in the full text via the *Read Chapter* tab. Filters, despite being intended to reduce visual complexity or isolate specific elements in the interface, were not used at all during the discussions. This could be attributed to the group setting, which constrained the ability to explore personal inquiries in detail (see Section 5.14.2).

Participants most frequently referred to character storylines, chapter appearances, personal dynamics data, chapter summaries, and character profiles. Several participants noted the advantage of being able to view all characters in the novel during discussions. P10 summarised this as also being a transferable benefit for other texts:

> "Sometimes in books there's so many characters, I have to go back and see, even when you're reading an article, you know, in a newspaper." (P10)

This capability also facilitated the rediscovery of forgotten characters, a point discussed further in Section 5.14.4. The settings element was referenced multiple times across all groups and appeared to effectively address participants' desires to recall or learn about the locations

where chapters took place. For example, P6 used the settings element to describe their feelings regarding the location shifts in chapter 2.1 of *A Study in Scarlet*:

> "The Great Alkali Plain, the Sierra Blanco, the caravan route ... makes it all sound very unappealing, and very alien." (P6)

In other instances, the settings element was not referred to, as the general atmosphere was described instead of specific textual details regarding locations. For example, P8 described the setting of a chapter in *A Study in Scarlet* as a source of tension:

> "I liked the atmosphere ... when they were trying to escape." (P8)

Similarly, P1 described a sequence of events in *A Study in Scarlet* as creating a "spooky scene". These observations suggest that a less literal interpretation of settings could also be valuable to visualise, although this approaches the realm of personal interpretation rather than accurate textual representation.

For the read novel, the key events elements were occasionally referenced, but chapter summaries and personal dynamics data appeared sufficient to prompt recollection during discussions. Clues were moderately referred to for the read novel, whereas advanced technologies proved popular for exploration in the unread novels. This demonstrates that integrating specific genre elements into the visualisation adds a contextual layer that enriches both recollection and exploration. However, in the unread novels, key events and clues were often avoided due to spoiler concerns (see Section 5.14.3).

The plot function feature was the least referenced and was occasionally mistaken for the chapter summary, as in some circumstances it offers a shorter recap of a chapter. This overlap suggests an element of redundancy in its current implementation. To address this, future iterations will involve refining the prompt provided to ChatGPT to generate more distinctive information that explicitly identifies a chapter's narrative role – whether as an introduction, conflict, or resolution. Consequently, this feature could become optional depending on the visualisation's usage scenario.

Data Reception

Participants rarely questioned the AI-summarised textual data used in the visualisations, but in two separate instances, both P1 and P7 critiqued the use of the word "unctuous" to summarise a character's emotion in chapter 1 of *The Mysterious Affair at Styles*. P1 suggested that the facilitator should have a clearer understanding of the AI's vocabulary:

> "I suggest you maybe might want to know what that word means." (P1)

P7, on the other hand, commented on the unnaturalness of its usage:

> "Unctuous is a word that most humans wouldn't use." (P7)

These observations underscore participants' sensitivity to language as a marker of authenticity in literary contexts and their awareness of the limitations of AI in replicating human-like

phrasing. This raises the question of whether experts in literary analysis might offer similar critiques of specific word choices.

AI-generated character images elicited mixed responses. While some participants found them engaging or humorous, others drew unintended associations. For example, P3 noted a resemblance to pop culture in the visualisation for *The Time Traders*:

> "That one looks like Thor." (P3)

This reaction highlights how image-based visual elements can simultaneously spark engagement and reveal the subjective nature of interpretation.

Instances of data inaccuracy were rare, with only one participant identifying a specific error in their questionnaire feedback (Q21): "there was an instance of swapped character information" (P1). Despite this, no participants used the *Data* tab to correct textual features. This lack of engagement could stem from several factors, including assumptions about the ownership of the data, satisfaction with its overall accuracy, or a prioritisation of discussion over data correction. It also suggests that participants perceived the visualisation as a resource provided by the facilitator rather than a collaboratively editable tool, despite being informed that all menu features were available for use during the session. These reflections raise questions about agency, trust, and expectations of AI-generated data in collaborative, non-expert literary analysis settings.

5.14.2 Collaborative and Variable Use

Codes discussed in relation to the category of Collaborative and Variable Use include: Group Dynamics, Desire to Explore Personal Inquiries, Reading Information Aloud, Task Orientation, and Reaching a Consensus.

Group Dynamics

Group dynamics played a pivotal role in shaping how participants engaged with both the visualisation and each other during the sessions.

In Group A (group of 4), P2 frequently took on a leadership role, effectively integrating the visualisation into discussions, and initiating multiple conversations around the visualisation's elements. This proactive engagement set a collaborative tone, with other participants anticipating P2's input, as illustrated by this exchange:

> "Want the mouse?" (P3)
> "Yeah, I'll have the mouse." (P2)

In Group B (group of 3), P7 controlled the mouse without contention. While P6 actively participated in discussions and observed the visualisations even without direct control of the mouse, P8 provided shorter, more concise contributions. These brief responses were often instrumental in filling memory gaps for the group. Notably, prior exposure to the visualisation technique during Study I did not appear to influence Group B's dynamics or the degree to which the visualisation guided their discussions compared to the other groups.

In Group C (group of 2), P10 primarily operated the mouse but encouraged P9 to engage actively, fostering a shared dynamic. Meanwhile, the Pilot Group, consisting of P1 and the facilitator, adopted a structure more akin to an interview. This format naturally resulted in P1 referring to the visualisations more frequently than participants in other groups, a factor taken into account during data analysis.

Despite being the largest group, Group A demonstrated the highest level of collaboration, with participants actively supporting and building upon each other's lines of inquiry. Across all groups, variations in size and seating configurations did not hinder the collaborative atmosphere, which was consistently observed and positively regarded. This sentiment was reflected in the freeform feedback section of the questionnaire (Q21), where one participant noted:

> "The experience of reading and discussing the novel in a group setting was very enjoyable." (P6)

Desire to Explore Personal Inquiries

Participants occasionally became engrossed in personal inquiries, momentarily diverging from the structured prompts. For example, P1 focused on inspecting a character's traits, counting their appearances aloud while temporarily losing track of the discussion prompt. This spontaneous behaviour demonstrated the visualisation's ability to engage participants on an individual level, encouraging curiosity and personal exploration.

In the questionnaire, P2 reflected on the group dynamic's dual nature:

> "One on one would have led me to use the visualisation tool more, as having a group felt more rushed. But the group setting was more collaborative and fun." (P2)

These reflections highlight a tension between the collaborative benefits of group discussions and the desire for deeper individual engagement. The group setting fostered a lively and interactive atmosphere, but it sometimes limited the time available for participants to explore personal interests at their own pace. This shows the visualisation can be versatile as both a collaborative tool for group discussions and an engaging resource for individual exploration, catering to different user needs and contexts. Further investigation into how individuals may leverage the visualisations is needed.

Reading Information Aloud

Reading information aloud was a common activity, particularly during the exploration of unread novels. When Groups A, B and C engaged with the *About This Book* tab (Figure 5.9), it was always to establish a shared understanding of the unfamiliar text prior to beginning their exploration of the visualisation.

This collective reading was a clear demonstration of creating a baseline of knowledge among the participants. By starting with the *About This Book* tab, participants aligned their understanding of key contextual details, such as the genre, the author, central themes, and a brief introduction to the main characters – which was the aim of integrating this feature.

When participants read quotes or passages from the full text aloud, this often served as a way for an individual to direct the group's collective attention to a specific detail they found significant. An example of this is discussed later in Section 5.14.4. This behaviour highlights the active role participants played in shaping the group's collaborative exploration. By directing attention to specific details supported by textual evidence, they helped establish a shared understanding of key moments or characters. These individual contributions fostered meaningful engagement, encouraging others to connect the visualisation with the text and build on each other's ideas.

Task Orientation

As the discussions unfolded, some participants transitioned from strictly adhering to the provided discussion prompts to taking ownership of their roles within the group, leading discussion points and adapting their approach based on emerging interests. This shift was particularly evident during the exploration of the unread novels, where participants developed a flexible process for selecting the next book to read (discussed further in Section 5.14.5). Their tasks evolved dynamically as they switched between analysing genres and character dynamics.

One illustrative moment occurred when P7 proposed a spontaneous task inspired by the visualisation's presentation of character appearances across chapters:

> "I wonder if we can tell how long the story is? How long is it going to take to read?" (P7)

P7's question exemplifies how the visualisation supported reflective thinking, transforming a seemingly small observation into a broader discussion about narrative pacing and reading time. Similarly – during the exploration of the unread novels component – participants navigated between contrasting genres and characters, weighing their preferences and priorities to guide their selection process.

Task orientation was also predicated on the type of exploration warranted. In the discussion of the read novel component, tasks were disguised within the prompts (discussed above in Section 5.14.1), whereas in the exploration of the unread novels component, participants had to form their own tasks.

Participants displayed varying task orientation, which appeared to motivate integration of the visualisation. P1, P2, P4, and P7, demonstrated high task focus, referring to the visualisations frequently – however, it must be noted that for P1, use of the visualisations was their primary mode of interacting with the texts.

P4, P6 and P10 exhibited moderate task orientation, achieving a balance between intermittent use of the visualisations with human-human interactions. Lastly, P8 and P9 were less inclined

to refer to the visualisations, drawing frequently on personal knowledge and recall. This underscores a distinct amount of variability in the manner of how the visualisations were integrated in response to – or for forming – tasks.

Reaching a Consensus

In the unread novels phase, participants were tasked with selecting the next book to read, requiring group consensus. This activity revealed an interesting interplay between instinctive preferences and structured approaches to decision-making. P2 suggested an informal, intuitive method:

> "So do we feel *The Stainless Steel Rat* or do we feel *The Time Traders*?" (P2)

This focus on feeling reflects a personal, almost emotional response to the unread novels, hinting at the influence of immediate impressions. In contrast, P4 introduced a more systematic approach, proposing that participants articulate their preferences and reasoning:

> "We could ... take turns to say which and why." (P4)

This structured suggestion shifted the group towards reflective discussion, providing space for participants to articulate how specific elements – such as the visual layout, character appearances, or personal reading goals – influenced their decisions.

The visualisation played a pivotal role in these moments of negotiation. Participants referred to visual elements to support their arguments, whether highlighting the "boom, boom, boom" (P5) structure of a storyline or reflecting on the estimated length of the narrative. Expanding on P5's comment, they not only demonstrated aesthetic appreciation but also used this visual insight to advocate for their preferred book:

> "[The] chart's like pretty beautiful, going like, boom, boom, boom ... I think like ultimately, we should go with this book ... even though I'm outvoted." (P5)

Notably, the visualisation acted as an almost visual blurb, offering a condensed overview of key character and narrative elements that supported both instinctive and reflective decision-making. The final book selections were varied: the Pilot chose to read *The Mysterious Affair at Styles*, Groups A and C chose *The Stainless Steel Rat*, and Group B chose *The Time Traders*. The groups' diversity of selection – shaped by personal interest, visual appeal, and pragmatic concerns such as reading time – further highlights the visualisation's versatility in represeting different novels. While it could not eliminate differences of opinion, it provided a shared reference point that encouraged negotiation and justified decisions. These findings suggest future potential for literary visualisations to act as decision-support tools in book discussion scenarios, and an interesting avenue for investigating the concept of a data-driven visual blurb.

5.14.3 Interpreting Visual Encodings

Codes discussed in relation to the category of Interpreting Visual Encodings include: Analysing Narrative Structure, Navigating via Visual Signposts, Misinterpreting Storylines Creatively,

Counting and Comparing Characters, Balancing Curiosity and Spoiler Avoidance, and Interpretive Confidence.

Analysing Narrative Structure

During the read novel component of the sessions, participants frequently commented on *A Study in Scarlet*'s unusual narrative structure. The visual separation between parts one and two in the visualisation – driven by character appearances – effectively highlighted the cause of surprise for many participants, as an entire cast of new characters were introduced, while most of those in part one were backgrounded. Evidence of this in the visualisation acted as a catalyst for analysis. P7 used it to refer to the structural contrast:

> "There's such a stark contrast ... I found myself thinking, am I reading the same book?" (P7)

The visualisation was able to make this shift explicit, as it was caused by character appearances, providing participants with a foundation to critically analyse the novel's composition. While plot is usually discussed in terms of events, the character-centric layout offered an alternative lens for examining structural changes. The visualisation thus supported both recognition of the novel's unconventional form and participant-driven interpretations of how it shaped their reading experience.

Interestingly, the plot function contextual element was barely referenced during the sessions. Instead, gaining a sense of how the novels were structured was achieved through the overview. This indicates that textual descriptions of narrative construction are not as useful in a collaborative setting, where immediate visual cues everyone can see are more accessible. This was discussed earlier in Section 5.14.1. For the unread novels, the visual structural overview played a different role. This is discussed in Section 5.14.3.

Navigating via Visual Signposts

The chapter encodings and storylines were pivotal in guiding participants' navigation through the visualisation. These elements allowed users to contextualise characters' journeys, identify key events, and uncover data associated with character appearances, such as clues. For instance, P6 demonstrated this process when they used the visualisation to locate a critical moment in the plot:

> "Where was ... following this line back to, yes, the wedding ring being found here at the scene of the murder of Drebber." (P6)

This example highlights the visualisations effectiveness in replicating the structure of a novel to support navigation. The chapter-based presentation enabled participants to orient themselves within the narrative and locate certain detail with accuracy. By acting as "visual signposts", the chapter boxes and character storylines transformed what might otherwise be an overwhelming amount of textual information into an accessible, structured overview.

Notably, these visual cues did not just support linear exploration but also encouraged flexible, user-driven navigation. More technically proficient participants (P1, P2, P4 and P7) moved fluidly between macro-level patterns – such as overarching storylines – and micro-level details, such as individual clues or key character appearances. This ability to zoom in and out was useful for participants to follow their own lines of inquiry.

Misinterpreting Storylines Creatively

Participants occasionally misinterpreted the character storylines, often in ways that were both creative and engaging. For example, some participants mistakenly associated the curvature and arrangement of the storylines with the pacing or complexity of the plot. P5 remarked when looking at the visualisation for *The Time Traders*:

> "This story may be more complex, but that's purely based on how the chart is looking." (P5)

Such comments reveal an intuitive, but inaccurate, interpretation of visual patterns. Interestingly, these creative misreadings reflect the participants' inclination to actively engage with the visualisation, applying their own reasoning to its structure rather than relying on the explanations in the visualisation menu.

The aesthetic appeal of the visualisation further encouraged this type of engagement. Participants frequently commented on its visual charm, framing the storylines as objects of beauty and evoking comparisons to natural forms. For example, when Group A were exploring the unread novels they engaged in the following dialogue:

> "It's so beautiful to look at." (P5)
> "They [the storylines] are really nice to look at." (P2)
> "I like this shape [of the storylines] more." (P3)
> "They look like mountains." (P4)

These imaginative interpretations highlight how the visualisation's design captivated participants, fostering a positive emotional response that complemented its functional role. Although these associations did not align with the visualisation's intended encoding, they underscored its ability to entice non-expert readers. Notably, misinterpretation of the storylines did not occur in the Pilot or among Group B's participants – all of which had prior exposure to the visualisation.

In the questionnaire, usefulness (Q7) and attractiveness (Q9) both averaged high scores of 6.1 and 6.2 out of 7. This, compared to the qualitative findings, suggests that while clearer explanations of the visualisation's underlying algorithms – such as the co-occurrence arrangement – could reduce misinterpretations, such creative readings should not be dismissed. Instead, they point to the visualisation's broader potential as a tool that encourages exploratory and playful engagement.

Of course, it must be acknowledged that these findings also highlight an issue inherent in the storyline layout, raising questions about its suitability for more in-depth, plot-centric discussion. This limitation suggests that, while the layout excels in summarising character appearances and relationships, it falls short in providing an overview that intuitively represents the shifts in the plot's dynamics.

Counting and Comparing Characters

Counting and comparing characters emerged as a recurring activity, enabling participants to assess character frequency. This process often fostered collaboration, as participants worked together to make sense of the data. For instance, P7 quickly identified that fewer characters are introduced at the start of *The Stainless Steel Rat* than in the other novels:

> "Immediately, there's a lot less characters." (P7)

Interestingly, of all the novels visualised, *The Stainless Steel Rat* features the most characters overall. This suggests that the early introduction of a smaller, core group of characters says less about the story's scope and more about the author's narrative strategy – starting with a focused cast before gradually expanding it. This pacing appeared to offer participants a smoother entry point into interpreting the visualisation, giving the impression that the story's initial exploration was more accessible.

P6 further highlighted this perception, expressing an expectation that they would need to remember characters introduced at the start:

> "[There are] two [characters] introduced in the first chapter. So they'll be easier to remember." (P6)

This comment provides insight into participants' ingrained reading habits, such as relying on memory to track characters. Even though the visualisation provided persistent access to character information, participants were observed to approach the task of keeping track of characters in familiar ways. This behaviour suggests that while character-centric literary visualisations can offer new tools for character recollection and understanding, they do not immediately displace habitual approaches to processing character information.

Balancing Curiosity and Spoiler Avoidance

The unread novels component of the evaluation was initially intended to understand the effectiveness of the visualisations in supporting exploration and discussion of unfamiliar texts. While I considered that concerns regarding spoilers would arise, the intensity of reactions demonstrated by some participants was unanticipated. This was particularly evident for *The Mysterious Affair at Styles* detective fiction visualisation, where hovering over the clues contextual markers raised concerns about revealing critical plot details. P1 explained:

> "Because it's a detective novel ... I'm trying to avoid looking." (P1)

In contrast, the advanced technology contextual elements in the science fiction novels did not raise spoiler concerns. In fact, they increased interest in reading the novels, as P7 remarked:

> "Lots of different technology throughout ... sounds pretty good." (P7)

So while the design of the contextual data encodings allows for flexibility in deciding what to encode for a given genre, certain elements of different genres can serve to entice or repel end-users from engaging deeply with the visualisation at a micro level, if they have not read the novel. Even though the unread novels component of the evaluation allowed participants to explore the visualisations at their own pace, caution shaped their behaviours when zooming or looking at the full text. P1 did not open the *Read Chapter* tab at all, explaining:

> "Now, I don't want to like spoil this novel ... So I'm not going to read any." (P1)

Interestingly, in the overview of each visualisation, participants did not indicate a fear of spoilers, nor when counting and comparing the number of characters across different novels. Comments were also made about the visual appeal of the layouts when viewed at a macro level (see Section 5.14.3). However, once elements were inspected at a micro level, concerns began to arise, particularly around the chapter three mark:

> "Again, I'm driving, and I'm quite hesitant to look too far into the end of it." (P7)

In Q21 of the questionnaire, P5 confirmed that revealing the end of the book was the primary concern:

> "For choosing a book to read, the visualisation could lead to spoiling the ending." (P5)

Interestingly, these behaviours were less prominent in Group C. P9 and P10's engagement with the unread novels demonstrated curiosity, but their behaviours and comments did not indicate a fear of spoilers. Nevertheless, the majority of participants exhibited a desire to balance curiosity with spoiler avoidance. This highlights the need for spoiler-sensitive features – such as progressive disclosure of the chapters – that would enable deeper engagement without compromising future enjoyment, if the visualisations were to be used to entice readership.

Interpretive Confidence

Participants exhibited varying levels of interpretive confidence when engaging with the visualisation. For some, hesitation and uncertainty were evident, as they sought validation from the group before sharing their perspectives. Others acknowledged their lack of formal literary training upfront but still confidently contributed insights grounded in the visualisation. P5, for instance, framed their perspective by referencing the visualisation to anchor their reasoning:

> "So I never read this book, like in an English literature class or anything like that ... so I'm gonna go right back to 1.2 when Sherlock Holmes was introduced." (P5)

At the higher end of the confidence spectrum, participants like P6 combined prior knowledge with the visualisation to substantiate their interpretations. P6's engagement highlighted how the visualisation could reinforce pre-existing familiarity with the text:

> "So, where does Poirot come in? [points to the visualisation] He comes in here." ... "I've read quite a few of them, but a long time ago." (P6)

Over the course of discussions, participants appeared to gain confidence, both through their interactions with the visualisation and their exchanges with other group members. This progression suggests that the visualisation served not only as a tool for supporting textual analysis but also as a means of fostering interpretive confidence in participants who might otherwise hesitate to share their views.

It is important to note, however, that external factors, such as the knowledge of being recorded or the social dynamics of discussing insights with unfamiliar participants, may also have influenced interpretive confidence. These pressures should be considered when evaluating the visualisation's role in building confidence and facilitating discussion.

5.14.4 Consulting Textual Data

Codes discussed in relation to the category of Consulting Textual Data include: Information Searching, Recollecting the Read Novel, Nuanced Perspectives on Relationships, Rediscovering Forgotten Characters and Textual Memory.

Information Searching

Participants frequently leveraged the visualisation to support information searching during discussions. These searches were often prompted by specific questions or moments from the read novel that they were trying to recall. For instance, P7 used the tool to revisit Lucy Ferrier's backstory:

> "I was trying to remember how Ferrier and Lucy, what their backstory was, because they were just found dehydrated and ... can I use the tool?" (P7)

At the time of the study, quotes were not visually linked to characters – a feature added later (see Section 5.9.2) – which made locating specific passages challenging. Participants often had to identify the relevant chapter before scrolling to the desired text. This multi-step process was evident when P7 sought to locate a memorable quote by recalling a moment they enjoyed. The personal dynamics data played a key role in guiding this search:

> "Right, so [reading John Watson's goal aloud] 'Understand Holmes'. He was saying ... [does Holmes have an] interest in astronomy or the planets, and Holmes was like, 'why would I need to know how the planets turn if I can solve the mysteries that are in front of me' ... I'm just trying to find where that was." (P7)

Eventually, P7 successfully located the quote and read it aloud, expressing satisfaction with their discovery. Such processes highlight two important insights: the utility of the personal

dynamics data in supporting memory and search tasks, and the need for enhanced features to streamline information retrieval, such as linking quotes directly to characters and providing global search functionality.

The questionnaire further validated the visualisation's effectiveness in presenting essential information from *A Study in Scarlet*. Participants rated its completeness (Q3) an average of 6.3 out of 7, reflecting a strong overall perception of the visualisation as a comprehensive tool.

Recollecting the Read Novel

In addition to information searching, recollecting details from *A Study in Scarlet* often involved collaborative human-human and human-computer interactions. Group discussions frequently combined participants' memories with the visualisation to reconstruct narrative elements. For example, in Group B, participants collaboratively pieced together the backstory of Lucy Ferrier and her companions:

> "Do you remember why they were together? Didn't really go into their backstory." (P7)
> "They were a group that were travelling together. And they ran out of water." (P8)
> "That's right." (P7)
> "And then they died, one by one." (P8)
> "They were the last." (P7)
> "I think 21 other people had died along the way and they were the last two that were left ... in this description here [refers to the visualisation] of the setting of the Great Alkali Plain ... that brought back ... that 21 people had died." (P6)

This exchange demonstrates how participants collaboratively reconstructed narrative details, using the visualisation as a memory prompt to confirm or refine their recollections. The visualisation's presentation of the setting and events acted as a catalyst for recalling specific details, such as the number of people who perished during the journey.

In some instances, participants' recollections conflicted. For example, when recollecting some of the events in *A Study in Scarlet*, without referring to the visualisation, P2 mistakenly conflated the murderer with one of the protagonists – on several occasions. These errors went uncorrected by the other participants in Group A. However, when P2 later attempted to search for the character in the visualisation, they realised their mistake and corrected themselves. This highlights how the visualisation can serve as an independent tool for resolving inaccuracies in recollections, even in the absence of peer correction.

These interactions underscore the dual role of the visualisation in collaborative memory-building: both as a prompt for confirming group recollections and as an individual resource for verifying and refining specific details. Such features make it a valuable tool for supporting discussions, especially when participants' memories are incomplete or conflicting.

Nuanced Perspectives on Relationships

As discussed in Section 2.5, character relationships are typically encoded in visualisations based on proximity of character mentions in the text or dialogue exchanges. Some participants observed the significance of the relationships being based on dialogic frequency. For example, P1 remarked, "Poirot's a chatty one," when observing Hercule Poirot's dialogue-heavy scenes in *The Mysterious Affair at Styles*.

For the most part, participants offered varied and nuanced perspectives on character relationships. Often, they interpreted or framed them through textual data rather than relying on the social dynamics representations. For instance, P4 used the character personal traits data to evidence that John Watson's relationship with Sherlock Holmes was primarily about trying to understand him:

> "It's a great story to introduce the dynamic between Sherlock and Watson, because if we look at this [the visualisation], we've got 'Understand Holmes' in the beginning, and then all the way towards the end, we've still got 'Understand Holmes'. So, he's still trying to figure out this person." (P4)

Participants also framed relationships differently across genres. In detective fiction, relationships were often discussed in terms of personal values, emotional bonds, or roles. For example, P3 emphasised loyalty:

> "The main relationship that I found quite interesting was that ... John Ferrier ... was so loyal to the rest of the Mormons, for so long." (P3)

By contrast, P9 mentioned being enemies as a relational factor:

> "The hate ... between the murderer and the murderees ... was the ... most impactful ... relationship." (P9)

For the two unread science fiction novels, relationships were described as hierarchical or transactional, such as leaders and subordinates or service providers. However, since these novels were not read by the participants, it is unclear whether this surface-level framing reflects the genre or the participants' lack of familiarity with the characters.

Nevertheless, these findings highlight the limitations of representing relationships solely through co-occurrence or dialogue exchange methods. Furthermore, relationships in different genres may be multi-layered and contextually distinct, suggesting a need for more nuanced visual encodings. Incorporating role-based, value-driven, or hierarchical elements could better capture the complexity of character dynamics to further enrich casual literary discussion and analysis.

Rediscovering Forgotten Characters

The visualisation prompted multiple discussions about forgotten characters as they were rediscovered via interaction with the *A Study in Scarlet* visualisation. Mrs. Sawyer, a minor character in the novel, prompted this exchange:

> "I don't even remember who Mrs. Sawyer is. Aside from misleading." (P3)
> "Yeah, who was Mrs. Sawyer? Was she the one who dropped the ring off? Maybe we should have a look." (P2)

Similarly, Group B's examination of another minor character in *A Study in Scarlet* – John Rance – led to a collaborative reconstruction of his role:

> "It [the visualisation] has reminded me of what happened ... Rance was the detective that Holmes... uh, [reading John Rance's profile] the policeman, that Holmes and Watson go to visit to find out what happened when the body of Drebber was found. And Rance tells them about the drunk man who was waiting outside on the night of the murder. And of course Holmes deducts immediately that he was actually the murderer." (P6)
> "When he came back to get the wedding ring." (P8)
> "That's right. Yes." (P6)

While Group C used the visualisation to confirm the identities of two secondary characters:

> "Lestrade? Was that one of them?" (P10)
> "Gregson or something." (P9)
> "Yeah." (P10)
> "1.1, 1.2... So he meets them both ... Here they are." (P9)

These moments of collaborative reflection illustrate how the character-centric layout supported participants in piecing together character roles, particularly for those who are not the main characters and might otherwise fade into the background of memory. These interactions not only rekindled interest in minor and secondary characters but also enriched the discussion by encouraging participants to collectively interpret the implications of these figures within the broader narrative.

In the freeform feedback section of the questionnaire (Q21), P7 commented:

> "I felt like we could really keep track of specific points of the story, and it had all the extra characters I'd forgotten." (P7)

This rediscovery of forgotten characters highlights the visualisation's potential as a tool for bridging gaps in memory and sparking deeper reflections on character importance and narrative structure. Through making all characters in the novels accessible, participants were able to reassess their initial interpretations and uncover connections they might have overlooked.

Textual Memory

The visualisation demonstrated its potential to support participants in recalling details from the read novel, *A Study in Scarlet*. This was particularly evident in an exchange between P9 and P10, where the visualisation helped identify the chapter associated with what they recalled had happened to a character:

> "Must be 2.5 is it? Yes." (P9)
> "Yeah. [Lucy's motivation was] Captured and forced to marry." (P10)
> "Forced to marry, yep." (P9)

Some participants had high praise for the tool's ability to prompt textual memory. P6 described it as "very helpful" in recalling a variety of story elements:

> "Very helpful in prompting recollections of character names, places, plot developments, clues for Sherlock, etc., that would otherwise have been difficult to recall." (P6)

Similarly, P8 reflected on how the visualisation supported their ability to express thoughts during discussions:

> "Helped to remember things I was trying to say." (P8)

However, prior to actively exploring the *A Study in Scarlet* visualisation themself, P3 remarked:

> "I've completely forgotten like half of it." (P3)

This suggests that the visualisation served as a catalyst for memory retrieval once participants actively explored its content. Without this interaction, participants like P3 initially struggled to remember key details from the novel. The visualisation bridged this gap by providing structured cues that reconnected participants with the narrative. Additionally, flexible navigation pathways and the multiple textually enriched features of the visualisation supported different approaches to recalling and verifying details.

These findings highlight the visualisation's value as a structured memory aid, particularly in supporting participants who might otherwise flounder with unassisted recall. However, the tool's effectiveness depends on participants recognising its role and engaging with its features. Designing features that naturally invite exploration and support initial engagement could further enhance its utility for textual memory.

5.14.5 Applying Literary Domain Knowledge

Codes discussed in relation to the category of Applying Literary Domain Knowledge include: Identifying Domain Conventions, Referencing Other Media, and Comparing Novels and Genres.

Identifying Domain Conventions

Across all sessions, participants identified domain conventions – related to both literature in general and genrre – in all of the novels. At times, they framed their interpretations around these insights. For instance, P6 identified a common narrative device within the plot of *A Study in Scarlet* when reviewing the clues:

> "I think that was meant to be a red herring ... it's just to confuse the plot." (P6)

Additionally, P10 identified a common trope in detective fiction regarding the portrayal of police:

> "It was sort of a little bit cliched ... that sort of thing of bumbling police." (P10)

Non-experts may not explicitly reference specific conventions in their literary analyses, but it is evident they recognise their deeper significance. This was clear when participants speculated about character roles in an unread novel, such as when P2 questioned the relevance of certain characters:

> "Do you reckon these are like supporting characters or real characters?" (P2)

P5 expanded on this, considering the significance of recurring roles in establishing narrative importance:

> "Can they be supporting if they're only in one chapter? Or like, they have just progressed the story and then they're no longer important?" (P5)

This exchange highlights participants' awareness of conventional character roles and their critical engagement with how those roles contribute to the story. P4 provided further insight by distinguishing between "flat" and "round" characters:

> "They're very one dimensional ... the villains are ... you know, villains. Yet, Jefferson Hope ... he was the murderer. But ... he's got a whole story ... like, a lot more dimension to him." (P4)

By recognising the distinction between flat and round characters, P4 demonstrated an ability to identify subtleties in character development. The visualisation has some support for these reflections through the storyline prominence encoding, however, more explicit differentiation between protagonists and supporting characters could further enhance character exploration.

Some participants demonstrated expertise in domain by contextualising the novels within their historical and cultural settings. For instance, P1 remarked on Arthur Conan Doyle's integration of contemporary advancements in detective work:

> "Arthur Conan Doyle ... based a lot of things that happened in the novel on improvements in detective work that were coming about at his time of life. Like forensics was a new thing that was happening." (P1)

Similarly, P6 reflected on Lucy Ferrier's actions in *A Study in Scarlet* through the lens of the societal norms of the novel's era:

> "It was very dated, of course, because of when it was written, and the attitudes of the men towards one another, towards foreigners, and towards women and the poor people, and so on. I found that was all very interesting and probably pretty indicative of the time in which it was written." (P6)

This ability to situate the narrative within its historical framework contrasted with modern, emotionally driven critiques of the same character (discussed in Section 5.14.6). P6 consistently

demonstrated domain familiarity, even factoring it into their choice of *The Time Traders* as the next novel to read:

> "It looks like there might be a little bit more in-depth characterisation [than *The Stainless Steel Rat*]." (P6)

This depth of knowledge may stem from P6's diverse prior experiences in non-expert literary discussions, as outlined in Table 5.5.

These observations about domain conventions were often used to support others' understanding of the novel or demonstrate personal understanding, highlighting collaborative knowledge sharing within the groups. The participants appeared to recognise varying levels of domain knowledge among each other, showing a willingness and interest in imparting insights to enhance collective understanding.

Referencing Other Media

Participants drew extensively on their familiarity with other novels and media, such as TV shows and films, to inform their interpretations of *A Study in Scarlet* and the unread novels. While these findings did not always involve direct use of the visualisation, they illustrate a mode of interpretation that is characteristic of non-expert literary analysis.

For example, P4 noted how John Watson's portrayal in the novel differed from their expectations:

> "I've mainly watched the TV shows or the movies, and ... John Watson in the book is ... a lot more passive ... like, more of an observer than I expected." (P4)

P5 likened the novel's structure to that of a superhero film, drawing a parallel to a climactic moment:

> "For me getting through the first chapter and into the second half was kind of like that Avengers moment." (P5)

They also highlighted how the character introductions mirrored those in detective TV shows, making sense within the genre's conventions:

> "If you think about it in like detective ... TV shows, how they do it ... the character introductions made sense for the type of novel it was." (P5)

Casual intertextual comparison was also evident, as P7 drew on their fresh knowledge of *A Study in Scarlet* to analyse the characters in *The Mysterious Affair at Styles*:

> "[reading Hercule Poirot's on-hover profile] 'A brilliant Belgian detective renowned for his meticulous methods'. So he's a Belgian Holmes." (P7)

These references to other media highlight how participants' exposure to diverse narratives – both visual and textual – scaffolded their understanding and sharing of insights regarding the novels' characters, structures, and genres. This approach appeared to make discussions of

specific tropes or conventions more accessible, using broadly recognisable media as a frame of reference or a shared language for interpretation.

Comparing Novels and Genres

Participants engaged in comparative analysis during the unread novels component of the sessions, systematically evaluating visualisations side-by-side to note differences in character appearances and narrative structures. For example, P4 highlighted the linearity of *The Time Traders* compared to the complexity of *The Stainless Steel Rat*:

> "[The Time Traders] feels more ... linear [than The Stainless Steel Rat] ... you're very much following the same three people ... these three characters' lines are very consistent, whereas here [in The Stainless Steel Rat] it diverges and introduces different people." (P4)

A remark from P6 emphasised the visualisation technique's ability to portray distinctions between the novels while remaining generalisable across them:

> "Well, all three novels sound pretty good to me, but they're all very different, aren't they?" (P6)

Across all groups, participants approached the comparative analysis in a consistent manner. First, they selected a novel to focus on. Then, compared it with the other novel of the same genre, focusing on differences and similarities within detective fiction or science fiction. Rarely did participants compare novels at the micro level across genres, as though an unspoken rule required them to use genre as a framework for interpretation. This reflects that participants' had an implicit recognition of genre as a natural organising principle for analysis. Interestingly, despite this structured approach, most comments about the novels were generic across genres, focusing on aspects such as the number of characters, their genders, and the number of chapters.

Some discussions focused on the evolution of genres, with participants in Group A speculating on how the visualisations reflected changes within detective novels:

> "This could be [for discussing] the evolution of detective novels." (P5)
> "Wow, that'd be so interesting. I like that idea as a book club." (P2)

This specific example also demonstrates an interesting potential for the casual comparison of literary visualisations to inspire book club formats.

Group B also compared characters across detective novels, noting similarities between the detective duos in *The Mysterious Affair at Styles* and *A Study in Scarlet*. P7 confirmed this observation by examining the character of Arthur Hasting's character profile:

> "Ah! Hastings is a medical soldier, same as Watson." (P7)

Across all groups, contextual framing for these discussions was established through reading the *About This Book* menu tab, providing an overview of the novel and an indication of its genre.

While the genre element contextual markers were referred to in these investigations (see Section 5.14.3), they were not the primary focus when making comparisons between novels of the same genre. This suggests that other genre-specific features may better support comparisons of novels both within and across genres.

5.14.6 Emotional and Personal Reactions

Codes discussed in relation to the category of Emotional and Personal Reactions include: Unrelatable Characters, Relatable Characters, Surprise and Enjoyment, and Use of Humour.

Unrelatable Characters

Several exchanges occurred in which participants made emotionally charged comments regarding unrelatable characters. The character of Lucy Ferrier in *A Study in Scarlet* prompted the most discussion regarding unrelatability, with multiple participants expressing frustration with her:

> "I don't understand how Lucy just didn't move on once the guy went away." (P3)
> "Why didn't she try for true love more?" (P4)

P9 in particular linked Lucy's lack of agency to what they perceived as poor character development:

> "Lucy was this fabulous, strong woman, then she wilts away and dies ... [I'm] looking at this character that's not well developed." (P9)

There were also differences in opinions on which characters were relatable or unrelatable. P3 and P2 engaged in a disagreement over the murderer in *A Study in Scarlet*:

> "Didn't Lucy technically die because she was just really sad and unwell ... it's not like they actively murdered her." (P3)
> "Well, they did force her into a marriage she didn't want to be in." (P2)
> "Yeah, but that doesn't kill a person." (P3)

This exchange was prompted by an initial reflection by P2 about the *relatability* of the character, covered in the next subsection.

Despite the negative judgements, the data summarising the characters does not conflict with these interpretations. On the contrary, these interpretations were often prompted by discussions centred on characters' actions, considerations of their goals, or analysis of their underlying motives. These exchanges confirmed the relevance of the character personal dynamics data in the visualisation, particularly in analysing a character's journey. However, an additional layer of moral and ethical judgements, not represented in the visualisation, frequently emerged. Encoding this type of "data" would compromise the goal of maintaining accuracy to the text. Instead, the visualisation serves as a springboard for participants to develop and express more personal views on the characters.

Relatable Characters

The visualisation also served as a reference point to evidence sympathy for characters or demonstrate their relatability. For instance, P2 referred the visualisation when remarking on how the structure of *A Study in Scarlet* supported a sympathetic view of the murderer:

> "I think he [the author] didn't want him [the murderer] to feel like the villain, if that makes sense. And he might have been writing it ... so that he feels evil at first, if you have like this [refers to clues in the visualisation], like leaving notes, the Rance mystery ... the name written in blood ... He might have been like, he seems like super evil ... But he's kind of got pure motivations ... I liked the feeling of discovering that he was a decent dude." (P2)

Similarly, P5 reflected on how *A Study in Scarlet* humanised the murderer, making his actions relatable:

> "I think I enjoyed that character a bit as well. Because the story was easy to relate to, like, to understand why he did what he did. And you kind of, I guess, felt sympathy at the end when he was caught ... he was a good character to read and understand." (P5)

P7, in turn, noted the tragic fate of characters in Part II of the novel, reflecting on their harsh experiences:

> "I didn't really think about it at the time, I was enjoying the story of it. It's only after you kind of realise what's happening... the terrible ends of some of them that you start to think about it."

Similarly to the discussions regarding unrelatable characters, these observations show how the visualisation prompted layered emotional responses, adding depth to the participants' interpretations.

Surprise and Enjoyment

The exploration phase of the unread novels evoked strong positive emotions, as participants uncovered new details within the visualisations. For instance, in Group B's session on *The Stainless Steel Rat*, P7 exclaimed while zooming out:

> "Here's the rest of the characters. So it's quite, potentially, oh, oo..." (P7)

This reaction conveyed a sense of wonder at the visualisation's ability to reveal the scope of the narrative.

Group A similarly expressed excitement and astonishment while navigating the complexity of *The Mysterious Affair at Styles*:

> "Ohh... wow, whoa." (P3)
> "All right. Yeah, yeah, yeah!" (P2)
> "Wow, this is, uh, a lot more complicated." (P4)

These spontaneous responses underscore the visualisation's capacity to evoke surprise, transforming the exploration of unfamiliar texts into an engaging and interactive experience. By making narrative patterns and character dynamics visually explicit, the tool not only heightened participants' curiosity but also encouraged them to explore novels in ways that a traditional blurb or linear reading might not immediately inspire.

In the questionnaire, enjoyment of the overall experience of using the visualisations to discuss novels with others (Q20) received an average rating of 6.4 out of 7. This suggests that the visualisations enhanced enjoyment of the discussion experience for most participants, making it more engaging.

Use of Humour

The visualisations also brought levity to the discussions, with humour emerging as a shared way to process and engage with the text. In *The Stainless Steel Rat*, the play on the character Doctor Mcvbklz's name became a source of amusement as participants speculated on its pronunciation:

> "How do you even pronounce that?" (P3)
> "Mick Bickles." (P5)
> "Mickverbickle!" (P2)
> "Ha ha ha." (P3)

This playful exchange highlights how humour broke the tension of encountering unfamiliar elements, transforming confusion into a shared moment of enjoyment. In another instance, P5 spent some time providing their analysis of the relationship between the murderer and Holmes in *A Study in Scarlet*, to which P2 humorously replied:

> "That's deep dude, that's deep." (P2)

P5's analysis, however, provoked others to provide their own insights, demonstrating sudden shifts between casual banter and thoughtful analysis. Similarly, P8 used humour to provide their interpretation of the stark contrast between the two parts of *A Study in Scarlet*:

> "Part one was in civilisation, hah. Part two was in hell." (P8)

These comments demonstrate how participants used humour and colloquial language to reframe literary conventions, such as metaphor, in accessible, relatable terms. Each session had a casual and collaborative atmosphere, where participants could engage playfully with both the familiar and unfamiliar texts while maintaining meaningful discussion with each other. Humour also served to defuse disagreements and form commentary on group dynamics. For instance, P3 light-heartedly described their role in Group A:

> "I ended up being that person. The controversial one, ha ha." (P3)

Ultimately, humour was central to the casual discussion and analysis of the novels, even featuring prominently in the Pilot session with P1. While humour itself is not an emotion, it often elicits positive emotions, such as amusement or happiness. Participants expressing these

emotions, in turn, contributed to a relaxed atmosphere that encouraged others to share their thoughts freely.

5.14.7 Generated Theory: How Character-Centric Literary Visualisations are Integrated into Casual Book Discussions – in an Evaluation Setting

Casual literary analysis tasks are inherently flexible, shaped by discussion prompts, shared or conflicting interpretations, and personal inquiries. The visualisations proved most effective when they seamlessly integrated into both the technical and social aspects of discussions, supporting the conversation flow without causing disruption. The findings suggest that their primary role is to scaffold textual memory during the analysis of familiar novels while also generating specific discussion points. Although facilitator prompts initiated topics, participants often diverged as their interpretations evolved, sharing insights through a balance of human-to-human and human-to-computer interactions. The degree to which the visualisations were integrated and explored depended largely on the fluidity of these interactions.

Participants used the visualisations as reference points to clarify details, rather than as catalysts for in-depth textual interpretation. The visualisation for a read novel was particularly effective in anchoring memory and organising thoughts, making information readily accessible without disrupting conversational flow. Engagement was naturally deeper and more dynamic when participants had already read the visualised novel. Conversely, when exploring unread novels, participants were more hesitant, citing spoiler concerns. While intrigued by the visual aesthetics and encoding shapes, they expressed a desire to read the novels in the future. This highlights how certain visual encodings can effectively convey the overall "feel" of a novel, even as textual elements risk revealing critical plot spoilers.

The character-centric layout technique had particular advantages in drawing attention to forgotten or overlooked characters, offering a visual prompt that encouraged participants to revisit and question these characters' significance within the narrative. By clearly displaying each character's presence and connections across chapters, the layout facilitated deeper investigation into their roles, motivations, and relationships, often sparking discussions about their contribution to the plot and themes of the novels.

However, participants' use of the visualisation varied based on individual preferences for use of the technology and the dynamics of the conversation. Some integrated it seamlessly to reference specific details or clarify plot points, while others engaged with it more sparingly. The visualisation supported discussions by enabling quick recall of information without dominating the conversation. Pauses to navigate the tool were generally brief and did not significantly disrupt the flow, though participants occasionally felt pressured to locate information quickly to substantiate their points before others introduced alternative perspectives.

The facilitator played a key role in the evaluation setting, acting most effectively as a guide. By introducing the visualisation and providing technical assistance only when necessary, the facilitator maintained the natural flow of the session without exerting control or interrupting the discussion. Participants integrated the visualisation organically, drawing on it when needed,

while the facilitator used prompts to steer the conversation back on track, echoing the dynamics of a traditional book club. This organic integration contrasts with task-based evaluations of literary visualisations, which are more prescriptive and goal-oriented.

Technical proficiency also influenced interactions with the visualisation. Participants with greater proficiency incorporated it seamlessly, often assuming leadership roles in discussions and using it as a valuable tool when required. Those with lower proficiency tended to rely on guidance from others or avoided navigating the tool altogether. However, increasing familiarity with the interface enhanced participants' perceived value of the visualisation, highlighting the importance of intuitive design and progressive assistance to accommodate varying skill levels and ease less proficient users into the experience. Notably, even when interaction was limited, participants remained engaged, albeit in a more passive role. Interpretive confidence was strongly linked to familiarity with the text and the ability to decipher encodings in the visualisations. Participants who had read the novel or were familiar with the genre demonstrated greater confidence in using the visualisations to substantiate their viewpoints.

Casual literary analysis is characterised by personal interpretation, where elements such as characters and settings are evaluated in terms of their appeal. Other media were often referenced to demonstrate personal knowledge of a genre, and humour served as a distinctive feature of both exploration and recollection of texts. These markers underscore the informal and collaborative nature of casual book discussions, but also their depth and meaning. Ultimately, the visualisations were most effective when acting as flexible scaffolds, supporting memory and exploration without overshadowing discussion or analysis. Therefore, their design should prioritise accessibility, provide interpretive guidance, and create opportunities for both collaborative and personal engagement, accommodating the diverse needs of users.

5.15 Conclusion

This chapter has explored the continued design, development, and evaluation of the *Clover Connections* visualisation layout, which aims at supporting non-experts in literary analysis within casual book discussion contexts. The visualisation design was enhanced to improve its aesthetics, usability, and contextual enrichment. The addition of contextual elements regarding plot and genre provide more features in the interface to support casual readers to engage more deeply with novels. Through this iterative design process, I implemented enhancements that addressed both aesthetic and functional aspects of the visualisation, ensuring it could serve as a meaningful support for discussion and analysis. This process was guided by user feedback and informed by theories of usability, aesthetics, and reader engagement, which underscored the importance of creating an intuitive and engaging tool.

The evaluation phase demonstrated the effectiveness of the visualisation in enhancing discussions around both read and unread novels. Participants generally found the tool to be engaging, useful, and enjoyable, particularly when it supported their recollection of forgotten characters. However, the study also revealed areas for improvement, such as making clearer the

meaning of the storyline encodings' curves and better managing the risk of revealing spoilers when exploring unread novels.

The grounded theory analysis highlighted that the visualisation succeeded in scaffolding textual memory in group discussions, while also revealing challenges regarding technical and social integration. The visualisation effectively facilitated comparisons across different genres and novels and even inspired an idea for a book club format. These insights provide valuable implications for the ongoing design and refinement of literary visualisation tools aimed at casual readers. As the visualisation technique and system continue to evolve the findings from this chapter will inform future iterations, ensuring it remains both relevant and responsive to the needs of its target end-users.

Chapter 6

Discussion

6.1 Introduction to the Discussion Chapter

This chapter synthesises the findings from the two studies undertaken in this research, reflecting on their implications for the design of casual literary visualisation techniques targeted at non-expert users. It explores how designing the character-centric literary visualisation technique and evaluating it in a discussion context has answered the two study research questions, and ultimately contributes towards answering the the main research question. The chapter also examines the broader insights gained from conducting this research, offering both theoretical and practical contributions to support other researchers when investigating the development of casual literary visualisation techniques. Finally, it concludes with an overview of the research strengths and limitations, which present opportunities for the broader field and my own future work.

6.2 Answering the Research Questions

In this chapter, I begin by addressing how the main and study-specific research questions were answered by synthesising insights from Study I and Study II. Together, these investigations demonstrated how the *Clover Connections* visualisation technique enhances casual literary discussions and analysis among non-experts, while also providing practical and theoretical contributions to the design of casual literary visualisations outlined in later sections of the Discussion chapter.

6.2.1 Study I Research Question

To recap, the Study I Research Question is:
How can data on characters in novels be abstracted and visually encoded to represent their development and connections to each other?

Study I focused on designing and evaluating visual encodings to represent character data across three dimensions – temporal, social, and personal. These dimensions were mapped to intuitive visual elements:

- **Temporal Dynamics:** Encoded using storylines to represent distinct character identities and chapter-based visual cues to represent character appearances.
- **Social Dynamics:** Represented as interaction networks with dialogue frequency visualised through line thickness, to capture character connections to each other.
- **Personal Dynamics:** Summarised using clover-shaped glyphs, encoding goals, actions, motivations and sentiments (later, emotions) to capture character development.

The evaluation confirmed that these abstractions were clear and usable for general character analysis tasks, such as identifying significant relationships or tracking changes in character motivations. However, the task-based approach – conducted on an individual basis – was limited for addressing *how* non-experts would use the visualisation system in interpretive, collaborative – but also casual – settings. This insight informed the more context-driven evaluation in Study II.

6.2.2 Study II Research Question

To recap, the Study II Research Question is:
How do non-experts in literary analysis integrate character-centric literary visualisations into casual book discussions?

Study II explored the use of the visualisation in book-club-inspired focus groups, highlighting its potential to support interpretive discussions and collaborative analysis. Key findings included:

- **Natural Integration:** Participants used the visualisation as a reference tool for character recall and narrative exploration, with many seamlessly integrating it into their discussions without significantly disrupting conversational flow. The visualisation technique was demonstrated to support both revising elements of a read novel and exploring those of unread novels.
- **Scaffolding Discussion and Analysis:** The tool facilitated engagement with different narrative elements, such as clues in detective fiction or characters' changing (or unchanging, and therefore, unrealised) goals, enabling participants to connect personal insights with textual accuracy. The visualisation technique was demonstrated to be generalisable across different novels and different genres.
- **Varied Interaction:** Engagement with the tool varied based on participants' overall interest in the book being discussed, their familiarity with the specific narrative, their ability to orient themselves towards integrating it into specific tasks (such as exploration or resolving specific questions), and their technical comfortability with using the tool; demonstrating the importance of adaptability in design.

The visualisation supported discussions by reducing the cognitive load of remembering narrative details, allowing participants to focus on interpretation and analysis. However, it was

the social dynamics of group discussions that drove interpretive depth, with the visualisation acting as an enabler rather than the primary medium for literary analysis.

6.2.3 The Main Research Question

To recap, the Main Research Question is:
Can a non-expert targeted literary visualisation technique enhance the casual discussion and analysis of characters in novels?

This question was addressed through the iterative design and evaluation over the two studies, culminating in the *Clover Connections* visualisation technique. The research findings confirm that a literary visualisation tailored to non-experts can enhance casual book discussions and analysis, particularly in character-focused conversations.

The enhancement was realised through three key activities:

1. Designing Accessible Encodings

The visualisation abstracted character data across temporal, social, and personal dimensions, collectively referred to as character dynamics. Temporal dynamics were represented through a storyline technique overlaid with chapter-based encodings, offering a structured view of character appearances and actions. Social dynamics were visualised as interaction networks, with line thickness denoting dialogue frequency. Personal dynamics were summarised using a new in-context direct text visualisation approach, where text labels were affixed to clover-shaped glyphs, per each character's chapter appearance. These were encoded with goals, actions, motivations, and emotions (originally sentiments). The character dynamics abstractions and encodings preserved the complexity of character interactions while prioritising usability for non-experts.

2. Iterative Validation and Refinement

The design of the research approach supported iterative validation and refinement of the visualisation technique:

- Study I assessed the clarity and usability of the encodings through task-based evaluations. While participants successfully identified character dynamics, the evaluation highlighted the limitations of task-oriented methods for capturing the interpretive and collaborative uses of the visualisation.
- Study II introduced enhancements such as plot and genre context, an "About This Book" tab, textual data editing capabilities (to recognise the subjectivity of literary summaries), and aesthetic improvements. A book-club scenario focus group methodology for evaluating the technique situated four visualisations of different novels in a realistic discussion and analysis context. Participants organically integrated the visualisations into their discussions and explorations, using it for character recall, understanding, and genre-specific analysis.

3. Integration into a Realistic Context

The visualisation supported both surface-level recall and deeper interpretive dialogue. For example, participants used the tool to rediscover minor characters and connect narrative conventions with character dynamics, enriching both individual insights and group discussions.

These findings demonstrate that non-expert targeted visualisations can indeed enhance casual literary discussions and analyses. The enhancement depends on aligning character data abstractions with user needs, evaluating the tool in realistic contexts, and prioritising accessibility and adaptability in design. This work contributes to rethinking literary domain expertise by reflecting on how casual readers engage with literary visualisations.

6.2.4 Synthesis of Findings

The combined insights from Study I and Study II illustrate that enhancing casual literary discussion and analysis requires aligning visual encodings with user needs, situating evaluations in realistic contexts, and balancing accessibility with interpretive depth. These findings contribute to a broader understanding of how visualisation techniques can enrich literary analysis for non-experts, while respecting the diversity of casual readers' interpretive practices.

The theoretical and practical contributions of this research are further detailed in this Discussion chapter, addressing:

- A discussion on rethinking literary domain expertise, distinguising between building expertise and supporting casual interest, in Section 6.3
- Insights into the literary visualisation pipeline for casual readers, from a designer's perspective – that is, the casual literary visualisation design pipeline, in Section 6.4
- Proposed dimensions of visualisation interaction variability in casual literary analysis, to guide other designers, in Section 6.5

6.3 Rethinking Literary Domain Expertise

The framing of end-users of a visualisation as "novices" – or as I and others in the field refer to them (Gough et al., 2016; J. Roberts & Gough, 2016; South et al., 2020; Tylosky, Knutas, & Wolff, 2023), "non-experts" – is a critical and timely topic in visualisation research. This was highlighted in a recent paper by Burns et al. (2023), titled: *Who Do We Mean When We Talk About Visualization Novices?*, which was recognised with the Best Paper Award at CHI, underscoring the widespread relevance and importance of this issue across multiple domains of visualisation research.

Burns et al. (2023) address the challenges inherent in designing for non-expert audiences, whose needs, knowledge levels, and engagement styles vary significantly. As visualisations become more integral in fields ranging from education to public communication, understanding how to effectively cater to non-experts has become a pressing concern – an issue Gough, de Berigny Wall,

and Bednarz (2014), Gough et al. (2016) and Gough, Ho, et al. (2014) developed foundational research on, with a particular focus in regards to scientific data communication.

The research by Burns et al. (2023) critiques the inconsistent and ambiguous use of terms like "novice", "non-expert", "general public", and "layperson" in visualisation research. Often used interchangeably, these labels lack clear definitions, creating challenges for designing and evaluating visualisations for these groups. Instead, non-experts are typically framed in contrast to experts, emphasising their deficiencies – such as limited domain knowledge or technical skills – rather than acknowledging their unique perspectives, usage scenarios, or existing strengths. This deficit-oriented approach risks marginalising diverse audiences and reinforcing narrow design goals, such as improving task performance, while neglecting broader objectives like fostering engagement or exploration.

Burns et al. (2023) recognise the alternative ways of knowing and doing in non-expert audiences. This establishes recognisable implications for the findings of my own research into developing a literary visualisation for non-experts in literary analysis.

6.3.1 Reflecting on Defining Casual Readers as Non-Experts in Literary Analysis

In Section 2.7, I provided a rationale for why casual readers can be characterised as non-experts in literary analysis, when approaching the design of a literary visualisation to support their discussion and analysis activities. This rationale was based on insights from the Literature Review chapter (Section 2.2), which established that casual readers' engagement with literature is highly individual and personal, and does not typically involve analysing texts through a formal theoretical lens, such as a postcolonial or feminist reading.

While the design of the visualisation technique did not intend to build expertise in the domain, the involvement of an expert in literary analysis during the initial design stage (Section 4.3.2) framed and influenced my view of non-experts in the domain as people who are yet to understand *how* to interpret the *meaning* of characters' journeys in a novel. This also stems from the domain expert's perspective, coming from a place of teaching others to craft skills in literary analysis. While this points to the obvious need to also involve casual readers in the data and task abstraction phase of the design, when I was approaching that stage of the design process, I held the belief that an expert could provide a more in-depth understanding of the domain than a casual reader, therefore providing a better foundation to abstract data of signicance to the character and story understanding process.

It is also important to note that many visualisation researchers investigating generalisable "story" data representation often default to designing systems aimed at "people" without even defining a target audience. This approach likely stems from the universal appeal of stories and a possible assumption that making narrative elements visible inherently benefits a broad audience. This trend is particularly evident in storyline visualisation studies, where the objective is to enhance comprehension of a narrative from start to finish through visual means (Arendt & Pirrung, 2017; Gronemann, Jünger, Liers, & Mambelli, 2016; Qiang, Chai, & Zhang, 2017; Tang et al., 2021, 2019). As the storyline visualisation technique has been evaluated multiple times

for its suitability for narrative progression comprehension, a similar approach was adopted at the beginning of this research, leading to the later recognition of the limitation of prioritising technical development over exploring potential co-design opportunities (discussed in Section 6.7.1).

Later, when investigating research in psychology, I discovered Collins and Evans (2007) posed the question, "What does it mean to be an expert?" to initiate a rethinking of expertise as a multifaceted concept. They argue that expertise extends beyond authoritative knowledge certified by institutions and incorporates forms of tacit knowledge, that is, knowledge we have but cannot easily explain. Central to their work is the concept of *interactional expertise*, a proficiency in the language of a specialised domain without full practical experience. This challenges traditional concepts of how expertise is developed, such as through a stage-based process of human skill-acquisition in a professional context (Dreyfus, 1982). In fact, Collins and Evans (2007) found that individuals with interactional expertise can exhibit an understanding of a field comparable to that of practitioners.

Hence, designing literary visualisations targeted at casual readers moves beyond the deficit model of non-experts as "lacking" and instead embraces a design approach that supports engagement, accessibility, and creativity. As discussed in the Literature Review chapter, literary visualisations are commonly designed for expert workflows, even when designed for character-centric analysis (Sections 2.4 and 2.5). While multiple studies have targeted casual readers with their designs (Coleman & Hinze, 2017; Hinze et al., 2018; Regan, 2011; Regan & Becker, 2010), there is still a gap for establishing a non-expert niche in literary visualisation research.

Ultimately, the findings from Study II (Section 5.14), and assumptions made in my own work, point to a broader issue with characterising non-experts in opposition to their expert counterparts. As mentioned, expertise is often framed as something to aim for by progressing through distinct stages of learning about a domain, however, participants' interactions with the visualisations did not reflect a desire to build literary expertise, nor a complete lack of it. Instead, they used the visualisations to scaffold their memory, and existing ideas about literary conventions, to explore elements of interest, discussing and analysing them through highly personal lenses.

Core to this revelation is the need to further characterise differences between non-expert literary visualisation – designed to build expertise in literary analysis – and casual literary visualisation, for use in personal contexts to enhance the enjoyment of analysing characters and novels.

6.3.2 The Casual Interaction Layer

While Study I heavily focused on obtaining expert advice to ensure the "correct" elements were added to cater to non-experts, as mentioned, the Study II evaluation findings highlighted a different understanding of this target audience.

In literary visualisation research, casual interaction can refer to both how end-users prefer to interact with a text, such as the intuitive and informal ways that readers engage with characters

or pivotal moments, without requiring deep analytical skills, and how they interact with the visualisation itself. Through these considerations, the design developed in this research never aimed to develop expertise in literary analysis, but rather, support the familiar ways casual readers engage with characters. Consequently, the visualisation does not fit neatly into the category of a "non-expert literary visualisation" but instead introduces the concept of a "casual literary visualisation".

This tracks with the umbrella concept of casual information visualisation, for which the target audience is often positioned as the "general public" (Pousman et al., 2007). However, in many cases in visualisation research, the general public as an audience is treated synonymously with non-experts in other studies aimed at supporting users without specialised training or domain knowledge (Burns et al., 2023). This conflation of terms can obscure important nuances in the intention of a design, particularly when applied to literary visualisations. In other words, while non-expert studies often focus on addressing gaps in domain knowledge or analytical skills, casual information visualisations aim to engage users who may already possess relevant knowledge but prefer intuitive, low-effort interactions over structured analytical processes.

For example, in literary visualisation, casual readers may demonstrate domain familiarity with narrative structures or character archetypes but lack formal training in literary analysis. This positions them differently from the generalised non-expert audience targeted in other fields, as their engagement is shaped more by preference and context than by a complete lack of expertise. Recognising this distinction is essential for designing visualisations that align with casual readers' expectations and behaviours, rather than adopting assumptions about what they lack or need to learn. Additionally, for literature, the interpretation of meaning is subjective, and hence while a literary visualisation should include accurate-to-the-text elements, such as the number of chapters and characters' appearances, ultimately the textual meaning is open to exploration. Therefore, it is not essential that casual end-users of a literary visualisation develop an in-depth understanding of formal literary analysis techniques to make use of or interpret the data for their own means.

Because of this, the challenges of designing and evaluating visualisations for non-experts vary significantly depending on the data domain, for example, when comparing the visualisation of scientific data to that extracted from fictional narratives. As Gough, de Berigny Wall, and Bednarz (2014) highlight, effective communication of science to non-experts often requires significant effort to overcome knowledge gaps. Non-experts in scientific domains may lack the foundational understanding necessary to contextualise complex, factually-based data. To address this, NEUVis leverages familiar cues and affective elements to make the information both accessible and engaging.

In contrast, when communicating characters within a narrative, the Study II findings demonstrated that casual readers approach the visualisation with an inherent familiarity with story structures, even for completely unfamiliar texts. Unlike scientific visualisations, which must bridge conceptual divides, literary visualisations targeted at non-experts can rely on users'

pre-existing knowledge of common narrative frameworks; which most people have been habitually exposed to their entire lives – as was discussed in Section 2.8.4 of the Literature Review. This working understanding means casual literary visualisation designs can focus more on enhancing the activities of casual readers who enjoy discussing and analysing literature, rather than improving their knowledge of formal literary concepts.

This understanding was embedded in my design rationales, but not fully articulated. It was evident that many existing character-centric literary visualisation techniques appeared unsuitable for casual readers, but by going through the design process and testing the outputs, I have gained a clearer understanding of why. Essentially, literary visualisations for casual readers need to provide quick entry points into the data, which was accomplished through the chapter-based design – a method of orienting the end-user to navigate via the familiar struture of a novel. For designs that instead visualise linguistic structures, gaining access to the significance or meaning of the data may be less intuitive. These assumptions offer areas for future research into comparing different visualisation techniques for casual literary analysis.

6.3.3 Non-Expert Versus Casual Literary Visualisation

This distinction within the field of casual literary visualisation does not inherently counter the development of expert literary visualisation tools. On the contrary, there exists a niche for visualisations aimed at supporting end-users in building expertise in literary analysis. Timely research in the digital humanities examines the phenomenon of digital social reading (Pianzola et al., 2020; Rebora et al., 2021), which holds significant implications for literary visualisation research. Such studies explore how casual readers engage online to interpret and analyse texts, as seen on platforms like *Wattpad* (Wattpad, 2024) or *Goodreads* (Goodreads, 2024), and consider the broader educational potential of these activities. For instance, Rebora et al. (2021) reference the work of Kaplan and Chisik (2005) to illustrate how annotation tools in digital library books can support literary education.

This means there are at least two pathways for designing non-expert-targeted literary visualisations: those that aim to support the development of literary analysis skills and those that accommodate a preference for casual discussion of personal interpretations or even the development of fan theories (see Figure 6.1). The former pathway could align with traditional educational or analytical goals, where the visualisation acts as a scaffold for users to engage with deeper textual analysis, progressively building their expertise, and adopting a pedagogical design model. The latter pathway, in contrast, prioritises accessibility of novel textual data summaries, focusing on fostering intuitive and conversational engagement with the text and recollection of key characters and events. An example of this is eBook visualisations (Coleman & Hinze, 2017; Hinze et al., 2018), which specifically aim to support the casual readers' comprehension and recollection of a text.

To capture these two pathways for future design investigations – and to establish their distinction from expert literary visualisations – I model their differences in Figure 6.1.

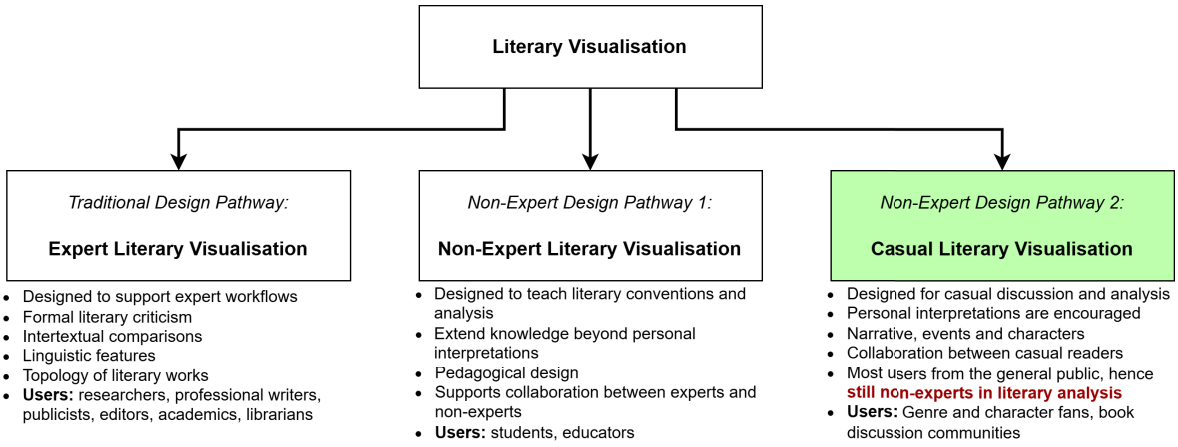

FIGURE 6.1: Three pathways for literary visualisation design: traditional expert interfaces, non-expert literary visualisations, and casual discussion and analysis supports. This research has developed a visualisation for the third pathway: casual literary visualisation.

6.3.4 The Collaborative Interaction Layer

The lens of collaborative interaction provides further nuance to rethinking expertise in literary visualisation. Building upon the personal and intuitive engagement highlighted in the casual interaction layer, the collaborative dimension foregrounds how literary domain expertise can be demonstrated and shared in group settings. The Study II qualitative findings (Section 5.14) reveal both opportunities and challenges unique to collaborative literary visualisation usage scenarios, offering valuable insights into the integration of these tools into collective discussions.

Participants demonstrated how the visualisation could function as a shared resource, mediating between individual interpretations and collective knowledge-building. Rather than driving discussion autonomously, the visualisation was frequently referenced to clarify or support conversational points. This emergent use reflects a dynamic interplay between human-human and human-computer interaction, where the visualisation supplemented rather than dominated the collaborative process.

These insights align with the broader literature on collaborative visualisation, which emphasises the value of tools that facilitate shared understanding without imposing rigid workflows (Isenberg et al., 2011). By providing a common ground for discussing character relationships, motivations, and events, the visualisation supported – in particular – Group A, B and C's abilities to synthesise individual insights into a richer collective understanding. This dynamic demonstrates the potential for literary visualisations to not only represent narrative data but also enhance social interactions through shared meaning-making.

The collaborative context challenges traditional notions of expertise by foregrounding the fluid and distributed nature of knowledge in group settings. Participants in Study II often relied on one another to navigate the visualisation, with some assuming roles akin to facilitators, guiding the group's attention to specific details or features. This reliance on peer-to-peer guidance

underscores the concept of interactional expertise (Collins & Evans, 2007), where proficiency emerges not solely from individual knowledge but from the ability to communicate and interpret within a shared domain.

Study II also revealed the emergent nature of workflows in collaborative contexts. Unlike expert-driven tools, often designed around predefined tasks, the visualisation's use in group discussions was characterised by spontaneous and adaptive interactions. Participants frequently shifted between using the visualisation as a reference and engaging in free-form conversation, reflecting its seamless integration into the natural dynamics of different groups. This aligns with findings in collaborative visualisation research that highlight the need for flexible tools capable of accommodating diverse interaction styles (Mahyar & Tory, 2014).

This emergent use underscores the limitations of task-based evaluation methods, as seen in Study I, for capturing the full scope of visualisation potential. As established in the Literature Review chapter (Section 2.10.3), few studies evaluate for collaborative scenarios. However, the findings in this research highlight how, for example, task orientation in collaborative settings evolves in response to the group's priorities, underscoring the need for tools that prioritise adaptability and minimal intervention. These findings have significant implications for literary visualisation tools designed to assist digital social reading activities. They also present opportunities for future investigation into how such tools might support online communities with varying levels of knowledge and expertise in the literary domain, specific genres, or book series.

6.4 Insights into the Casual Literary Visualisation Design Pipeline

Visualisation design frameworks, guidelines and procedures are all considered areas for improvement in the field of information visualisation, but an effective combination of these can significantly improve the process for the designer (Nesbitt, 2005). However, it can be difficult for designers, like myself, to know what these effective combinations are – particularly when a specialised area of visualisation is being addressed, such as literary visualisation.

In navigating the visualisation pipeline developed for this project, I had to address the unique challenge of working with textual data extracted from novels. This domain-specific focus requires understanding of the specific texts that may be visualised before abstracting data and tasks, and developing suitable visual encodings. In particular, the process of selecting novels, considering genre differences, and factoring in the length and structure of the text became critical first steps that directly influenced the rest of the design process. This is a notable departure from the generic information visualisation pipeline (Card et al., 1999), which typically focuses on raw data without the need for an in-depth understanding of character or narrative dynamics, and how to encode these textually-derived features. In my project, these considerations were fundamental, as the visualisation aimed to support casual readers, meaning the data needed to retain the complexities of the textual meaning while retaining the accessibility of a novel's structure.

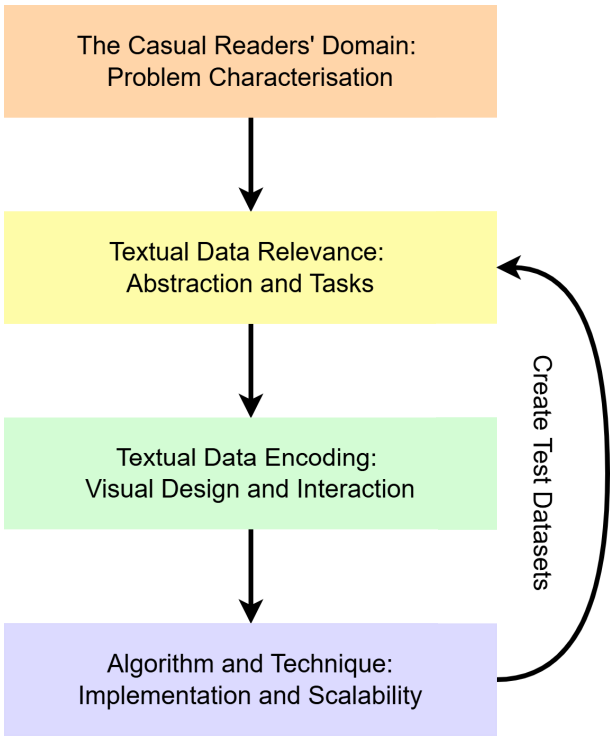

FIGURE 6.2: A model of the casual literary visualisation design pipeline reflected in this research's design stages.

In the following sections, I provide my insights, as a designer, into the casual literary visualisation design pipeline, including the main challenges to the successful implementation of the project and how these were overcome. Additionally, I include recommendations to improve on the work I conducted. These insights are structured into four stages, shown in Figure 6.2, to reflect their corresponding with the stages of Munzner's model of visualisation design (Munzner, 2009).

6.4.1 The Casual Readers' Domain: Problem Characterisation

This foundational step investigates the target domain to ensure the visualisation aligns with user needs and expectations. For casual literary visualisations, understanding the balance between expert knowledge and casual reader engagement is essential. In this project – after conducting my own research into the domain – I consulted a domain expert in literary analysis to identify the underlying principles of character analysis, how non-experts might approach it, and the core challenges of representing these elements in visual encodings. The expert provided insights into key aspects such as character development, relationships, and the structuring of chapters to represent the passage of time. Their input informed my approach to further characterising the literary domain from a non-expert perspective.

While domain experts provide valuable theoretical perspectives, my experience during this project suggests an additional recommendation: directly engaging with casual readers in book clubs or online communities. These readers interact with literature differently from experts. Specifically, connecting with individuals who lead or structure casual reading communities –

such as book club organisers or online community moderators – may offer improved insights into the general practices and preferences they consistently observe.

The casual readers' domain, existing within the "general public", is both ambiguous and wide-reaching. Casual readers may engage with visualisations in their living rooms to answer a personal query or in online forums with thousands of subscribers. Therefore, scoping the usage scenario is just as important as considering the interests of the potential end-user.

To complement this process of understanding, designers can utilise established design frameworks to guide planning. As this project targeted non-experts in literary analysis, non-expert design frameworks were referred to in order to address challenges with scoping and defining high-level project requirements. For example, the Six Questions for NEUVis (Gough et al., 2016) ensure the visualisation addresses practical user needs (e.g., what knowledge is new and accessible), while the NEUVis Data-Visualisation Schematic (Gough et al., 2016) clarifies relationships between data properties (such as dimensionality or acquisition) and user interactions. The NOVIS sense-making model (Lee et al., 2016) provides insights into aspects of visualisations that may pose challenges for non-experts.

After defining the domain, narrowing the scope is essential to focus on specific aspects of the data or content. This includes selecting the types of literary works suitable for analysis within the project's goals. For instance, a casual literary visualisation project may focus on visualising short stories, novels, or even poems. In this project, the challenge was to visualise characters' journeys in a novel, considering factors such as genre differences, text length, and the entities of interest (e.g., character identities, appearances, traits, and social relationships). Genres often require distinct considerations, as they are difficult to concretely characterise (Beghtol, 2001; Hinze et al., 2022).

Additionally, while genres are often visualised at a macro level (e.g., by genre category (Hinze et al., 2022; H. Kim & Park, 2013)), few studies attempt to visualise genre elements at a micro level. Features concretely represented in the text, such as clues in detective fiction or advanced technologies in science fiction, present the challenge of creating a layout technique generalisable across genres. Designers face significant decisions, such as whether to create a genre-specific layout with specialised encodings or develop encodings reusable across genres.

Designers must also evaluate the availability and quality of raw text for analysis, considering legal and ethical implications such as copyright restrictions or the sensitivity of the content. In Study I, two copyrighted novels were used due to their popularity with casual readers. While this familiarity benefitted informal presentations of the visualisations, it required anonymising the textual data during evaluations to mitigate familiarity bias. Additionally, copyright restrictions meant that the full text could not be embedded in the visualisation. This challenge has also been noted in other literary visualisation projects that were not distributed for public use (Regan, 2011; Regan & Becker, 2010). Regan (2011) discusses how this issue affected evaluations with book fans (p.2):

> Getting access to the text of popular current books proved surprisingly difficult ... it would have taken more effort than we had available to develop the interactive

visualisations to the extent where they could be released confidently online. So fans could not engage directly with the prototype.

This challenge was addressed in Study II by using texts available on Project Gutenberg (Project Gutenberg, 2024), which do not require permission for reuse and embedding. However, texts outside of copyright often contain outdated or controversial elements that require thoughtful representation and explanatory context to ensure negative stereotypes are not perpetuated through the visualisation's dissemination.

By carefully scoping the focus, designers can ensure the content is both manageable and meaningful to the project's goals. Furthermore, those aiming to evaluate their work on a public-facing platform must consider the legal and ethical implications of doing so.

6.4.2 Textual Data Relevance: Abstraction and Tasks

Data abstraction involves transforming domain-specific entities and relationships into forms suitable for visualisation (Munzner, 2009). This requires distinguishing between syntactic (e.g., word frequency, dialogue patterns), semantic (e.g., themes, character motivations), and structural (e.g., plot progression, chapter appearances) dimensions of textual data that are most relevant to the interests of the casual reader audience. The abstraction process also includes determining the data types (categorical, ordinal, temporal, quantitative) and dimensionality to ensure that the visualisation can effectively represent complex relationships without overwhelming users with limited exposure to advanced visualisation techniques.

Furthermore, designers must account for dynamic properties in the data, such as temporal changes or evolving relationships between entities. For instance, a character's goals may shift over the course of a story, necessitating data structures that can capture dynamic properties. Contextual information should also be scoped to ensure entities and relationships, such as between characters, can be understood in context, without introducing unnecessary complexity.

As mentioned, I consulted a domain expert in literary analysis to gain a deeper understanding of foundational concepts that govern character representation in novels. This engagement, although appearing counterintuitive for the development of a visualisation aimed at non-experts, did significantly help to establish a theoretical foundation for approaching complex textual data. Additionally, the domain expert pointed me to a series of readings that could support my visualisation efforts. So while casual readers can provide insights into visualisation tasks, a domain expert is still helpful to engage to understand the underpinning theory of literary construction.

Hence, I was able to identify key elements of character and narrative representation that might not be immediately apparent when considering how to visualise features of a text, such as fictional character identities. For example, while I initially considered physical descriptions as critical features, the expert highlighted that textually accurate information related to character development and relationships was more useful for analysis. This insight informed the focus on representing dynamic, narrative-centric features over one-time descriptions.

However, involving non-experts in the data abstraction process would undoubtedly enhance its applicability and relevance. While an expert perspective ensured a theoretically robust approach, it inevitably introduced a level of task abstraction that may not fully align with the task needs of casual readers. By incorporating non-experts into this process, I could have also captured a broader range of user perspectives, particularly regarding which aspects of narrative and character representation are most engaging or useful to casual readers in their discussions and analyses. This collaboration could lead to a more user-centred design, bridging the gap between literary theory and the practical application of a casual literary visualisation. While the domain expert provided critical guidance on what to abstract from the texts, non-expert participants could contribute insights into how these abstractions might be used via a series of casual literary analysis tasks.

The findings from Study II (Section 5.14), also highlighted that the design must cater to users with varying levels of task orientation. High task-orientation users, such as superfans with specific inquiries in mind, may require detailed, interrogative tools, while low task-orientation users, such as casual readers seeking to refresh their memory of the text, may prefer exploratory interfaces that prioritise accessibility and engagement. Designers should also consider whether the visualisation will be used individually or collaboratively, as group-based scenarios, such as book club discussions, may require features that facilitate collective decision-making or interpretation (Isenberg et al., 2011). This step ensures the tool is versatile and effective across diverse use cases.

Finally, during the data abstraction stage, designers should also investigate and select tools for textual data extraction. Techniques such as NLP and NER can be particularly useful for extracting entities, relationships, and temporal elements from texts; however, they have their limitations, which is discussed later in Section 6.4.5. The work of others in the literary visualisation domain can provide valuable insights into best practices and tool recommendations. Exploring these tools early ensures that the visualisation pipeline is technically feasible and grounded in established methodologies, enabling the extraction of relevant and accurate data to support user needs effectively.

6.4.3 Textual Data Encoding: Visual Design and Interaction

The choice of existing – or design of new – visual encodings plays a pivotal role in the effectiveness of a visualisation, determining how well it communicates its data. Storylines, for instance, are effective for illustrating character journeys while highlighting them as distinct visual entities, enabling users to track them over time (Gronemann et al., 2016; Padia et al., 2018; Qiang et al., 2017). Glyphs, icons, and network structures further enhance differentiation by visually representing entities and their connections. For example, incorporating character images into nodes can enhance memorability, while varying edge thickness in a network can signify the strength of relationships (Ahn, Plaisant, & Shneiderman, 2014). Textual data visualisation taxonomies provide critical guidance in determining appropriate encodings, ensuring they align with the goals of the visualisation (Kucher & Kerren, 2015), while exploring other visualisation

techniques specific to the project goals, such as character-centric literary visualisations, helps determine what to use for specific story-related data types.

At the same time, direct text representations often must be accommodated to preserve a close connection to the source material. This often necessitates a shift from traditional information visualisation principles toward "direct visualisation," which is particularly suited to humanities-related applications (Manovich, 2011). Textual summaries or the sentiment of text can also be encoded to surface deeper insights. These encodings must strike a balance between clarity and aesthetic appeal, ensuring the visualisation is both functional and engaging. For instance, in Design Stage I, the sentiment of character dialogue was encoded as positive, neutral, or negative, but feedback from Evaluation Stage I revealed that non-experts in literary analysis can struggle to understand how these sentiment encodings relate to the original text. This highlights the importance of aligning visual encodings with user expectations and interpretive abilities; particularly when supporting casual literary analysis.

One of the key challenges in this project was the representation of subjective character traits within their chapter appearances. To address this, a novel clover-shaped glyph was developed through iterative design. This glyph serves as a hybrid of iconography and data representation, reflecting the increasing adoption of hybrid techniques in accessible visualisation design (Byrne et al., 2015). These glyphs encapsulate complex data, enabling users to quickly grasp four character traits relevant to a singular chapter appearance.

Another challenge was the integration of tooltips to provide contextualising textual summaries, such as chapter overviews, character profiles, and plot and genre elements. While these summaries were ultimately best represented as on-hover text rather than visually encoded, encoding was still achieved through the inclusion of repeatable, in-context visual elements. This approach prioritised scalability, generalisability, and user comprehension, reducing the cognitive overload that might arise from an excess of visual variables. By striking a balance between visual simplicity and necessary context, the design enables users to effectively interpret unfamiliar texts without feeling overwhelmed.

In addition to visual encodings design, interaction design also plays a vital role. Interactions in a casual literary visualisation enhance user engagement by enabling dynamic exploration and manipulation of visualisation elements. In this project, a singular layout approach was employed, providing a map-like presentation that does not require users to understand a complex system or configure multiple views to see all of the data. This design choice aimed to ensure accessibility by presenting information at clear entry points through visual encodings, guiding users as they navigate the data. However, in response to feedback from Study I, an alternative simplified layout was added as a menu option to address visual complexity in the storyline view, ensuring that casual readers with lower technical proficiency or exposure to advanced visualisation techniques could still access and interpret the data. Having adapatable layout options balances simplicity and detail, helping to manage visual complexity while maintaining the visualisation's overall coherence.

A key insight from the domain expert was the necessity of supporting comparison tasks, particularly in analysing characters' development. Encoding character goals, actions, motivations, and emotions required a nuanced approach. Initially, these traits were annotated at a highly abstract level to facilitate quick comparisons. However, this approach was revised to include more specific traits, making identical characteristics less frequent but inherently more meaningful when identified. This specificity encouraged participants in Evaluation Stage II to discuss both the absence and presence of change in a character's personal traits, offering equally valuable insights into the narrative. Hence, the creation of test datasets (Section 6.4.5) is core to understanding the level of detail that supports understanding and useful interactions.

Lastly, the designer also needs to consider the use of thematic colours, literary fonts, and other aesthetic elements to create an enjoyable visualisation experience. In summary, the design choices for encoding and interaction in this project were guided by a commitment to accessibility, clarity, and engagement. By blending functional and aesthetic considerations, the visualisation supports both macro and micro level analysis, and casual exploration, meeting the diverse needs of non-expert users.

6.4.4 Algorithm and Technique: Implementation and Scalability

The final step involves translating the conceptual design into a functional tool. File structures and metadata are defined, algorithms are implemented to process and visualise the data, and datasets are piped into data structures optimised for the end user's preferred platform. Designers leverage existing libraries and frameworks to enhance efficiency and ensure compatibility. In this project, an existing storyline visualisation co-occurrence layout was used, based on JLouvain (Sugar, 2015), an open-source JavaScript implementation of the Louvain method of community detection (Blondel et al., 2008). This layout was designed for use with D3.js (Elvery, 2016), which suited the project's goal of being compatible for web-browsers.

While optimisation and performance considerations, such as load times and interactivity, are critical to the implementation of the visualisation technique, delivery of this to the end-user, such as via a downloadable or online program, also plays a significant role. In this project, the visualisation is embedded within an HTML webpage featuring a built-in menu system. This menu includes a key for understanding visual elements, settings for modifying the presentation, filters for customising the data view, a note-taking feature with an export option, access to the full text of the novel with highlighted quotes, and a data editing form for modifying the textual data as needed. In future, exporting and sharing options for the visualisation will allow casual readers to disseminate their personal insights.

During this stage, the creation of test datasets is a critical step for validating the visualisation's design. In literary visualisation, raw texts are pre-processed using manual and automated techniques, with NLP and ML toolkits employed to extract and standardise textual features. NLP and ML methods can be technically difficult to implement for those with limited experience in text analytics – and they are often trained on non-fictional data (John et al., 2016). In this project, the challenge of understanding linguistic abstraction and processing was eventually

overcome through the use of generative AI (ChatGPT (OpenAI, 2024)), which resulted in the development of a prompt-to-JSON pipeline for producing a visualisation that can summarise key aspects of characters and the novel.

The implementation of the pipeline still relies heavily on manual verification and management, which directly impacts the scalability of the design in this project. This trade-off was necessary to achieve a contextually and textually enriched visualisation layout, tailored to provide detailed insights for non-expert users. However, if scalability is a primary concern, this level of textual enrichment may need to be reduced. In such cases, automated data extraction and higher-level visualisation techniques could be employed, though this would likely come at the cost of the depth and specificity that manual enrichment provides. Balancing these priorities depends on the intended purpose of the visualisation, the needs of its end users, and the dedication of people willing to manually annotate and support the generation of literary datasets.

6.4.5 Create Test Datasets

As mentioned a number of times in the previous sections, the creation of test datasets is a foundational step in designing literary visualisations. Iterative experimentation with how to extract and store the data in appropriate data structures involves decisions that profoundly influence both *how* and *what* aspects of a literary work (in this case, a novel) are represented. For instance, extracting character dialogue lines to experiment with network visualisation or determining how to record character appearances – whether through direct mentions, inferred presence, physical presence, or even existing within the mind of another character – are not trivial tasks. Each choice shapes the interpretation and framing of the narrative in the resulting visualisation.

For example, I encountered a challenge when deciding whether to visualise characters who lack spoken dialogue. Since social networks were central to my visualisation design, the absence of dialogue could render characters invisible in these networks. This issue became particularly apparent while working with *The Time Traders* (Norton, 1958), where in Chapter 11, a single character is present throughout, with no direct interactions or dialogue exchanges with others. This scenario underscored how textual nuances and variations across novels can disrupt seemingly straightforward design rules. Such challenges only became evident after engaging with a diverse range of texts, highlighting the necessity of iterative testing and refinement.

It is crucial for designers of casual literary visualisations to immerse themselves in the texts they aim to represent. By doing so, they can better align the design with the experiences and expectations of casual readers. A designer might opt to enforce rigid rules for what constitutes an appearance to ensure generalisability and scalability across texts. However, this approach risks excluding outlier cases – such as solitary characters or unique narrative techniques – that deviate from these conditions. For example, a strict adherence to visualising only spoken dialogue could misrepresent novels that rely heavily on introspection or solitary storytelling, potentially diminishing the richness and fidelity of the visualisation.

Additionally, using NER has its limitations, particularly with texts where character identification is not straightforward due to the narrative's complexity. In *The Stainless Steel Rat* (Harrison, 1957), for example, the protagonist adopts multiple disguises throughout his adventure, each accompanied by entirely different names in various chapters. Similarly, his primary adversary Angelina is referred to by multiple names, including Angelica in certain instances, and Angela for an entire chapter. While these naming variations hold significant plot relevance, they pose substantial challenges for automated extraction using NER tools.

NER algorithms typically rely on patterns and context within the text to identify and classify named entities, such as people, locations, or organisations. However, they are not inherently equipped to resolve such ambiguities without additional contextual information or advanced co-reference resolution. In this case, distinguishing between the protagonist's disguises or the alternate names used for Angelina would likely require a more sophisticated approach, such as linking entities across sentences and chapters using external knowledge or annotated datasets.

Through traditional reading and manual annotation, I was able to understand and make notes on the context surrounding these naming variations, correctly interpreting both the protagonist's and Angelina's appearances and aliases. This process highlights an important limitation of NER: while it can efficiently identify and classify entities in simpler texts, it struggles with nuanced narratives where names are fluid or context-dependent. This underscores the need for iterative, human-informed review in cases where NER outputs are used to create literary visualisations, ensuring fidelity to the source material.

Another example of resolving a highly-specific issue for character appearances was discussed in the reflection on the *Harry Potter and the Philosopher's Stone* (Rowling, 1997) dataset, in Section 4.5.1.

Balancing these priorities – scalability versus nuance – is a core challenge in creating test datasets for casual literary visualisations (and literary visualisations in general). While strong generalisable rules may support automated pipelines and broad applicability, they may fail to capture the full complexity and diversity of narrative structures, entities and relationships. Designers must therefore navigate these tensions thoughtfully, considering not only the technical requirements of the visualisation but also the interpretive experiences they wish to support for casual readers. Ultimately, iterative engagement with varied texts to develop test datasets – supporting processes from abstraction to implementation (Figure 6.2) – combined with a willingness to refine both the underlying rules and the resulting representations, is essential for crafting effective and inclusive casual literary visualisations.

6.5 Visualisation Interaction Variability in Casual Literary Analysis

To better understand the optional and situational nature of interaction in casual literary contexts, this section introduces a framework of four key dimensions. These dimensions emerged from patterns of interaction variability observed in Study II (Section 5.14), and they provide a

lens for understanding the diverse ways casual readers may interact with and integrate literary visualisations into their individual or collaborative practices.

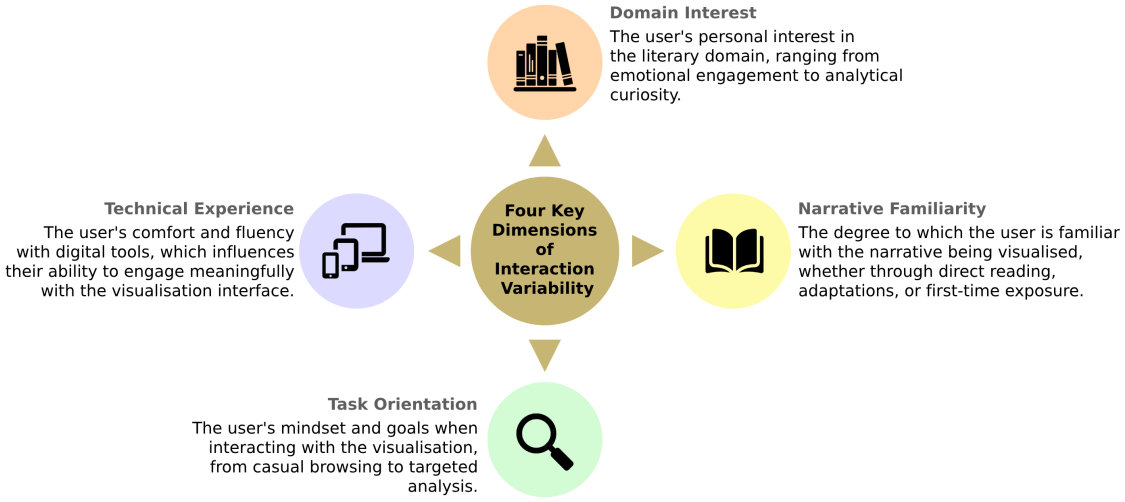

FIGURE 6.3: The four key dimensions of interaction variability that may be observed when a user interacts with a casual literary visualisation.

As shown in Figure 6.3, for a potential user of a casual literary visualisation, the four key dimensions of interaction variability are:

- **Domain Interest:** The user's personal interest in the literary domain, ranging from emotional engagement to analytical curiosity.
- **Narrative Familiarity:** The degree to which the user is familiar with the narrative being visualised, whether through direct reading, adaptations, or first-time exposure.
- **Task Orientation:** The user's mindset and goals when interacting with the visualisation, from casual browsing to targeted analysis.
- **Technical Experience:** The user's comfort and fluency with digital tools, which influences their ability to engage meaningfully with the visualisation interface.

Rather than reflecting a linear model of skill acquisition, these dimensions represent diverse and situational factors that shape casual literary visualisation engagement. They emphasise that variability in interaction is not a deficit to be corrected but a feature to be supported, especially in the context of casual, collaborative, and often exploratory literary analysis.

By proposing these dimensions, I aim to provide practical guidance to designers developing tools for casual literary analysis. Much like the Six Questions framework and NEUVis schematic (Gough et al., 2016), these dimensions can be used to inform design decisions and anticipate the diverse needs and preferences of casual readers engaging with literary content through visualisation. Similar to the proposed model of the casual literary visualisation design pipeline (Figure 6.2), the dimensions are coloured to reflect an optional correspondence

with the stages of Munzner's model of visualisation design (Munzner, 2009). This may help visualisation designers determine when to consider each dimension in their process; however, each dimension is relevant across multiple stages and should not be seen as fixed to any single phase. Instead, they offer a flexible lens through which to approach the iterative and context-sensitive nature of casual literary visualisation design.

Each of the following sub-sections introduces one dimension in detail, using findings from Study II to illustrate its relevance and offering reflective questions to guide future visualisation design.

6.5.1 Domain Interest

The domain interest dimension represents the ways casual readers choose to engage with the literary domain, shaped by their motivations, prior experiences, and exposure to related media. Domain interest encompasses diverse modes of interaction, from personal interpretations and emotional connections to cross-media comparisons and analytical insights. Rather than existing on a spectrum of expertise, user engagement reflects distinct approaches that are equally valid and meaningful based on the type of interest the casual reader has for the domain.

The findings from Study II highlighted how participants drew on their unique forms of domain familiarity, cultivated through interest in the domain (such as watching crime TV shows), to interpret the visualisation. For instance, some participants used the visualisation to reflect on how the characters have been represented across media, such as TV adaptations. Others focused on personal connections to characters or relationships, using the visualisation as an entry point to rediscover an emotional connection they felt to an aspect of the text. Still, a smaller subset adopted a more analytical perspective, examining the visualisation for insights into narrative structure and pondering the book author's intentions regarding how they represented their characters, which reflects a closer association with aspects of formal literary analysis.

These varied engagements suggest that the domain interest dimension is highly fluid and context-dependent. Readers with a strong affinity for emotional storytelling might use the visualisation to recall poignant character moments, potentially connecting these scenes to personal experiences and deepening their attachment to the narrative. Others with an analytical focus could use a casual literary visualisation to identify patterns in character representations, or explore how the plot aligns with genre conventions, such as the structure of a detective fiction novel. Additionally, the visualisation could facilitate cross-media engagement by prompting readers to consider how adaptations reimagine characters or omit key relationships, encouraging reflection on creative choices across different formats.

Questions the designer can ask to address this dimension:

- How can the visualisation support readers who prefer personal, emotional engagement with characters and narratives?
- In what ways can the visualisation facilitate cross-media comparisons, encouraging connections between the text and its adaptations in other media?

- Does the design include tools to support structured analysis, enabling readers to explore themes, character arcs, and narrative techniques?
- How can the visualisation balance these diverse approaches, providing flexibility for users to transition between casual exploration and deeper analysis?

6.5.2 Narrative Familiarity

The narrative familiarity dimension represents the degree to which users are familiar with the specific narrative that is visualised; whether through direct engagement (e.g. reading the novel), partial exposure (e.g. through adaptations or summaries), or encountering the story for the first time via the visualisation itself. This dimension influences how users rely on the visualisation to contextualise, explore, or clarify narrative elements.

This dimension aims to broaden the concept of textual memory to include varying degrees and types of engagement with a story. While some users may bring detailed recollections of the text, others rely on partial or indirect exposure, such as familiarity with similar genres or adaptations. Visualisations can bridge these gaps by offering tailored features that support exploration and understanding across all levels of familiarity. For example, a user may want to confirm if the original novel aligns with their familiarity with a TV show adaptation, or they may want to refresh their memory of a novel they have read.

In Study II, participants exhibited a wide range of familiarity with the text due to the study design. In the read novel portion, all users had read the novel, but their familiarity differed based on their recollection of the text, with some using the visualisation to supplement and clarify their memory, particularly for less prominent characters or plot details. In the unread novel exploration portion, some viewed the visualisation as a visual blurb, attempting to discern plot progression from the shape of the visualisation layout. Others used it to gain an initial understanding of characters but refrained from exploring too deeply, as they only wanted to determine if they would read the novels. Still others, familiar with characters through adaptations, drew comparisons to their pre-existing knowledge. Hence, this dimension reframes the visualisation not only as a memory aid but also as a narrative gateway, adaptable to users with diverse backgrounds and exposures. By accommodating varying levels of narrative familiarity, the design can potentially inspire readership, with appropriate methods of hiding spoilers, or support detailed recollection of a read novel.

Questions the designer can ask to address this dimension:

- How can the visualisation serve as a meaningful introduction to the story for first-time users?
- What features (e.g., summaries, visual highlights) can support users with partial familiarity, such as those exposed to adaptations or similar genres?
- How does the design accommodate users with varying levels of detail retention, from broad narrative understanding to intricate recollections?

- Does the visualisation encourage curiosity and exploration, providing value to both highly familiar and unfamiliar users?

6.5.3 Task Orientation

Task orientation refers to the approach or mindset a user adopts when engaging with a system, tool, or activity, based on their goals and objectives. It determines how focused or casual their interactions are and influences the strategies they use to accomplish their purposes. For casual literary analysis, this dimension shapes how users interact with the visualisation to conduct their narrative or character inquiries, influencing both the depth and structure of their engagement.

For instance, users with low task orientation may casually browse the visualisation without specific goals in mind, focusing on surface-level exploration such as identifying character appearances or skimming through relationship connections. Whereas medium task orientation may involve some loose objectives, like understanding relationships, moving from open exploration to the gradual formation of questions about narrative details. Those with higher task orientation exhibit focused objectives, such as resolving specific questions or verifying precise details.

Task orientation is also shaped by the context of use, such as, individual or collaborative. Study II revealed that task orientation in visualisation-supported casual book discussions is highly dynamic. While discussion prompts were devised to structure the sessions, participants often deviated from these to explore tangential topics or revisit points of personal interest. For instance, some participants used the visualisation to resolve specific questions, such as clarifying character appearances, while others used it to spark broader discussion.

In casual literary analysis, task orientation not only impacts how users interact with a visualisation but also shapes the kinds of insights they seek, whether they are looking for emotional resonance, narrative clarity, or structural patterns. Visualisations must accommodate these varying levels of focus and intention – or clarify the specific intent of their design – offering features that either support exploratory or goal-driven use, or for more sophisticated designs, both of these.

Questions the designer can ask to address the task orientation dimension:

- How does the visualisation accommodate both goal-driven tasks and casual exploration?
- Does the design allow users to shift seamlessly between individual and collaborative workflows?
- Are there features that support emergent tasks, particularly in group discussions?
- How does the visualisation avoid imposing rigid workflows while supporting task-focused users?

6.5.4 Technical Experience

The technical experience dimension reflects the target end-user or user group's familiarity with and exposure to digital tools and technologies. Rather than focusing solely on proficiency, this dimension acknowledges the diversity of technological experiences that influence how casual readers evaluate the integration of a literary visualisation into their discussions or analyses.

A user's familiarity with digital tools and interfaces is shaped by both prior exposure to technology and personal preferences. In Study II, participants displayed varying levels of comfort with the visualisation interface. While some navigated its features with ease, others relied on group members for guidance. Interaction was further constrained by the shared use of a single device (a computer with a mouse), which inadvertently created a dynamic where more technically confident participants took the lead, while others deferred. To address such barriers, a casual literary visualisation could be designed for synchronous use across multiple devices, such as tablets or smartphones, allowing participants to engage independently or collaboratively. Thus, technical comfort derived from experience impacts not only how users interact with a casual literary visualisation but also their ability to integrate it effectively into physical or online discussion settings, where logistical and technical constraints may also play a role.

Additionally, technical experience reflects how potential end-users habitually use technology to read and analyse literature. For instance, eBook studies highlight the importance of adapting existing technologies, such as character-centric literary visualisations, to enhance personal story comprehension (Coleman & Hinze, 2017; Hinze et al., 2018). These studies emphasise that casual readers should not need to learn complex interfaces as experts in literary analysis might. Experts often adopt advanced visualisation tools for professional tasks, which motivates them to develop their technical proficiency. In contrast, casual readers may be less likely to engage with a visualisation if it is difficult to adopt. In this research, the visualisation was designed for the web, recognising that non-experts in literary analysis frequently use web interfaces, such as wikis. However, the design falls short in optimising for mobile devices, which are more accessible in casual settings. Furthermore, if a casual discussion group meets online, considerations must be made for distributed engagement with the visualisation, particularly if participants wish to reference or update it collaboratively in real time.

Questions the designer can ask to address the technical experience dimension:

- How intuitive is the visualisation for users familiar only with everyday technologies like smartphones?
- Can the layout technique be adapted for multiple platforms and devices?
- How does the design balance simplicity with depth for technically experienced users?
- In collaborative settings, are there considerations in the design for co-located versus distributed use?

6.5.5 Unlocking the Affective Potentials of Casual Literary Visualisation

By addressing the cognitive and functional aspects of these dimensions, casual literary visualisations may unlock broader affective potentials. Positive and negative emotional reactions to characters were demonstrated in Study II when the visualisation functioned effectively as a reference point. That is, when users were able to quickly locate and recall character details or relationships, their engagement was enhanced, fostering both emotional responses to the narrative and confidence in their contributions to discussions. Conversely, the mitigation of negative emotions associated with a difficult-to-use or poorly integrated visualisation, such as frustration or intimidation, ensures that users can focus on engaging with the narrative and participating in discussions rather than struggling with the tool itself.

Affect is an important facet of non-expert user engagement (Gough, de Berigny Wall, & Bednarz, 2014), but it was not specifically addressed by the evaluations in this research. Affective outcomes were observed, but as practical integration was the primary focus of this work, further investigation is required to uncover the affective potentials of casual literary visualisation, such as the ability to entice readership, encourage genre exploration outside what is familiar to the end-user, or generate sympathy – or even empathy – for characters in culturally significant texts. This opens up avenues for future research into the role of affect in casual literary visualisations.

6.6 Research Strengths

In the following sections, I outline the key strengths of this research and how it contributes to the broader fields of non-expert user visualisation, casual visualisation and literary visualisation.

6.6.1 Contributing to the Dialogue on Non-Experts in Visualisation Research

This research contributes to a broader and ongoing dialogue in visualisation research about how to design for non-experts, particularly by addressing a critical gap in the underexplored domain of literary visualisation. Non-experts represent a dynamic group, with diverse perspectives that shift depending on context and engagement. As Burns et al. (2023) note, the term "non-expert" has been inconsistently applied in visualisation literature, creating challenges for the design and evaluation of tools intended for these audiences. By focusing on casual readers as a distinct subset of non-experts, this research advances understanding of how literary visualisations can support interpretive and exploratory practices in informal, collaborative contexts such as book discussions.

In the literary visualisation space, to my knowledge, this research is the first to explore the design and evaluation of a character-centric literary visualisation for non-experts to reference during casual book discussions. This aligns with the broader trajectory of research into casual information visualisation, which emphasises optional engagement and exploration over

predefined tasks (Pousman et al., 2007). The findings from this research demonstrate that non-expert users, such as casual readers, engage with visualisations in fluid, context-dependent ways. Study II, in particular, revealed how visualisations can facilitate diverse, spontaneous interactions by serving as a flexible reference tool, rather than enforcing rigid workflows. This reflects the need for designs that support interpretive agency, allowing users to navigate between individual reflection and group collaboration as their needs evolve during discussions.

This research further addresses a gap in non-expert visualisation studies, which have historically focused on domains like scientific visualisation (Gough, Ho, et al., 2014; J. Roberts & Gough, 2016). By contrast, literary visualisations must grapple with the subjectivity and interpretive complexity of narrative data – even when designed for experts – making them inherently different from tools designed for quantitative, abstract data. This project underscores how literary visualisations can encode textual data for non-expert audiences, such as summarising character appearances, relationships, and personal traits, while highlighting the complexity of balancing appeal with accuracy.

Moreover, this research situates literary visualisation within the evolving discussion of non-expert engagement in collaborative contexts. Collaborative visualisation literature highlights the importance of tools that facilitate shared awareness and flexible group workflows (Isenberg et al., 2011). This research extends these principles into the literary domain, demonstrating how literary visualisations can function as shared reference points that enhance group discussions without imposing predefined tasks. In doing so, it offers a new perspective on how casual readers integrate visual tools into their discussions, filling a gap identified in the literature on collaborative and non-expert visualisation.

By framing casual literary visualisation as a space that bridges personal interpretive and exploratory practices, this research contributes to the broader dialogue on designing for non-expert users. It highlights the importance of accommodating the variability of visualisation interaction during casual literary analysis, and calls for future studies to expand on these insights with longitudinal studies. In doing so, it not only advances the field of literary visualisation but also enriches the understanding of non-expert engagement within a relatively unexplored visualisation context.

6.6.2 Exploration of New Visual Encodings for Textual Data

A key strength of this work lies in the detailed exploration of visual encodings for accessible character-centric literary visualisation. Throughout the design process, significant effort was devoted to identifying effective ways to represent complex character data in a format that remained intuitive to non-experts while preserving the context of character journeys. This exploration culminated in the development of the innovative character clover encoding – central to the *Clover Connections* visualisation technique – which represents four personal character traits as text strings directly linked to their appearances, per book chapter (Section 4.9.3). By mapping these attributes to specific points in the book's structure, this encoding enables users to intuitively explore key character information in a way that is visually integrated with the

narrative. This approach not only enhances the accessibility and clarity of character data for non-experts but also offers a unique method for linking direct text visualisation of a character's attributes to individual chapters, fostering a textually and contextually enriched exploration of their role.

The integration of plot and genre contextual markers (Section 5.8), using on-hover encodings, was also the result of a deliberate and iterative design process. This approach prioritised the representation of textual data in a way that would remain interpretable and meaningful to non-expert users while ensuring the visualisation's primary focus on characters was not overshadowed. Each design iteration sought to balance simplicity with clarity, ensuring that the visualisation effectively conveyed character dynamics across different genres. This process underscored the importance of contextually enriched designs that provide meaningful insights without overwhelming users. Moreover, the investigation into methods of visualising genre-specific elements highlighted a gap in the broader field of literary visualisation. This work demonstrates how thoughtful design can bridge this gap, offering a visualisation technique that is both genre-adaptive and user-friendly.

6.6.3 Innovative Methodology for Evaluating Casual Literary Visualisations

The custom evaluation approach developed for Study II (Section 3.9.1) is a significant strength due to its detailed design, alignment with a real-world casual discussion context, and the level of precision that makes it reproducible for other researchers. The method was carefully crafted to simulate an book club setting while integrating the visualisation tool into the discussions. This dual focus on authenticity and rigorous data collection allowed the study to capture both the practical use of the visualisations and the dynamics of casual literary discussion.

The detailed descriptions of the setup, preparation, and facilitation provide a robust framework that ensures reproducibility. For example, by including specific details, such as the room setup and use of a wireless mouse and optional keyboard, the method is transparent regarding potential physical and technical barriers, ensuring that researchers consider how to optimise the environment for participant engagement.

The preparation phase further underscores the reproducibility of the approach. Participants were given clear instructions, including pre-reading a specific text, ensuring a shared foundation for discussion. The choice of *A Study in Scarlet* as the primary text was strategic, balancing accessibility with complexity to foster meaningful engagement with the visualisation. The use of discussion prompts, tailored to align with visualisation elements, bridged the gap between traditional book club facilitation and the novel integration of visualisations, making the methodology adaptable for future studies.

The incorporation of a book club-inspired focus group structure was another innovative element. This approach blended a structured session with open-ended discussion, allowing for organic participant interaction while maintaining a focus on the evaluation objectives. The division into two parts – discussion of a read novel and exploration of unread novels – provided

insights into the visualisation technique's utility across different usage contexts. This structure ensured that the evaluation was thorough, capturing both retrospective and exploratory integration of the visualisation into a casual book discussion setting.

Finally, the use of a semantic differential scale in the post-discussion questionnaire was devised to address common response biases associated with Likert scales, and allowed for a nuanced understanding of participants' perceptions of factors such as engagement and usability. Hence, the overall methodology offers an effective template for other researchers to use or adapt when seeking to evaluate in similar casual and collaborative contexts.

6.6.4 Online Accessibility of Visualisation Artefacts

Another strength of this research is the development of tangible, character-centric literary visualisation artefacts that are accessible online[1]. This format allows the artefacts to reach a wide audience, from casual readers to educators and researchers, offering an interactive and intuitive way to explore character dynamics and narrative structures. By hosting these artefacts online, the research moves beyond theoretical discussion and provides practical outputs that can be directly experienced by anyone with an interest in the topic.

Their immediate accessibility is useful in both demonstrating the research findings and disseminating the underlying techniques. Members of the general public can engage with the visualisations to deepen their understanding of literary texts in an enjoyable and straightforward manner, while researchers can explore the techniques used to determine their potential relevance to their own literary visualisation projects.

Furthermore, making the artefacts viewable online serves as an effective means of showcasing the research to a wide and varied audience. Throughout conducting this research, ad-hoc demonstrations were conducted and generated significant interest in the approach from people with a variety of professional backgrounds. These served as a discussion artefact not just in the Study II evaluation, but also in communicating the broader implications of the work to those interested in this relatively novel area of visualisation research.

6.6.5 Dialogue Datasets for Other Researchers

This research also contributes a set of manually annotated dialogue datasets derived from public domain novels[2]. These datasets can support researchers in various fields, including natural language processing, literary analysis, and social network analysis. By offering structured data on character interactions, this work provides a foundation for exploring character social relationships within popular genres.

The datasets cover dialogue exchanges in *A Study in Scarlet* (A. C. Doyle, 1888), *The Mysterious Affair at Styles* (Christie, 1920), *The Stainless Steel Rat* (Harrison, 1957), and *The Time Traders* (Norton, 1958), each of which represents a distinct narrative style within its respective genre.

[1] `https://natalie.house/phd`
[2] `https://github.com/nataliehouse/noveldialogues`

The inclusion of speaker-receiver relationships offers the added opportunity to quantify relationship strength and explore the directionality of character networks in a systematic way.

To ensure broad applicability, the datasets are provided in a standardised CSV format, making them compatible with common data analysis tools. These datasets were compiled with meticulous care, balancing manual accuracy with contextual inference when necessary. For example, dialogue directed at multiple characters is repeated to preserve relationship data, while instances of monologues or inaccessible speech are marked with blank receiver fields to maintain consistency.

By releasing these datasets, this research not only facilitates deeper exploration of literary works but also provides a resource for interdisciplinary studies, bridging literature with computational and data-driven approaches. Future researchers are encouraged to build upon these datasets, adapting them for new methodologies and uncovering fresh insights into the art and structure of storytelling. I also plan to continue adding to the repository after completion of the thesis.

6.7 Research Limitations

In the following sections, I outline the primary limitations of this research, the rationale for why these were encountered, and opportunities these create for future research.

6.7.1 Prioritisation of Technical Development

The early stages of this research project prioritised the development and navigation of a literary visualisation pipeline to abstract, extract, and visually encode textual data, focusing on summarising characters in a novel as systematically and cohesively as possible. A domain expert in literary analysis and criticism of novels was engaged at the commencement of Study I to guide decisions on which elements – such as character goals, actions, and relationships – were most critical to include for a non-expert audience, ensuring that the extracted data captured meaningful aspects of the text with as much objectivity as possible. After this consultation, I focused on ensuring that character data could be abstracted and encoded in a way that was scalable and consistent for different novels.

This technical prioritisation enabled the early development of tangible artefacts that were essential for the project's evaluation components. These artefacts served as tangible outputs for examining how non-experts engaged with character-centric literary visualisations in both Study I and Study II. The process of building these artefacts provided valuable insights into the feasibility of the pipeline, as well as the interpretive challenges and opportunities inherent in visualising literary data. Without these initial artefacts, it would have been difficult to structure and test the evaluation phases of the project effectively.

However, engaging potential end-users from the start – such as employing a co-design approach with casual readers – could have provided valuable insights into casual literary discussion and analysis practices. Therefore, this project represents one possible approach to navigating the design and evaluation of a character-centric literary visualisation, which begins with working to characterise the data for accurate and meaningful visualisation.

Rather than attempting to account for the full spectrum of potential use cases, the focus was on developing a tool that encapsulates a particular approach to summarising and encoding character data for interpretive use, whether referred to individually, collaboratively, online, or in-person. Study II revealed how non-experts adaptively engaged with the visualisation technique, demonstrating its capacity to support diverse interactions without requiring tightly defined tasks. These findings validate the flexibility of the tool and provide a strong foundation for future refinements that could incorporate a co-design approach to further expand its applicability.

In hindsight, smaller yet still formal evaluations conducted earlier, with target end-users, could have enhanced the UCD approach, however, informal testing throughout the design stages did help to validate various design decisions. Hence, prioritising technical feasibility ensured a workable visualisation design pipeline that produced the artefacts needed to evaluate with non-experts both informally throughout the process, and formally at the end of both design stages.

6.7.2 Participant Numbers

The evaluation process for Study II faced significant challenges in recruitment, particularly due to the specific inclusion and exclusion criteria used. Burns et al. (2023) note that many studies in visualisation research recruit participants from Western, Educated, Industrialised, Rich, and Democratic (WEIRD) societies, which narrows the demographic scope and limits the generalisability of findings. The major issue regarding this is the propensity for academic researchers (like myself) to recruit from within the university. Avoiding this bias meant that my recruitment process was considerably more difficult, as I recruited participants using a snowball/referral technique to find people aligned with the intended target audience of a casual literary visualisation technique. The specific challenges encountered were discussed in detail in Section 5.12.1 of Study II.

Furthermore, the significant time investment required for the evaluation in Study II – approximately 7 hours in total – acted as a deterrent for many who initially expressed interest in participating. Several withdrew after learning of the time involvement, underscoring the challenges of conducting evaluations on a voluntary basis that require a significant amount of dedicated time commitment from participants. One potential solution for future studies could involve limiting the participant workload by only requiring them to read certain chapters or sections of the novel for evaluation purposes. However, reflecting on the wealth of data I collected from the smaller groups of participants who collaboratively engaged with visualisations of both a read and unread novels, I consider the sample size to be justified. The depth of interaction and

discussion resulting from full engagement with the read novel in particular provided a rich dataset that would likely have been reduced had the evaluation been more limited in scope.

This observation is critical for other researchers in literary visualisation to consider, as the depth of participants' engagement with the source material directly influences how much can be illuminated through their use of the visualisation. It is also worth noting the ethical considerations that arise when recruiting participants, such as ensuring that recruitment from established reading groups respects their existing reading schedules and recognising that not all members may be interested in participating collectively.

Finally, it is worth noting that other character-centric literary visualisation studies that conducted in-depth qualitative evaluations of their techniques recruited between five and 13 participants (Hinze et al., 2018; Hoque et al., 2022, 2023; N. W. Kim et al., 2018; Watson et al., 2019). This suggests that recruiting participants who meet the specific criteria required for a technique's intended application can present a significant challenge for researchers in this field.

6.7.3 Technical Implementation

As a designer with moderate web programming skills, I was aware from the outset that I would encounter technical limitations in undertaking this project. However, this awareness did not deter me from successfully developing the implementation, which demonstrates both the viability and accessibility of the approach to the pipeline. For instance, using ChatGPT (OpenAI, 2024) to generate the character personal traits provided a consumer-friendly way of incorporating generative AI into the project, enabling the extraction and structuring of narrative data into the JSON format via the application of a series of prompts per novel chapter (see Appendix C). This project demonstrates the usefulness of generative AI in supporting those who lack the time and advanced technical skill to become fully versed in the configuration and application of less user-friendly NLP and ML text classification models.

The technical implementation I developed did serve its purpose, which was to answer the research questions and provide accessible online design artefacts. Of course, the process of building these visualisations requires a significant amount of manual input and a moderate level of technical expertise, particularly in the creation of the JSON dataset that forms the foundation of the visualisation. There is also the added challenge of working with literary data, which is inherently subjective, layered, and rich in interpretive nuance. For example, time has to be dedicated to verifying the ChatGPT outputs to ensure they are accurate to the text, and ensuring accuracy requires having read the text too. While the resulting visualisations are accessible for non-experts to use, this reliance on manual dataset creation introduces scalability challenges. Nevertheless, these challenges also present opportunities for future advancements in automation and community collaboration.

Continued advancements in NLP and ML offer promising opportunities to address the challenge of desiring highly specific, and dynamic, textual datasets. Recent work by Sang et al. (2022), for example, describes the specific challenges of developing narrative comprehension techniques from the perspective of understanding characters, and propose a multi-view model

for fictional character personality prediction, building on prior work in text classification. The popular and continued development of tools for entity recognition, relationship mapping, and thematic analysis continue to automate much of the data extraction process. A more automated approach to extracting the character personal traits, utilising more advanced tools, would preserve the interpretive depth of the dataset while significantly reducing the workload required to produce it. This would make the visualisation pipeline more efficient and accessible, particularly for non-technical users without specialised resources.

The collaborative potential of the visualisation also provides a pathway to mitigate the challenges of dataset creation. Once completed, the visualisations are web-based and accessible to a wide audience. Similar to digital wikis, which rely on collective contributions, the visualisation platform could be enhanced to enable community-driven collaboration. Book clubs, educators, or literary enthusiasts could work together to create visualisations, sharing the effort of dataset creation and expanding the tool's reach. Once created, these visualisations could then serve as reusable and expandable resources, situated on the web to facilitate ongoing updates and new contributions. This collaborative model aligns with the project's goals of general audience accessibility and shared exploration, transforming the visualisation system into a living resource to reference characters' journeys in a novel.

These opportunities highlight the potential for the pipeline to evolve beyond its current limitations. While the manual nature of dataset creation reflects the complexities of literary data, it also underscores the importance of focusing on automation and community-driven workflows in future iterations. By integrating advancements in NLP and fostering collaborative contributions, the pipeline can become more scalable and inclusive, without compromising the richness of the narratives it visualises.

6.8 Future Research

In this section, I outline my plans for the next phase of this project, as well as broader implications for future research in casual literary analysis.

6.8.1 The Next Design and Evaluation Cycle Iteration

In the next design cycle iteration, I plan to incorporate key design improvements based on the findings from Study II. The following subsections describe my personal plans for future work on this research project.

Exploration of Relationship Encodings

I plan to design and integrate relationship encodings to visually represent the nature of relationships between characters, categorising them into distinct types such as professional, familial, romantic, or role-based. This approach aims to support more nuanced interpretations of character relationships, as observed in participants' responses in Study II. By encoding relationships with specific visual markers, I aim to help users better understand and track the

dynamics between characters as they evolve throughout the story, such as when characters become friends or progress to a romantic relationship. Casual readers who enjoy teen fiction, for example, consider characters' romantic dynamics to be of particular interest (Pianzola et al., 2020), demonstrating that specific relationship encodings could enhance the utility of casual literary visualisations.

While investigating this idea, I uncovered research that can serve as a practical foundation. Massey, Xia, Bamman, and Smith (2015) employed manual annotators to classify character relationships across several novels from Project Gutenberg (Project Gutenberg, 2024) into coarse-grained categories – such as familial, professional, and social – and fine-grained types, including friend, rival, parent, and lover, while also capturing changes in relationships over time. Their study demonstrates that even non-expert annotators, working from third-party summaries such as *SparkNotes* (SparkNotes, 2024b), can provide structured insights into character relationships, which may be translatable to effective visual encodings.

Spoiler-Free Mode

Study II's evaluation design had the unintended side effect of highlighting another avenue for future research, which will involve enhancing the visualisation tool by introducing features that cater to the needs of readers exploring new narratives. This will be added in the form of a spoiler-free mode, designed to hide critical plot revelations or key story twists. This feature could address concerns raised during Study II, where participants expressed hesitation in engaging with the visualisations of unread novels due to fears of encountering spoilers.

A spoiler-free mode would allow readers to navigate the overview without revealing critical plot details, making the tool more suitable for readers who prefer to approach novels with minimal prior knowledge of the plot. One approach currently in the ideation phase is to have a click-to-reveal function to add the next chapter and associated characters to the layout. This contributes towards a larger theoretical idea of generating a data-driven visual blurb for a novel, which I discuss later in Section 6.8.2.

Time-to-Read Feature

To address participants in Study II's desire for a clear understanding of how long it would take to read a novel, a time-to-read feature will be added per chapter. This feature will estimate the reading time for a chapter based on word count and average reading speed, allowing users to make informed decisions when selecting a novel for their book club discussions. By providing an approximate duration, the feature will cater to participants who want to balance their reading commitments with other responsibilities, ensuring that they have realistic expectations of how long the novel might take to complete.

H. Kim, Lee, and Park (2011) explored one method for visualising text readability and time-to-read to assist casual readers in selecting books, particularly from large online bookstores where practical questions like reading difficulty and time requirements often arise. The researchers proposed a method to simulate the human reading process visually by using factors

such as word length, sentence length, and paragraph size, which significantly influence readability. These elements were transformed into visual patterns, where books with longer and more complex text structures appeared as dark, static images, while books with shorter, simpler text structures were represented by bright, dynamic patterns.

The study tested this method on several books, demonstrating distinct visual representations that correlate with the books' readability. Most participants in the user study were able to correctly predict a book's readability based on the visualisations, validating the approach. By combining word count with average reading speeds, as suggested in H. Kim et al. (2011), an approximate time-to-read estimate can be presented clearly and intuitively. While their visualisation of readability is distinct from the existing *Clover Connections* layout, the underlying concept of equipping readers with practical information to aid book selection aligns with the goals of this feature. Integrating such a calculation into the visualisation interface will enhance its utility, enabling participants to plan their reading schedules or reflect on the significance in length of a novel they have already read.

Data Uploading and Visualisation Sharing Functions

In the next iteration of the visualisation system, I will add functionality to enable users to upload a JSON dataset via the *Data* tab in the system menu. This feature will allow users to replace the existing dataset with their customised data, enabling greater flexibility and personalisation. The uploaded JSON file will be parsed and validated to ensure it adheres to the required schema for compatibility with the visualisation layout. Errors or inconsistencies in the dataset will trigger user-friendly error messages, prompting corrections to maintain system stability.

Additionally, I will introduce the ability to generate a sharable link for the visualisation layout. This feature will allow users to share their customised visualisation with others, including the uploaded dataset, in a single URL. Technically, this can be achieved by creating a snapshot of the current visualisation state, serialising the layout and dataset into a compressed JSON object, and appending it to the URL as a query parameter. Alternatively, the system could store the snapshot on a server, with the link referencing a unique ID that retrieves the saved data. The first approach is lightweight and avoids the need for server-side storage, but poses some technical hurdles, while the second approach offers more scalability for large datasets. By adding these features, the system will support a more collaborative and flexible approach to data exploration and sharing, allowing users to seamlessly share their interpretations and customised datasets with others in their community.

Evaluate the Visualisation in an Online Setting

I plan to evaluate the visualisation in an online setting to explore its potential for supporting distributed casual literary analysis. Existing research on digital social reading (Pianzola et al., 2020; Rebora et al., 2021) highlights how online book discussion communities rely on a blend of textual and interactive tools to facilitate engagement. However, the role of visual aids, particularly those designed for character-centric analysis, remains underexplored. The

Clover Connections layout offers a unique opportunity to address this gap by providing a textually enriched and visually integrated reference point for digital discussions, as discussed in Section 2.2. Evaluating its use in online environments would provide critical insights into its effectiveness in enhancing distributed literary engagement and supporting diverse user needs.

Moreover, such an evaluation could reveal practical challenges and opportunities specific to online settings, such as how participants collaboratively navigate the visualisation or adapt it to asynchronous discussions. By focusing on popular online book discussion platforms, this investigation could establish whether tools like *Clover Connections* are not only useful but also intuitive and accessible in these contexts. This approach is strongly motivated by the growing trend of digital and hybrid literary communities, where tools that support visual and textual interaction could significantly enrich the book discussion experience.

6.8.2 Areas for Future Research into Casual Literary Visualisation

Additional gaps reveal multiple avenues for other researchers to conduct further investigation into the potential of casual literary visualisations. In the following subsections, I outline areas that offer interesting opportunities for future research.

Exploring Genre-Specific Visualisations

An exciting avenue for future research lies in visualising different genres to uncover how their unique conventions influence user engagement and interpretation. While this project centred on detective and science fiction genres, expanding the scope to include genres like romance or fantasy presents an opportunity to discover innovative ways to represent their distinct narrative structures and character dynamics. In this project, genre elements were added in the form of contextual markers on a per-chapter basis – clues for detective fiction and advanced technologies for science fiction – but these additions did not modify the core layout itself in order to retain its generalisability to all genres.

Taking a deeper dive into a single genre could provide valuable insights into designing graphical representations that resonate with casual readers by capturing the essence of that genre. This would require not only understanding the unique data types inherent to that genre but also abstracting and organising this data to represent elements of the novel within the genre's context. Although challenging, this undertaking holds significant promise for pushing the boundaries of literary visualisation, and text analytics in general.

Visualisations for Superfans

Another interesting avenue to explore involves adapting the visualisation for fan-driven contexts. As discussed in the literature review (Section 2.2), casual reader communities often engage deeply with alternative narratives and canonical critiques. While this research acknowledged the relevance of such contexts, it did not target a specific fan community, instead recruiting a variety of casual readers with diverse reading interests. Conducting a more focused

study with readers of a specific genre or dedicated fanbase, such as those centred around a particular book series or franchise, could yield deeper insights into how visualisation tools might be leveraged to support collaborative exploration of specific narratives. Such a study could examine how fans use visualisations to validate their interpretations, identify alternative readings, or critically reflect on canonical storylines. By focusing on a well-defined fan community, future research could better understand how visualisation tools facilitate both personal and shared interpretations, while also accommodating speculation on alternative theories regarding character or plot development.

The Use of a Literary Visualisation as a Visual Blurb

In addition to adding a spoiler-free mode, the idea of a visualisation functioning as a visual blurb to assist in the selection of novels is an intriguing area for future research that came out of the findings from Study II (Section 5.14.2). By summarising a book's character dynamics, themes, or narrative structure through non-revealing visual representations, the tool could serve as a supportive resource for readers choosing their next book. This would be particularly useful in contexts like book clubs or library services, where readers might wish to compare multiple options quickly. Future studies could evaluate how visual blurbs affect decision-making processes and whether they enhance readers' overall engagement with novels they have not yet read. Such explorations would expand casual literary visualisation's applicability, providing value both for deep literary analysis and for casual browsing or selection purposes.

6.9 Conclusion

In conclusion, this chapter began with a detailed overview of how the research questions were answered. It then provided critical insights into designing casual literary visualisations, focusing on the unique challenges and opportunities of supporting non-expert users in collaborative and interpretive contexts. By reflecting on the casual literary visualisation design pipeline, I highlighted the importance of addressing the nuanced demands of visually encoding textual data and generating test datasets to uncover unique differences between literary texts.

I also introduced a framework for understanding variability in how casual readers interact with literary visualisations, emphasising four dimensions: domain interest, narrative familiarity, task orientation, and technical experience. These dimensions capture the diverse ways users engage with visualisations, whether through emotional connections, analytical inquiries, or as tools for narrative exploration. Unlike traditional models of expertise, the framework highlights user-driven, optional interactions shaped by personal preferenes. By providing targeted questions for designers, it supports the creation of flexible, accessible casual literary visualisations that accommodate varying engagement levels.

Key contributions of this research include the development of a character-centric literary visualisation technique, which encodes complex character data in an intuitive format, the dissemination of all visualisations generated as online design artefacts, and a robust book-club scenario focus group evaluation methodology. A number of limitations, such as the complexity of the

technical pipeline for literary visualisation, and the number of participants recruited, provide opportunities for other researchers in the literary visualisation field to learn from this project.

By addressing the areas proposed for future work, researchers can better support inclusive and effective casual literary analysis. Collaboration between casual reading communities and literary visualisation designers has the potential to advance the field, fostering greater accessibility and engagement with literature. Such efforts could empower book lovers to explore and discuss texts in more meaningful and dynamic ways, enriching the overall literary experience for diverse audiences. Overall, the analysis presented in this chapter offers a foundation for further exploration and development within the field of casual literary visualisation.

Chapter 7

Conclusion

This thesis has explored the iterative design and evaluation of a character-centric literary visualisation technique called *Clover Connections*, which was successfully applied to six novels across two studies, spanning multiple genres. Its aim was to support non-expert readers in engaging with complex character-centric data extracted from novels in order to both better recall characters in familiar texts and explore those new to them. By focusing on casual literary discussions, the research demonstrated how thoughtfully crafted visualisation tools can foster meaningful exploration and interpretation of fictional characters and narrative elements. Through iterative design, evaluation, and refinement, this work contributes a novel approach to non-expert-targeted visualisations, offering both practical insights into the development of such tools and theoretical contributions to this interdisciplinary field.

The findings underscore the potential of visualisation to make literary analysis more accessible for casual readers. Insights from participants reaffirmed the importance of designing for diverse audiences, with an emphasis on simplicity, usability, and adaptability. While the visualisation effectively facilitated collaborative discussions and personal exploration, challenges such as participant recruitment and the need to develop a new evaluation methodology highlight areas for further research within the domain of casual literary visualisation.

In addition to its practical contributions – including datasets, design reflections, and a web-based visualisation tool – this research provides a framework for future exploration into casual literary visualisation. Key opportunities include exploring genre-specific visualisations and integrating visualisation tools into digital collaborative contexts. Additionally, there is potential to investigate how visualisations might support alternative interpretations in fan communities or function as an engaging visual blurb that inspires readership.

This work represents a significant step toward making complex textual data accessible to casual readers with an interest in exploring different characters and stories, while maintaining accuracy to the original works. By addressing the research limitations and building on its findings, future research can continue to innovate at the intersection of visualisation design, casual literary analysis, and meaningful textual data extraction and encoding. It is my hope that the insights presented here will inspire further developments in creating engaging tools that empower casual readers to grow their communities and enrich their shared experiences through the characters and stories they love.

Appendix A

Study I Supplementary Materials

This appendix provides the supplementary design and evaluation materials for Study I (Chapter 4).

- Domain Expert Interview Questions and Responses
- Information and Consent Form
- Survey and Questionnaire

SIGNIFICANCE

Q1. What are the intended outputs of a literary analysis of a novel? Is intertextual analysis the norm or do you also analyse novels as standalone pieces of work?

There are two ways to conduct a literary analysis:

1. Examine its interactions with its composed society and its interactions with its read society.
2. Conduct a formal analysis of the features of the text to understand its formal properties, to determine what these say about its written or read community.

Intertextual analysis is inevitable during the process, as every novel exists on a continuum. Each novel is not isolated enough to comment on it alone – not without another novel to help inform how novels function. It is also necessary to place a novel in the literary context of other novels from the time period itself.

Lecturers/tutors will assume students have studied other novels – even if only during high school.

Q2. How important or integral is the process of analysing characters in relation to understanding the overarching plot, theme or genre of a novel?

It is becoming increasingly significant to develop a tool for the specific tasks of character exploration and analysis.

Initially, 1950s modernist literary authors, such as James Joyce and D.H. Lawrence, decided character was unimportant.

Then, literary traditions outside modernism began to see character as incredibly important. The target audience of a character analysis is a literary analyst focused on a specific era of literature – namely, the Postmodern era, which focuses on individuals in places and spaces.

Q3. What role does character analysis play in a close-reading approach? What role does character analysis play in a distant-reading approach? Is character analysis more significant to either of these approaches, or roughly the same level of significance?

Distant-reading comes from close-reading where you identify a main text/features or relevance then think about how do these features compare or sit in conversation (identifying commonalities) with other texts. Character analysis is performed as a close-reading task.

For some background, from 1910 onwards individualism was dead, and we entered an experimental phase of literature. Hence, much of the focus was on distant-reading of texts.

Q4. Is it possible to analyse a text without paying attention to the characters and how they change over time? Why or why not?

It is possible, but characters inevitably come up in the conversation. An analyst may focus more on setting or themes, for example. However, characters are not always representations of people – they can also be literary devices.

In *Ulysses*, for example, characters are just devices, not actual people. We know this because they are never given psychological autonomy. A character must have psychological autonomy to do a study on them.

PROCESSES & TARGET AUDIENCE NEEDS

Q5. Do undergraduate novices/non-experts express concerns when asked to conduct character analysis task(s)? How do lecturers and/or tutors typically support them to complete the task(s)?

Non-experts struggle with close reading in general, as the typical high school education in English does not prepare you for University level analysis work.

Close reading can feel boring without an active and engaged classroom tutor. To engage students, tutors may manipulate the environment/the room, and use "visualisations", such as a paragraph of text where the emphatic moments are coloured. The colour coding is decided by the tutor. There is no particular method for choosing colours, but once chosen their application is consistent to retain their meaning for study purposes.

I use a colour coding/symbols-based schema that includes underlining what is not understood, circling portions of the text to return to, starring what is important in the text. I then recycle these symbols and eventually students use them when they do close reading. Other tutors might not use symbols, but do often use highlighting.

Tutors support students to identify what is referred to as "rough language", that is, any part of language in a piece of text that the student does not understand or feels it may be important as it goes against the "smoothness" of the text. This process is informed by intertextual meaning and intuition developed through experience working with texts.

It is a relatively consistent process in terms of what students believe is important in the text, as certain formal properties encourage people to pay attention to portions of the text.

Tutors will also adapt tasks to suit topics/themes that are becoming popular among students. For example, during the Black Lives Matter movement, race became popular. Gender roles are also becoming popular for analysis. This method of adapting to a topic-based interest will hopefully become standard practice for tutors in future. Tutors want flexibility to explore things with students that students are particularly interested in.

I have tried using technology more, such as *Padlet*, as it gets really quick, direct input from students which helps to shape the rest of the lesson.

Q6. Please describe the typically prescribed steps taught for analysing characters in novels at an undergraduate/non-expert level.

Before running a class, I will have identified around three paragraph long passages throughout the text that can be used throughout the class. These three paragraphs would be concerning character, a pivotal moment, and an interesting dynamic at play.

For example, I teach the book *Pamela* over two seminars. In the first seminar, the first half of the novel is explored, and in the second seminar, the second half.

In the first seminar, they start with Pamela's first piece of dialogue in the novel, consider who she is, what is important to her, such as her goals, what values or motivations she might have, and what these features might tell the reader about her actions, concerns or fears for the future. They also use this information to discuss what they might expect to happen to her in the novel.

In the second seminar, they address what is important to Pamela during a pivotal moment, whether or not the dynamics addressed are foreign to us in our contemporary context, or if they appear contemporary to us.

This two-seminar format works well with students. The main objective is to cultivate empathy, that is, treat the characters in class discussions as real people, as though they are in the room with everyone, and consider how they might feel hearing the discussion.

Q7. How are the data from these processes abstracted, extracted, stored and manipulated?

There is no specific model to understand the "must know/need" information about a character. However, you cannot say anything you want about a character either. Meaning, you cannot say something falsifiable. The product of a character analysis is a paper or a discussion or student essay. It would be graded based on how accurate the information is, but there is flexibility in how a student extrapolates and interprets the text about the character.

There are no strict/formal "data extraction" methodologies, but reading is done with a theoretical approach, such as a feminist reading, queer reading, Marxist reading, etc.

As an example, a feminist reading of a character differs from a regular reading, as it considers how ideals of femininity play out in the characters' construction. Examples include balancing the expectation to be beautiful, with intelligence and being well-spoken. This came from the "new idea" that women in novels could also have intellectual lives. This means that for different readings there would be different requirements for the data.

Using *Pride and Prejudice* as an example novel, a feminist reading of the character Mr. Darcy would explore how he conforms to ideals, his inability to express himself stemming from his class position, and his struggle to reject masculinity to associate with Lizzy. There are features like class/social status that change over time which would be documented by a literary analyst. Another feature that is highly important is relationships. In many novels, social networks, such as family networks, are central to interpreting the novel.

Q8. Are there differences between the analysis of characters who appear once versus characters who appear multiple times throughout the story?

The number of appearances of a character can be relevant. It is more important to know if a character is "round/dynamic" or "flat/static". However, typically, characters that appear one-off will tell the reader more about other characters than about themselves.

Q9. Is there a different analysis process for different literary genres? For example, fantasy characters versus epistolary characters. If so, describe some examples of the differences?

Typically, the focus is on studying different themes. In a fantasy novel, the concept of good or evil is very obvious, whereas in *Pride and Prejudice* good and evil are shades of grey.

There is, however, definite bias against studying "genre fiction".

Different specialists in different genres may have different processes. Amatory (romance) fiction, contemporary genre fiction, period fiction, literary fiction (from the last 150 years), all have different specialists associated with their study.

SPECIFIC FEATURES OF CHARACTERS

Q10. How do you determine a social relationship exists between characters?

(I explained to the DE that many automated approaches for extracting social relationships from texts assume if two characters exist within a paragraph together then they are socially interacting. The DE disagreed with this approach, saying it is not an approach literary analysts would use.)

Social relationships are assumed to be formed when a dialogue interaction occurs. Talking shows a relation to each other (even without meeting, which is the case in some texts). Dialogue makes more sense than same-paragraph appearances, as there is typically no reason why a social relationship between characters would not manifest through dialogue.

However, other context cues point to relationships. For example, Mr. Darcy and his sister have a described relationship as being related to one another, not a dialogic relationship, which is a very important relationship in the text. This relationship is pivotal to the *Pride and Prejudice* novel, highlighting classes/groups of people.

Q11. How do you determine the environment/location/event participation of characters?

Purely through contextual cues. There is no formal method for doing this.

Q12. What role does the passing of time play in the interpretation of characters in novels?

The passing of time became important in interpretation of characters at the start of the 19th century. This started with the literary genre: Bildungsroman.

Prior to this, the "growing up young woman" genre was the primary form of literature for 80 years (in the 18th century). Then, in the early 19th century, they took this idea and changed the format of the "life narrative" (get old and die, with some of the progression interrupted by events).

Time is used in novels to demarcate life events. For novels, this time is referred to as "diegetic time".

Epistolary novels (letter format) always have a date stamp, which makes the passing of time easier to directly interpret. In this format, one can observe the exact time period between letters. So, six months without receiving a letter will tell you something important has happened.

Additionally, in novels, time expands and contracts based on when interesting things happen. The dynamics of time are not linear. They are clustered around particular moments or important life events. The theoretical/ideological perspective on this is that novels invest energy in moments like sexual discovery, marriage, and death, and centre the narrative around these events. These important moments are given the most textual space.

Dividing a summary into chapters makes the most sense. Chapters tend to cluster information together – they are self contained units with important events that are discrete to that chapter. Time occurs outside the chapter, but within the chapter its real time. A chapter generally introduces what has happened since the last chapter, or how much time has passed, then presents the new situation in the current chapter.

Q13. What are the important features of a character to record? For example, physical appearance, age, role in the story, job, mood, political preference, role in relation to another character (supporting/antagonist), etc.

What is important to record is whatever is contextually relevant information. That is, whatever situates the characters in a world. And what is recorded on one character should be recorded for all characters to support comparison tasks.

Q14. How are the data (questions 10, 11, 12 & 13) abstracted, extracted, stored and manipulated?

Data are "abstracted" or "extracted" using a pen in hand, and making notes in the margin. Sometimes I create spreadsheets of page numbers mapped to characters and themes. The page numbers are derived from the standard scholarly editions of the novels.

No statistical analyses are done. This approach is more popular in the digital humanities where data or text mining are used to determine the answer to high-level research questions, such as "how loud texts are". The methodologies are consistent with thematic analysis techniques. I personally do not think these outputs are in-depth enough to understand a text.

I do use a software package called *Ecco*, which converts 18th century texts into searchable text. It contains a huge corpus – around 1.2 million – of texts, and provides results to search, with the page number for where the result appears in the text.

TECHNOLOGIES & FUNCTIONS

Q15. What types of technologies, tools or interfaces do you use to analyse characters? Which of these support distant-reading and which support close-reading? What are the benefits and limitations of these?

There is push back among lecturers and tutors when it comes to using technologies.

Interestingly, 18th century scholars are more tech literate, as many students are younger and most archives only exist digitally. For example, for some books from this century, only two real copies may exist in the whole world.

One technology that is quite accepted is hand-writing recognition technology used to analyse 17th century texts. And of course, academic databases, Google, the Microsoft Office suite products – Word and Excel – are all acceptable to use.

There are lots of "purists" in the field, and some journals may be against the use of technology – it really depends on the journal and the person.

Q16. What is on your "technology wish list"? For example, imagine an interface that supports your character analysis needs – what functions/views are embedded in this interface? How do you imagine characters would be represented?

Being able to map character interactions at different points. Using colours to make the interface easier to interpret – but the colour coding needs to be flexible. It would be unappealing to have pink automatically applied to feminist themes, for example.

Being able to pull the information of interest from the text on command, and be able to verify it against the raw text (like a raw text panel), would be great!

Having a note-taking section would also be good. This should be readable outside the use of the original tool too.

I would like a tool that supports visualising raw text, but ultimately the students would then still be expected to confirm their findings outside the tool through methods such as Mind Maps to connect the characters. A visualisation of a Mind Map explaining a character, such as Lizzy in *Pride and Prejudice*'s values, would be useful.

To represent characters, any tool should just use the character's name. Images create biases about how characters look and influence student interpretation. Name is the best identifier.

Q17. Are you interested in technologies that automate the process of analysing characters for you? Why or why not?

I am very interested in technologies that automate the process of analysing characters, if they can be verified. This means access to the data is highly important. Such technologies would be used the most as a teaching tool, however, not a research tool.

Q18. Are there any processes that you believe cannot be supported by technology? For example, what are your thoughts on the use of natural language processing algorithms to summarise the meaning of a text?

I am concerned about the implementation of technologies in teaching – most lecturers/tutors do not want students to become over reliant on technology. They want students to develop close-reading skills as they build empathy in students, which in turn improves them as writers. My rationale is that empathy makes students better at representing people in their own works. The humanities is less skills focused (like IT), and more goal-driven in its teaching. A major goal in the humanities is to create more empathy among members of society. Like how you learn a programming language, but may never use again, but you learn the foundations. Empathy is the foundation you are learning.

However, engagement is very important, so any technologies/tools that get people to pay attention as they build empathy is a good idea.

FURTHER READING

Q19. What are the introductory texts prescribed to learn how to conduct literary analysis?

- Character Three Inquiries – Amanda Anderson
- Post-Modern books
- Stanley Fish paper: What is a Poem – one of the first things undergrads read
- T.S Eliot – What is a Classic?
- Rebuttal of the above – Jane Cloetsky
- A Room of One's Own – Virginia Woolf – founding document of feminist literary theory

It is not possible to simply pick up these books and self teach literary analysis methods. Experts are needed to teach and inform on the processes involved.

Q20. Which novels are popular to analyse in general literary analysis studies? Why?

The popular novels to analyse include:

- Pride and Prejudice
- The Odyssey
- Ulysses
- Handmaid's Tale
- Argonauts by Maggie Nelson (Post-Modern)
- Evilena by Francis Burney
- Robinson Crusoe (informs race discussions)

The main reasons for using these novels are:

- The institutional credibility of them, that is, they are considered important in literary inquiry
- There is a lot of work on them, which means high quality research exists
- Students are guaranteed to find papers on them
- Most lecturers can teach them all

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Creativity & Cognition Studios

PARTICIPANT INFORMATION SHEET
Visualisation of Character Dynamics in Novels
UTS HREC ETH19-3452

CCS Project Reference Number: *2023-9*

WHO IS DOING THE RESEARCH?

My name is Natalie House and I am a PhD student at the University of Technology Sydney.
My supervisor is Professor Andrew Johnston, Head of Interaction Design at the Faculty of Engineering & IT, Research Director at Animal Logic Academy, and Co-Director of the Creativity and Cognition Studios.

WHAT IS THIS RESEARCH ABOUT?

This research is to find out about the suitability of a visualisation interface to communicate data on characters in novels for the tasks of visually analysing the characters' dynamic journeys.

FUNDING

Funding for this project has been received from an Australian Government research scholarship.

WHY HAVE I BEEN ASKED?

You have been invited to participate in this study because you are not an academic or professional in literary analysis and do not use data or information visualisations as part of your job.

This means you may be able to provide valuable feedback on the suitability of a visualisation interface designed to visualise characters in novels for non-experts in literary analysis.

IF I SAY YES, WHAT WILL IT INVOLVE?

If you decide to participate,

- I will coordinate with you, via email, a suitable date and time to conduct the evaluation
- I will meet you at the University of Technology Sydney and take you to the study location
- You will be seated in front of a laptop
- I will provide you with a 5 minute briefing on the interface evaluation procedure
- I will ask you to use a visualisation interface to answer a short survey and questionnaire that will take approximately 30 to 55 minutes to complete

ARE THERE ANY RISKS/INCONVENIENCE?

Yes, there is a minor risk that you may feel self-conscious about your interaction choices or what you write in your responses to the short survey and/or the questionnaire.

Please be assured that the purpose of the study is to evaluate an interface, not your individual performance. The results of the questionnaire will not be used to indicate your success or failure at answering the questionnaire, but rather, the success or failure of the visualisation interface to suitably support your ability to answer the questionnaire.

In addition to this, the survey and questionnaire are delivered in such a way that you will have complete control over the inputting of responses, hence, only information you choose to type in will be recorded.

DO I HAVE TO SAY YES?

Participation in this study is voluntary. It is completely up to you whether or not you decide to take part.

WHAT WILL HAPPEN IF I SAY NO?

If you decide not to participate, it will not affect your relationship with the researchers or the University of Technology Sydney. If you wish to withdraw from the study once it has started, you can do so at any time without having to give a reason, by contacting Natalie House on [redacted] or at natalie.house@student.uts.edu.au or Professor Andrew Johnston at andrew.johnston@uts.edu.au. You

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should be aware that non-identifying data collected from the questionnaire, up to the time you withdraw, will form part of the research project results, unless you explicitly request for your responses to be deleted.

CONFIDENTIALITY

By signing the consent form you consent to the researcher, Natalie House, collecting and using your non-identifying survey and questionnaire responses for the research project.
Your personal information (name, email address and/or phone number) will only be used for the purpose of contacting you in regards to this research project. This information will be treated confidentially and will not be used as part of the research data/outputs.

We plan to discuss and publish the results of this evaluation study in a paper for submission to an academic conference. The results will also be discussed in Natalie House's dissertation. The discussion of the results are likely to include direct quotes from the questionnaire responses, in quotations, and summaries of responses written in paragraph form. In any publication or record of these results, information will be provided in such a way that you cannot be identified.

WHAT IF I HAVE CONCERNS OR A COMPLAINT?

If you have concerns about the research that you think Natalie House or her supervisor, Professor Andrew Johnston, can help you with, please feel free to contact Natalie House on [redacted] or at natalie.house@student.uts.edu.au, or Professor Andrew Johnston at andrew.johnston@uts.edu.au.

You will be given a copy of this form to keep.

NOTE:
This study has been approved in line with the University of Technology Sydney Human Research Ethics Committee [UTS HREC] guidelines. If you have any concerns or complaints about any aspect of the conduct of this research, please contact the Ethics Secretariat on ph.: +61 2 9514 2478 or email: Research.Ethics@uts.edu.au], and quote the UTS HREC reference number: ETH19-3452. Any matter raised will be treated confidentially, investigated and you will be informed of the outcome.

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CONSENT FORM
Visualisation of Character Dynamics in Novels
UTS HREC ETH19-3452

CCS Project Reference Number: *2023-9*

I _____ agree to participate in the research project 'Visualisation of Character Dynamics in Novels' being conducted by Natalie House under the supervision of Professor Andrew Johnston. I understand that funding for this research has been provided by an Australian Government funded Research Excellence Scholarship.

I have read the Participant Information Sheet or someone has read it to me in a language that I understand.

I understand the purposes, procedures and risks of the research as described in the Participant Information Sheet.

I have had an opportunity to ask questions and I am satisfied with the answers I have received.

I freely agree to participate in this research project as described and understand that I am free to withdraw at any time without affecting my relationship with the researchers or the University of Technology Sydney.

I understand that I will be given a signed copy of this document to keep.

I agree that the research data gathered from this project may be published in a form that does not identify me in any way.

I am aware that I can contact Natalie House on [redacted] or at natalie.house@student.uts.edu.au, and/or Professor Andrew Johnston at andrew.johnston@uts.edu.au, if I have any concerns about the research.

_____ ____/____/____
Name and Signature [participant] Date

_____ ____/____/____
Name and Signature [researcher or delegate] Date

Prior Experience Survey

Instructions

The following questions will help the researchers to understand your experiences with visualisations and reading/studying novels. This understanding will help to contextualise and better inform the analysis of the answers you provide in the evaluation questionnaire. Please do not include any personally identifying information in your answers.

A. **On a scale of 1 to 7, with 1 being "not at all confident", and 7 being "completely confident", rate the level of confidence you have in your ability to read data/information visualisations.**

B. **Have you ever read novels for the purpose of discussion or study? If yes, please briefly describe your experience(s).**

C. **If you answered yes to the previous question, were there any barriers to effectively relaying your perspective(s) on the novel(s) under discussion? If yes, please briefly describe these barriers.**

D. **On a scale of 1 to 7, with 1 being "not at all confident", and 7 being "completely confident", rate the level of confidence you would feel in recalling and discussing the features and appearances of all the characters in a novel you have read and are quite familiar with (such as your favourite novel or a novel you have studied).**

Evaluation Questionnaire

Instructions

Today you will interact with two visualisations that allow you to explore the evolving individual journeys of characters in novels.

The datasets were generated from real novels and anonymised for the purpose of this user study, hence, some important context for understanding the overarching narrative may be missing (such as in-depth character and chapter summaries). Therefore, the questionnaire is designed to remove the need for this context to answer the questions.

Before you begin, please take some time to familiarise yourself with the visualisation elements. You can refer to the menu (small blue book icon) to understand how to read, interact with, change settings for, and filter, the visualisation elements.

When you are ready, please view and interact with the visualisation(s) to answer the questionnaire. Some questions will require you to analyse multiple elements of the visualisation(s) to form your answer. For each question, please write the reasoning behind your answer with examples from the visualisation(s), providing as much detail as you feel necessary. If you do not understand a question, you may ask for further clarification. If a question cannot be answered, please write why you left it unanswered. Please do not include any personally identifying information in your answers.

Visualisation A

1. Who is/are the first character(s) to enter the story?

2. Which character has the thickest storyline for the majority of the story?

3. How many characters are in Chapter 7?

4. Which character(s) appear in only one chapter of the story?

5. Which character(s) appear(s) in every chapter?

6. Which character(s) is/are negative in sentiment in Chapter 10?

7. If possible, name a character whose motivation is the same in two or more chapters. The chapters do not need to be consecutive.

8. Locate Mr. Grayson and answer the following questions:

- **8A. What is Mr. Grayson's goal, action and motivation in Chapter 12?**

- **8B. Is Mr. Grayson's sentiment the same in Chapters 7, 8 and 10?**

- **8C. With which character(s) does Mr. Grayson have the strongest social interaction(s) in Chapter 7?**

- **8D. With which character(s) does Mr. Grayson have the weakest social interaction(s) in Chapter 7?**

- **8E. Which character commits the same action as Mr. Grayson in Chapter 8?**

9. Who is/are the main character(s)? Why?

10. Are there connections between character storyline thicknesses, chapter appearances, social interactions and/or goals/actions/motivations/sentiments? Why or why not?

Comparative Side-by-Side: Visualisation A and Visualisation B

11. Which visualisation contains more characters, and what is the difference in number?

12. What are the main similarities, if any, between the characters in the two visualisations?

13. What are the main differences, if any, between the characters in the two visualisations?

Experience Using the Visualisation(s)

14. When exploring the visualisation(s), what felt intuitive and/or engaging? Why?

15. When exploring the visualisation(s), what felt like a struggle and/or confusing? Why?

16. Which question(s) did you find the easiest to answer? Why?

17. Which question(s) did you find the hardest to answer? Why?

18. Did the menu system provide enough context for you to understand how to read and explore the visualisation? If not, what additional context or settings would you add?

19. On a scale of 1 to 7, with 1 being "not at all confident", and 7 being "completely confident", rate the level of confidence you would feel in recalling and discussing the features and appearances of all the characters in a novel you have read and are quite familiar with (such as your favourite novel or a novel you have studied) if you had this visualisation to support you.

20. What improvements, if any, would you make to the visualisation for better visually representing characters in novels for the purpose of discussing those characters?

21. In what sort of environments/settings, if any, could you see this visualisation approach being used to visualise characters in novels (with or without your recommended improvements)?

Optional: Please provide any final comments you wish to make in relation to this study and your experience using the visualisation.

Appendix B

Study II Supplementary Materials

This appendix provides the supplementary design and evaluation materials for Study II (Chapter 5).

- Information and Consent Form
- Post-Discussion Questionnaire

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Creativity & Cognition Studios

PARTICIPANT INFORMATION SHEET
Visualisation of Character Dynamics in Novels
UTS HREC ETH23-8664

CCS Project Reference Number: *2024-3*

WHO IS DOING THE RESEARCH?

My name is Natalie House and I am a PhD student at the University of Technology Sydney.
My supervisor is Professor Andrew Johnston, Head of Interaction Design at the Faculty of Engineering & IT, Research Director at Animal Logic Academy, and Co-Director of the Creativity and Cognition Studios.

WHAT IS THIS RESEARCH ABOUT?

This research is to find out about the suitability of a visualisation interface to communicate data on characters in novels to support casual analysis of novels among non-experts in literary analysis.

FUNDING

Funding for this project has been received from an Australian Government research scholarship.

WHY HAVE I BEEN ASKED?

You have been invited to participate in this study because you are a non-expert in literary analysis but you are interested in exploring and discussing novels that you read.

Your prior experience/interest in reading for enjoyment and participating in a book club makes you a suitable participant for evaluating an interface, designed to support recall and interpretation of novels, that can be used in a collaborative setting.

IF I SAY YES, WHAT WILL IT INVOLVE?

If you decide to participate,

- I will coordinate with you and the other participants to determine a suitable date and time to conduct the evaluation, which will be either a weekend day or weekday evening
- At least two weeks prior to the evaluation session, you will be asked to complete a reading – this will be the novel, *A Study in Scarlet* by Arthur Conan Doyle (text and audiobook versions will be provided)
- On the day of the evaluation session, I will meet you at the University of Technology Sydney and take you to the study location
- You will be seated at a table with the other participants in front of a screen(s)
- I will provide you with a quick briefing on the visualisation and evaluation procedure
- I will prompt you and the other participants to discuss the novel you have read while using the visualisation interface
- I will prompt you and the other participants to view a collection of other visualisations of novels you have not read, to both explore and discuss together
- Both the discussion audio and screen interactions (with the visualisation) will be recorded
- At the conclusion of the session, you will be asked to complete a questionnaire on your own

ARE THERE ANY RISKS/INCONVENIENCE?

Yes, there is a minor risk that you may feel self-conscious about your discussion input, visualisation interactions, and what you write in your responses to the questionnaire.

Please be assured that the purpose of the study is to evaluate an interface, not your individual performance. Additionally, the discussion audio recording, screen interactions captures and questionnaire responses will be anonymised when the data are inputted into the data storage system.

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There is also the minor inconvenience of having to read the novel in preparation for the study. The novel will take approximately 4 hours and 30 minutes to read, which roughly equates to around 20 minutes of reading or listening to the audiobook a day, over the 2 week period. This is just a guideline – the book can be completed at your preferred pace during the 2 week period. If you feel it is unreasonable to dedicate this amount of time, please let Natalie House know prior to committing to the study.

DO I HAVE TO SAY YES?

Participation in this study is voluntary. It is completely up to you whether or not you decide to take part.

WHAT WILL HAPPEN IF I SAY NO?

If you decide not to participate, it will not affect your relationship with the researchers or the University of Technology Sydney. If you wish to withdraw from the study once it has started, you can do so at any time, without having to give a reason, by contacting Natalie House on [redacted] or at natalie.house@student.uts.edu.au or Professor Andrew Johnston at andrew.johnston@uts.edu.au. You should be aware that non-identifying data collected up to the time you withdraw will form part of the research project results, unless you explicitly request for your input to be removed.

CONFIDENTIALITY

By signing the consent form you consent to the researcher, Natalie House, collecting and using your non-identifying discussion and questionnaire responses for the research project.

Your personal information (name, email address and/or phone number) will only be used for the purpose of contacting you in regards to this research project. This information will be treated confidentially and will not be used as part of the research data/outputs.

We plan to discuss and publish the results of this evaluation study in a paper for submission to an academic conference. The results will also be discussed in Natalie House's dissertation. The discussion of the results are likely to include direct quotes from the discussion and questionnaire, in quotations, and summaries of responses written in paragraph form. In any publication or record of these results, information will be provided in such a way that you cannot be identified.

WHAT IF I HAVE CONCERNS OR A COMPLAINT?

If you have concerns about the research that you think Natalie House or her supervisor, Professor Andrew Johnston, can help you with, please feel free to contact Natalie House on [redacted] or at natalie.house@student.uts.edu.au, or Professor Andrew Johnston at andrew.johnston@uts.edu.au.

You will be given a copy of this form to keep.

NOTE:
This study has been approved in line with the University of Technology Sydney Human Research Ethics Committee [UTS HREC] guidelines. If you have any concerns or complaints about any aspect of the conduct of this research, please contact the Ethics Secretariat on ph.: +61 2 9514 2478 or email: Research.Ethics@uts.edu.au], and quote the UTS HREC reference number: ETH23-8664. Any matter raised will be treated confidentially, investigated and you will be informed of the outcome.

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Creativity & Cognition Studios

CONSENT FORM
Visualisation of Character Dynamics in Novels
UTS HREC ETH23-8664

CCS Project Reference Number: *2024-3*

I _____ agree to participate in the research project 'Visualisation of Character Dynamics in Novels' being conducted by Natalie House under the supervision of Professor Andrew Johnston. I understand that funding for this research has been provided by an Australian Government funded Research Excellence Scholarship.

I have read the Participant Information Sheet or someone has read it to me in a language that I understand.

I understand the purposes, procedures and risks of the research as described in the Participant Information Sheet.

I have had an opportunity to ask questions and I am satisfied with the answers I have received.

I freely agree to participate in this research project as described and understand that I am free to withdraw at any time without affecting my relationship with the researchers or the University of Technology Sydney.

I understand that I will be given a signed copy of this document to keep.

I agree that the research data gathered from this project may be published in a form that does not identify me in any way.

I am aware that I can contact Natalie House on [redacted] or at natalie.house@student.uts.edu.au, and/or Professor Andrew Johnston at andrew.johnston@uts.edu.au, if I have any concerns about the research.

_____ ____/____/____
Name and Signature [participant] Date

_____ ____/____/____
Name and Signature [researcher or delegate] Date

Name: _____

1. In which settings have you participated in discussions about novels with others in the past? (*Circle multiple*)

None	Online Forums or Social Media	Informal Gatherings	Book Clubs or Reading Groups	Literary Events or Workshops	Secondary Education	Tertiary Education

2. How enjoyable was the experience of reading (or listening to the audio book of) the novel *A Study in Scarlet*?

1	2	3	4	5	6	7
Very Unenjoyable	Unenjoyable	Slightly Unenjoyable	Neutral	Slightly Enjoyable	Enjoyable	Very Enjoyable

3. How complete was the information presented in the *A Study in Scarlet* visualisation?

1	2	3	4	5	6	7
Very Incomplete	Mostly Incomplete	Somewhat Incomplete	Neutral	Somewhat Complete	Mostly Complete	Very Complete

4. How visually perceptible were the elements used to display data in the *A Study in Scarlet* visualisation?

1	2	3	4	5	6	7
Very Difficult to Perceive	Mostly Difficult to Perceive	Somewhat Difficult to Perceive	Neutral	Somewhat Easy to Perceive	Mostly Easy to Perceive	Very Easy to Perceive

5. How accurate (to the novel) was the information in the *A Study in Scarlet* visualisation?

1	2	3	4	5	6	7
Very Inaccurate	Mostly Inaccurate	Somewhat Inaccurate	Neutral	Somewhat Accurate	Mostly Accurate	Very Accurate

6. How familiar were the *A Study in Scarlet* visualisation's graphs and interface?

1	2	3	4	5	6	7
Very Unfamiliar	Mostly Unfamiliar	Somewhat Unfamiliar	Neutral	Somewhat Familiar	Mostly Familiar	Very Familiar

7. How useful was the information provided by the *A Study in Scarlet* visualisation for answering the discussion prompts and responding to others?

1	2	3	4	5	6	7
Very Useless	Mostly Useless	Somewhat Useless	Neutral	Somewhat Useful	Mostly Useful	Very Useful

8. How effective was the *A Study in Scarlet* visualisation in supporting recollection of the novel?

1	2	3	4	5	6	7
Very Ineffective	Mostly Ineffective	Somewhat Ineffective	Neutral	Somewhat Effective	Mostly Effective	Very Effective

9. How aesthetically pleasing (attractive) was the *A Study in Scarlet* visualisation?

1	2	3	4	5	6	7
Very Unattractive	Mostly Unattractive	Somewhat Unattractive	Neutral	Somewhat Attractive	Mostly Attractive	Very Attractive

10. How appealing (engaging) was the *A Study in Scarlet* visualisation in drawing you into the data?

1	2	3	4	5	6	7
Very Unappealing	Mostly Unappealing	Somewhat Unappealing	Neutral	Somewhat Engaging	Mostly Engaging	Very Engaging

11. To what extent did the *A Study in Scarlet* visualisation impact the flow and quality of the discussion?

1	2	3	4	5	6	7
Very Negatively	Mostly Negatively	Slightly Negatively	Neutral	Slightly Positively	Mostly Positively	Very Positively

12. How helpful was the *A Study in Scarlet* visualisation in supporting you to gain improved insights or understanding of the novel?

1	2	3	4	5	6	7
Very Unhelpful	Mostly Unhelpful	Somewhat Unhelpful	Neutral	Somewhat Helpful	Mostly Helpful	Very Helpful

13. How did the *A Study in Scarlet* visualisation influence the way you collaborated and interacted with others?

1	2	3	4	5	6	7
Very Negatively	Mostly Negatively	Somewhat Negatively	Neutral	Somewhat Positively	Mostly Positively	Very Positively

14. How did using the *A Study in Scarlet* visualisation compare to more traditional discussion aids (such as printed notes, websites, Wikipedia summaries, etc.)?

1	2	3	4	5	6	7
Much Worse	Worse	Slightly Worse	Neutral	Slightly Better	Better	Much Better

15. How useful was the information provided by the other three visualisations in selecting a novel to read?

1	2	3	4	5	6	7
Very Useless	Mostly Useless	Somewhat Useless	Neutral	Somewhat Useful	Mostly Useful	Very Useful

16. How appealing (engaging) were the other three visualisations in terms of drawing you into their data?

1	2	3	4	5	6	7
Very Unappealing	Mostly Unappealing	Somewhat Unappealing	Neutral	Somewhat Engaging	Mostly Engaging	Very Engaging

17. Compared to the *A Study in Scarlet* visualisation, how was the experience of locating information on the characters, chapters and overall narratives in the other three visualisations?

1	2	3	4	5	6	7
Much Harder	Mostly Harder	Somewhat Harder	Neutral	Somewhat Easier	Mostly Easier	Much Easier

18. How was the experience of comparing the visualisations of different novels to each other?

1	2	3	4	5	6	7
Very Difficult	Mostly Difficult	Somewhat Difficult	Neutral	Somewhat Easy	Mostly Easy	Very Easy

19. How did using the other three visualisations to select a novel to read compare to more traditional methods (such as Google searches, online reviews, looking through library/bookstore shelves, etc.)?

1	2	3	4	5	6	7
Much Worse	Worse	Slightly Worse	Neutral	Slightly Better	Better	Much Better

20. How enjoyable was your overall experience of using the visualisations to discuss novels with others?

1	2	3	4	5	6	7
Very Unenjoyable	Mostly Unenjoyable	Slightly Unenjoyable	Neutral	Slightly Enjoyable	Mostly Enjoyable	Very Enjoyable

Name: _____

Comments, suggestions or feedback on any aspects of the design and this experience:

Appendix C

Prompts for Generating Textual Data

The following figures contain the prompts used across both studies to generate textual data for the JSON files.

Chapter Summary Prompt

Complete the following steps in order and output the result: Refer to Chapter 1 of Harry Potter and the Philosopher's Stone, which is the text I have supplied you. Using the novel text, write a short summary of what happens in Chapter 1. The chapter summary should only be of Chapter 1.

Ensure that the chapter summary is concise and accurately reflects what happens in Chapter 1, firmly grounded in the text.

Prompt supplied to ChatGPT to generate chapter summaries.

Personal Dynamics Prompt (Original – Study I)

Complete the following steps in order and output the result: Refer to Chapter 1 only of the novel The Lion, the Witch and the Wardrobe, which is the text I have supplied you.

Your final output should only consider Chapter 1. Using the novel text, determine three traits to describe the character "Lucy", and all ways to which she, the character, is referred.

The traits are the character's: salient goal, salient action and salient motivation. Salient goal means: "What they are trying to achieve or are told to do". Salient action means: "Their key action, reaction, behaviour or state". Salient motivation means: "The underlying reason for their goal and/or action".

Summarise the three traits into short text descriptors. Each trait short text descriptor must be at least 2 words in length but no more than 3 words in length. Insert the summarised traits into the following JSON structure: "traits":["salient goal", "salient action", "salient motivation", "mean sentiment"], where mean sentiment is left blank ("").

The original prompt supplied to ChatGPT, devised in Study I, to generate the personal dynamics traits.

Personal Dynamics Prompt (Updated – Study II)

Complete the following steps in order and output the result: Refer to Chapter 1 only of the novel A Study in Scarlet, which is the text I have supplied you.

Your final output should only consider Chapter 1. Using the novel text, determine three traits to describe the character "Stamford", and all ways to which he, the character, is referred.

The traits are the character's: salient goal, salient action, salient motivation and salient emotion. Salient goal means: "What they are trying to achieve or are told to do". Salient action means: "Their key action, reaction, behaviour or state". Salient motivation means: "The underlying reason for their goal and/or action". Salient emotion means: "The most prominent, persistent or key emotion displayed by the character".

Summarise the four traits into short text descriptors. Each trait short text descriptor must be at least 2 words in length but no more than 3 words in length. Insert the summarised traits into the following JSON structure: "traits":["salient goal", "salient action", "salient motivation", "salient emotion"].

The updated prompt supplied to ChatGPT in Study II, to generate the personal dynamics traits. Mean sentiment was changed to salient emotion.

Settings Prompt

Complete the following steps in order and output the result: Refer to Chapter 6 of The Mysterious Affair at Styles, which is the text I have supplied you. Using the novel text, identify the settings mentioned in the chapter. The settings should include specific locations and/or time periods in which the events of the chapter take place, with each being clearly identifiable in the text from the reader's point of view. The settings should only be those mentioned in Chapter 6.

Summarise these settings and format them using an unordered HTML list. Place each setting inside an <li> tag within a <ul> that has the class attribute 'datalist'. Ensure that each setting is concise and accurately reflects what can be identified in the chapter, firmly grounded in the text.

Prompt supplied to ChatGPT in Study II to generate a chapter's settings.

Key Events Prompt

Complete the following steps in order and output the result: Refer to Chapter 2 of The Time Traders, which is the text I have supplied you. Using the novel text, identify the key events mentioned in the chapter. The key events should include significant incidents or occurrences that drive the plot forward, with each being clearly identifiable in the text from the reader's point of view. The key events should only be those mentioned in Chapter 2.

Summarise these key events and format them using an unordered HTML list. Place each key event inside an <li> tag within a <ul> that has the class attribute 'datalist'. Ensure that each key event is concise and accurately reflects what can be identified in the chapter, firmly grounded in the text.

Prompt supplied to ChatGPT in Study II to generate a chapter's key events.

Plot Function Prompt

Complete the following steps in order and output the result: Refer to Chapter 4 of The Time Traders, which is the text I have supplied you. Using the novel text, identify the plot function of the chapter. The plot function should describe the significance and/or purpose of the chapter within the overall narrative in terms of its construction. The plot function should only be that of Chapter 4.

Summarise the plot function into a short, one sentence description. Ensure that the description is concise and accurately reflects what can be determined as the plot function of the chapter, firmly grounded in the text.

Prompt supplied to ChatGPT in Study II to generate a chapter's plot function.

Clues Prompt

Complete the following steps in order and output the result: Refer to Chapter 7 of A Study in Scarlet, Part 1, which is the text I have supplied you. Using the novel text, identify the key clues discovered in the chapter. The clues should include items, people, and events of interest, with each having a concrete representation in the text.

Summarise these clues and format them using an unordered HTML list. Place each clue inside an <li> tag within a <ul> that has the class attribute 'datalist'. Ensure that each clue is concise and accurately reflects the relevant items, people, or events of interest from the chapter, firmly grounded in the text.

Prompt supplied to ChatGPT in Study II to generate a chapter's clues (only for detective fiction novels).

Advanced Technologies Prompt

Complete the following steps in order and output the result: Refer to Chapter 1 of The Stainless Steel Rat, which is the text I have supplied you. Using the novel text, identify the advanced and futuristic technologies mentioned in the chapter. The advanced and futuristic technologies should each have a concrete representation in the text.

Summarise these advanced and futuristic technologies and format them using an unordered HTML list. Place each advanced or futuristic technology inside an <li> tag within a <ul> that has the class attribute 'datalist'. Ensure that each advanced or futuristic technology is concise and accurately reflects what is mentioned in the chapter, firmly grounded in the text.

Prompt supplied to ChatGPT in Study II to generate a chapter's advanced technologies (only for science fiction novels).

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