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Towards Automated Generation of VA Systems for Adventure Stories

Case Study in “Around the World in 80 Days”

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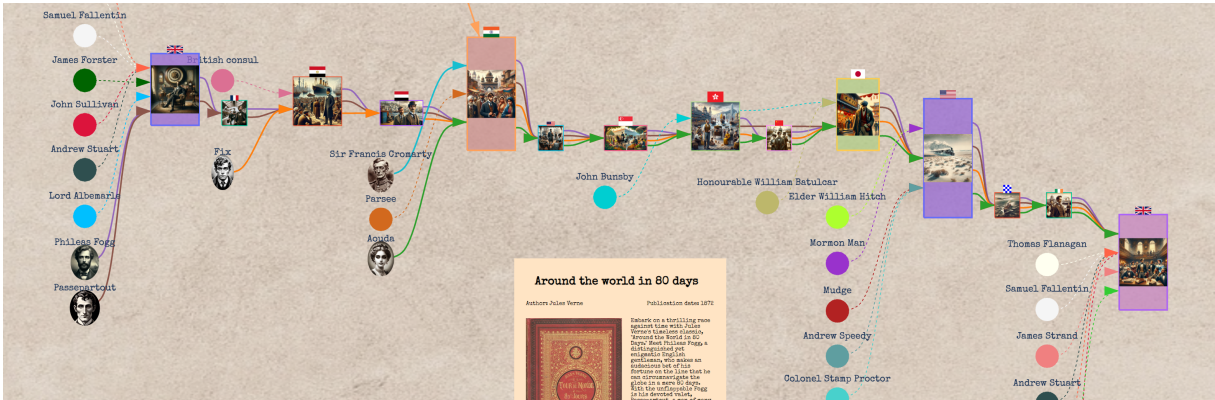


Figure 1: The storyline of “Around the World in Eighty Days”

ABSTRACT

The purpose of this study is to establish a systematic method of constructing a visual analytics system for adventure travel novels. The system aims to assist in understanding the novel and to encourage communication using this novel as material. For this purpose, we leverage text generation AI, image generation AI, various natural language processing, graph drawing algorithms, optimization, and clustering.

Index Terms: Human-centered computing—Visualization—Visualization design and evaluation methods

1 INTRODUCTION

The subject of this study is the novel of adventure travel. In this type of novel, the main characters overcome various obstacles they encounter in their journey and achieve their original important goal. Examples of this type of fiction include “The Adventures of Tom Sawyer” by Mark Twain, “The Lord of the Rings” by J.R.R. Tolkien, “The Da Vinci Code” by Dan Brown. What the reader reads from the novel is not only the things in space and the movements of the protagonists, but also the chain of circumstances and decision-making that define their behavior, and what defines their code of conduct is the important mission and purpose they formulated when they set out on their journey.

Novels of adventure travel are important not only because they are enjoyable to read, but also because they allow us to study the human characters depicted in them as archetypes of decision-making, and to see them as miniatures of the real world. The analysis of novels is central to the study of literature [1, 4, 7, 9, 11, 12] and is often chosen as the subject of visualization research [2, 5, 10]. In some cases, techniques developed in the visualization of novels [3, 6] have been applied to the reasoning of discussions in the real world [8].

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The goal of this study is to create a tool for visual exploration that allows us to better understand and communicate with each other about adventure travel novels, and to establish the techniques needed to do so. We take as our research material a relatively simple adventure journey, “Around the World in eighty Days” by Jules Gabriel Verne. The novel is a tumultuous tale that begins in 1872 at a gentleman’s club in London, where Phileas Fogg, a wealthy man who accepts a bet to “go around the world in eighty days,” sets out on his journey with his butler, Jean Passepartout

The visual analysis system being developed in this study is intended to aid in the understanding of this novel and to encourage communication on the topic of this novel. In developing the system, the following questions about the novel were identified.

Overview Significant moments, locations, obstacles in the journey?

Path What is the next destination? What are the method of transport and alternative methods? How and why the destination and the method of transport were chosen?

Time How many days are left until the due date?

Group dynamics Merges and breaks of a group and joins and leave of people to a group, and the reason for such evolution.

Activities What happened and why?

Another goal of this study is not only to present an overview of the novel (Fig. 1), but also to present the novel in progressively more detail, from the overview to the full text, as needed by the reader. In presenting the outline, our goal was to present not only symbols and a textual summary of the novel, but also illustrations that illustrate scenes from the novel (Fig. 2).

2 METHOD

2.1 Chapters

The novel consists of 37 chapters. A summary of the chapters is obtained by having ChatGPT (gpt-4-0613) summarize each of them. However, summarizing only the content of a chapter loses the

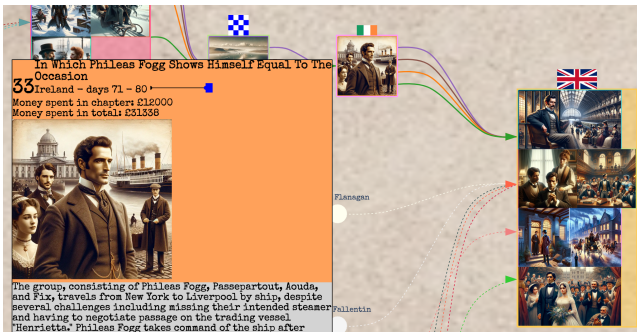


Figure 2: A slightly expanded view shows illustrations for each chapter and the chapter summary pops out on mouse hover.



Figure 3: Some images generated for the chapters in India

context of the previous chapters. Therefore, to compensate for this context, in addition to the content of the target chapter, summaries of all chapters prior to the chapter are also provided (e.g., the summary of chapter 37 in the gray box in Figure 2).

2.2 Characters

Characters in the novel and their relationships are important to the reading of the novel. We let ChatGPT analyze the descriptions and personalities and obtained 24 major characters and their descriptions from the novel. For example, for the main character Fogg, the following descriptions were obtained.

A polished, enigmatic Englishman in his 40s, possibly from London. Fogg is compared to Lord Byron in appearance, suggesting a distinctively handsome face with Byronic features. However, he differs from Byron in his tranquil demeanor and bearded appearance. He gives an impression of agelessness, suggesting a man who might live for a thousand years without aging. His personality is mysterious, quiet, and he is not known to be talkative. He has a habit of avoiding attention and lives a very structured and precise life.

2.3 Illustrations

We decided to use illustrations to provide a visual overview of the novel. For this purpose, we let OpenAI's DALL-E generate images based on the chapter summaries, and the individual images that DALL-E generates are incredibly high value relative to the efforts we are putting in, despite a few minor issues. However, when looking around the entire set of images generated, there are problems with inconsistencies in time period, location, story progression, and characters' appearances and clothing. Therefore, in addition to the chapter summaries, we ensured the consistency of the images by adding character descriptions and background information (Fig. 3).

2.4 Graph Drawing

Another part of the chapter analysis was the analysis of group organization. ChatGPT was asked to extract the travel trajectories and

means of transportation of the characters from the chapter descriptions and compile them into a CSV file, based on GraphGPT, which extracts a kind of Knowledge Graph from texts. The trajectory information obtained from the extracted data was used to identify the people who were traveling together as a group. In drawing the trajectories of people's movements, the edges representing the movements of people with the same behavior were bundled at the endpoints. In order to avoid crossing edges, the placement of characters was formalized as an integer optimization problem and optimized by Microsoft Z3 to obtain the chapter placement.

2.5 The Story Structure

The overview of the novel, which consists of 37 chapters, is based on the 13 countries visited by the main characters and is presented as illustrations of the events that took place in each country. The reader can zoom in on portions of this overview. If the screen space allocated to a country is large enough, chapter illustrations depicting events in that country are presented. For example, the United States at the top-left corner of Fig. 2 contains nine illustrations.

The current goal is to present more detailed information by dividing chapters into several hundred words according to their contents. So far, only automatically synthesized illustrations and AI-generated summaries of the novel's content have been presented, but in the final stage, the original text will be presented.

3 SUMMARY

This research initially began with a very simple graphical representation of character relationships. Significant progress was made in machine-based understanding of the novel's content by summarizing the text and generating knowledge graphs using text generation AI. The effectiveness of the image generation AI in generating illustrations for the novel was also demonstrated. The contribution of this research is that it demonstrated that the use of various types of generative AI, in addition to existing data visualization techniques, can effectively support the understanding of natural language texts, which has been considered difficult in the past.

This system is still under development. We are aiming to complete the technology to present the original text incrementally, starting from an overview of the entire novel.

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