Generación de historias a partir de un análisis temático de simulaciones
Story generation using thematic analysis over a simulation

Trabajo de Fin de Grado
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Dedicatoria

A mi familia y compañeros, por apoyarme cuando entro en pánico porque no me da tiempo a entregar el tfg.

Agradecimientos

Gracias a mi familia, por el apoyo y la comprensión recibidos durante los últimos años de mi tiempo en la Universidad.

A Pedro Pablo y Marco Antonio, por crear TeXiS e iluminar nuestro camino.

Gracias a los directores de este proyecto, Gonzalo, por no entrar en pánico cuando se leyó la memoria 2 días antes, y Pablo, por hacer las preguntas correctas que han permitido la realización de este proyecto.

Resumen

Generación de historias a partir de un análisis temático de simulaciones

El estudio directo de los temas como una métrica para valorar historias y como una herramienta para construirlas no ha tenido mucho uso en el campo de la generación automática de historias. El objetivo de este trabajo es diseñar un modelo temático tanto como métrica como sistema para extraer historias de un gran corpus de eventos. Para lograr esta tarea, se utilizará una simulación para generar los eventos, una implementación del modelo temático extraerá historias interesantes de él y los algoritmos de combinación de subtramas junto con una extensión del modelo se utilizarán para construir historias más complejas y cubrir las debilidades que el modelo temático presenta al extraer historias.

Palabras clave

Generación de historias, Combinación de subtramas, Análisis temático, Métricas en generación de historias, Simulación.

Abstract

Story generation using thematic analysis over a simulation

The direct study of themes as a metric to value stories and tool to build them has not seen much use in the field of automatic story generation. The objective of this paper is to design a thematic model both, as a metric, and as a system to extract stories from a large corpus of events. To accomplish this task a simulation will be used to generate the events, an implementation of the thematic model will extract interesting stories from it and algorithms of subplot combination in conjunction with an extension of the model will be used to build more complex stories and cover the weaknesses the thematic model presents when extracting stories.

Keywords

Story generation, Subplot combination, Thematic analysis, Metrics on story generation, Simulation.

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Chapter 1

Introducción

Toda historia tiene un tema, o una proposición subyacente que indica su tipo. El tema podría ser evidente y destacable, u oculto y vago; siempre está representado, y diferencia un tipo de historía de todos los demas. Sobre un tema se pueden contar infinidad de historias

Cook (2011)

En la última década, muchos avances en el campo de la generación de historias, es decir, el campo que estudia como generar historias automáticamente, han avanzado enormemente. A parte de ser un interesante ejercicio intelectual es una forma de construir maneras de presentar información de forma interesante lo que podría aliviar el problema de la sobrecarga de información o ayudar a personas con problemas de memoria.

El estudio de los temas tanto como componentes indispensables a la hora de contar historias como elementos esenciales a la hora de descomponer, estudiar y, a partir de ello, crear nuevas historias, es usado por muchas obras muy influyentes como guias para diseñar historias originales, vease Cook (2011) o Lemon and Reis (1965), los han usado como punto de clasificación esencial, sin embargo, en mi investigación sobre el tema, he encontrado pocas aplicaciones directas de los temas a la generación automatica de historias con lo que he decidido dedicar este trabajo a estudiar la viabilidad de un sistema basado en temas para la generación de historias.

1.1. Motivación

Citando a Lemon and Reis (1965) *"La emoción enlazada a un tema juega un papel importante manteniendo el interes"*. Como Lemon and Reis (1965) muchos otros trabajos literarios han defendido la importancia tanto de transmitir un tema en las obras artisticas (no necesariamente literarias, vease la interpretación musical

de Leavitt (2010)) como la de centrarse en el estudio de temas para construir nuevas historias, vease Cook (2011). Estos estudios sugieren la importancia de investigar esta ruta de generación de historias proceduralmente, tanto como heurista a la hora de juzgarlas como seleccionadora para construir tramas temáticamente consistentes a partir de eventos dados. Ademas, dada la naturaleza subtextual de los temas, permite transmitir información de forma más eficiente cuando se usan historias para este proposito.

1.2. Objetivo

El objetivo de este trabajo es diseñar un modelo que represente la representación de temas en una historia y utilizarlo para construir un prototipo de una métrica que será capaz de medir qué tan bien una historia transmite una idea determinada y utilizarla para generar un conjunto de historias.

Para la realización del proyecto, primero se elegirán algunos eventos y se utilizarán para generar una población considerablemente grande de eventos. Se desarrollará el sistema para estudiar, evaluar y extraer eventos basados en temas.

Estos temas serán definibles por el usuario del sistema sin necesidad de cambiar el sistema, ya que los temas de una narrativa son subjetivos, el usuario debe poder definir los componentes basados en su propio entendimiento subjetivo. Esto significa que el sistema debe permitir modificaciones en todos los aspectos relacionados con los temas. De esta manera, se espera hacer el modelo temático altamente adaptable sin la necesidad de reescribir el código.

Después de esto, se utilizarán algoritmos y heurísticas para combinar diferentes tramas, intentando mantener los temas con esta recombinación. Finalmente, las tramas completas se pasarán a algoritmos de generación de lenguaje natural utilizando tecnologías basadas en IA para hacerlas más digeribles.

Aunque este proyecto se centra en aplicar la heurística a un gran corpus generado mediante simulación, se espera que la heurística pueda aplicarse para medir cualquier historia.

1.3. Estructura del documento

Este trabajo se divide en 4 capitulos, en estos se expone los aspectos que se han considerado relevantes de este trabajo. La siguiente lista muestra un resumen de cada capitulo:

- En el capitulo 1, este capítulo, se introducen nociones básicas de lo que entenderemos por temas y su importancia así como los objetivos de este trabajo.

- En el capitulo 2 se muestran trabajos previos en los campos de generacion de historias que se usaran en este proyecto así como en estudios narrativos necesarios para el diseño de los algoritmos descritos.
- El capitulo 3 describe el trabajo realizado con las ideas y razonamientos que lo acompañan.
- El capitulo 4 reflexiona sobre los objetivos conseguidos, compara el trabajo realizado con trabajos anteriores y propone posibles vias de investigacion para expandir el trabajo.
- Los apendices A, B y C contienen información sobre los datos concretos utilizados para las pruebas del proyecto y sus conclusiones.
- El Apéndice D contiene historias generadas por el sistema que se utilizarán para evaluarlo y encontrar sus debilidades y fortalezas en el capítulo 4.

Chapter 1

Introduction

Every story has a Theme, or an underlying proposition that indicates its type. The Theme may be clear-cut and distinct, or shadowy and vague; it is always in evidence, and differentiates one type of story from all the other types. Around each Theme any number of distinctly different stories may be written.

Cook (2011)

In the last decade many advances in the task of story generation, that is, the automatic generation of stories, has advance greatly. Apart from being an interesting intellectual exercise, it is a way to construct methods to present information in an engaging manner, which could alleviate the problem of information overload or help people with memory issues.

The study of the central ideas of a story, or themes, both as indispensable components when telling stories and as essential elements when breaking down, studying, and thereby creating new stories is used by many highly influential works as guides to design original stories. (Cook, 2011), (Lemon and Reis, 1965) have used themes as an essential classification point. However, few direct applications of themes in the field of automatic generation of stories have been found. To palliate this deficit this work will be studying the feasibility of a theme-based system for story generation.

1.1. Motivation

Citing (Lemon and Reis, 1965) *"The emotion attached to a theme plays a major role in maintaining interes"*. Like Lemon and Reis (1965), many other authors have defended the importance of conveying a theme in artistic works, not necessarily literary (Leavitt, 2010), as well as focusing on the study of themes to construct new stories (Cook, 2011). These studies suggest the importance of investigating this

route of procedural story generation, both as a heuristic for judging them and as a selector for constructing thematically consistent plots from given events. Additionally, given the subtextual nature of themes, it allows for more efficient information transmission when stories are used for this purpose.

1.2. Objectives

The objective of this work is to design a model representing the representation of themes in a story and use it to build a prototype of a metric which will be able to measure how well a story conveys a certain idea and use it to generate a set of stories.

For the realization of the project, first, some events will be chosen and they will be used to generate a considerably large population of events. The system will be developed to study, evaluate, and extract events based on themes.

These themes will will be definable by the user of the system without the need to change the system, as the themes of a narrative is subjective the user must be able to define the components based on their own subjective understanding, this means the system should allow for modifications of all the aspects regarding the themes. In this way, it is expected to make the thematic model highly adaptable without the need to rewrite code.

After this, algorithms and heuristics will be used to combine different plots, trying to maintain themes with this recombination. Finally, the complete plots will be passed to natural language generation algorithms using AI-based technologies to make it more digestible.

Although this project is concerned with applying the heuristic to a large corpus generated via simulation, it is expected that the heuristic can be applied to measure any story.

1.3. Structure of the Document

This work is divided into 4 chapters, in which the aspects considered relevant to this work are presented. The following list shows a summary of each chapter:

- In chapter 1, this chapter, basic notions of what we will understand by themes and their importance, as well as the objectives of this work, are introduced.
- In chapter 2, previous works in the fields of story generation used in this project, as well as narrative studies necessary for the design of the described algorithms, are presented.
- Chapter 3 describes the work done with the accompanying ideas and reasoning.

- Chapter 4 reflects on the achieved objectives, compares the work done with previous works, and proposes possible research avenues to expand the work.
- Appendices A, B, and C contain information about the specific data used for the project's tests and their conclusions.
- Appendix D contains stories generated by the system which will be used to evaluate it and find its flaws and strengths in chapter 4.

Chapter 2

State of the art

Throughout this chapter, an overview of the techniques, tools, and research that have led to this work is provided. The most relevant ideas in relation with this work will be further discussed throughout the rest of the document.

This chapter is divided into three main sections, the first will discuss the generalities of story generation, the main approaches to tackle this problem and classical work done in it. The second section studies themes, both from a literary perspective and from a computational one. The last chapter intends to give a brief summary of previous works in plot combination, heuristics used and the methods employed.

2.1. Previous works on story generation

The first work on automated story generation is considered to be *Novel Writer* designed by Klein (1973) who followed a simulation approach to simulate a simple murder mystery. Since then the field has grown, developing different approaches, incorporating literary works such as (Propp, 1968), (Booker, 2004) or (Figgis, 2017) as templates and applying emerging technologies such as the recently popularized transformer neural networks.

To understand what story generation aims to achieve, an understanding of what is a story must be attained.

2.1.1. What is a story

According to Swartjes and Theune (2008) a story is divided into three levels, plot, narrative and presentation. The first level, the plot, consist of a simple set of events which make up the content of a story and are related in time and causality. This level would describe the events produced by an observation, raw data of the world.

The second level, the narrative, is the transformation of the data presented in

the plot into a story, it grants perspective to the events, selecting, redefining and reordering them into a story. This level would describe the extraction of the events of the plot by an algorithm. It is comparable to the definition of a plotline presented in (Gervás et al., 2022a), *"a sequence of plot-relevant elements that make sense in the order in which they appear in the story, and linked by at least a shared set of protagonist and secondary characters"*. During this document plot and narrative will be used indistinctly as most of the time the processing will be done with an increasingly small set of events.

The third and last level is the presentation, the adaptation of a narrative to a particular medium, a narrative could be told orally, it could be written or it could be made into a movie, all this are possible presentations of a story.

2.1.2. Approaches to story generation

Approaches to story generation can be broadly categorized in two main branches. The first branch, the simulation approach, Has been implemented by works such as (Klein, 1973), (Park et al., 2023) and (Johnson-Bey et al., 2022). It works under the philosophy that the stage where the story is taking place should be defined first and from interaction rules defined over the world the story will unfold organically and the main task of a story generation system should be to extract the stories from it. This project will follow a philosophy similar to this one.

An important subset of these methods have also been called character centric, where the importance is put on simulating characters with goals and motivations, (Chang and Soo, 2008) is a good example of this type of generation. This approach at writing stories has been famously used by J.R.R. Martin in his *Song of Ice and Fire* series.

Traditionally, the simulation approach has been carried out using events and rules defined by an author as can be seen in (Swartjes and Theune, 2008) and (Klein, 1973) but recently, due to the rise in AI technologies, more AI and big data approaches are being used for designing worlds, (Martin et al., 2018) for example, and events, like the one used in (Park et al., 2023).

This approach generates a high number of events but due to the lack of authoring intent this events do not necessarily convey interesting stories and depends on heavy post-processing work to extract interesting stories from a report of events.

The other approach, author centric, as described in works like (Mason et al., 2019), (Bernstein, 2001), (Garbe et al., 2019) or (Gervás, 2019), is more concerned on the structure of the story, and characters and settings are treated as devices to serve such story. This method often relies heavily on prior literary studies to select events and the order this events may be combined into to satisfy the narrative objective of the story.

The importance of narrative design usually makes the author centric approach dependant on the desired type of story as it is built using literary works centered only in the study of a certain genre. For this reason this systems are resistant to changes in tone or theme, which bounds them to the specific type of story they are designed to generate. This affects the variety of stories these systems can generate but gives them consistency.

There are compromises between these two approaches, some author centric models build over the simulation approach but directs it to a particular narrative goal, changing the problem from a simulation problem to a path-finding or planning problem. (Swartjes and Theune, 2008) is an example of this kind of method. These approaches palliate some of the problems inherent with the two approaches described above but also carries others from both. On one hand they produce more variety than a purely author centric model but are still restricted by the planner. On the other They generate more consistent stories but are still dependant on a interesting story emerging from the simulation.

2.1.3. The authoring process in automatic story generation

Most methods regarding automatic story generation require a set of events and rules to generate the stories. The decisions made when building the system are, in part, what defines the type of stories the system will be able to generate. The definition of these components is what is called the authoring process.

One important aspect of this process is the definition of the granularity the story, that is, what the minimal narrative unit must be, is the story told as a succession of important and complex events throughout the years or every action of every character must be conveyed in order to pierce the true meaning of the story?

Some recent works, like (Martin et al., 2018) or (Chen et al., 2021), have started to rely on emerging technologies based on artificial intelligence to build large datasets of events and rules from preexisting stories. Even this is part of the authoring process as the data used to generate the events and rules must be selected by the designer and influence greatly the type of stories the system will generate.

2.2. Works on thematics

Thematics is the subset of narratology that studies themes(Hargood et al., 2008), there exists a wide catalogue of literary studies on thematics and the ideas that form them, such as (Lemon and Reis, 1965) or (Leavitt, 2010). Even some of the most influential works on automatic story generation such as (Cook, 2011) put a heavy emphasis on them. Meanwhile, this aspect has been mostly absent in studies on automatic story generation, thought some works such as (Hargood et al., 2008) have made superficial studies.

2.2.1. Narratological studies on thematics

Many guides to story generation such as (Cook, 2011) use themes as a guide to classify events from where to build stories, this is an author based approach but lacks the information needed to extract themes for stories and use them as a metric to evaluate them. Even so, the definitions and properties this kind of works propose are useful to this study.

Lemon and Reis (1965) defines a theme with the following sentence, *"The meaning of the separate sentences of a work of literature combine to produce a definite structure unified by a general thought or theme"* Another definition is given by Cook (2011), *"Every story has a Theme, or an underlying proposition that indicates its type. The Theme may be clear-cut and distinct, or shadowy and vague; it is always in evidence, and differentiates one type of story from all the other types. Around each Theme any number of distinctly different stories may be written"*. In other words, a theme can be described as the main idea of a story which does not define it but makes it cohesive. This idea may be straightforward like "the war on Iran" but it may be subtle and enforced in the subtext, like "love", this is why most works on the inference of themes when analyzing an academic work, like a news article in the case of (Maria et al., 2000), fail to be of use in the study of themes in more artistic forms of expression, such as stories.

To study themes, a good start is to study the way they form, as Lemon and Reis (1965) puts it, *"the work has a theme and it's individual parts have a theme"*, to inference the theme of a story we should define theme atoms, also called motifs. (Lemon and Reis, 1965) defines motifs as the theme of a sentence, *"The theme of an irreducible part of a work is called the motif. Each sentence, in fact, has it's own motif"*, a similar definition is be given by (Leavitt, 2010)[1], *"Motifs can be thought of as existing on the level of the sentence, yet they are no mere 'sentences' [Sentenzen], but plastic moments-of-Feeling"*. As can be inferred from this definitions, the motif is a theme, the main idea in a textual or sub-textual way, of a sentence or basic action.

Lemon and Reis (1965) starts it's discussion of motifs calling into attention the difference on their presentation between 'descriptive' works, such as a news article or a painting, whiout a temporal importance in the way the motifs are studied, and 'stories', tales, novels or epics, those in which *"causal-temporal relationships exists between the motifs"*. This is an important distinction as most works in automatic classification on themes work over descriptive works.

Motifs are the main tool for the study of themes. Lemon and Reis (1965) has an in-depth classification of motifs. First they are classified between bound motifs, those motifs essential to convey the plot, and free motifs, motifs which are not necessary for the plot but are important in the artistic presentation of one, an ex-

[1]Leavitt (2010) discusses the importance of themes and motifs in music but it states implicitly that this results are inspired by and applicable to narrative.

ample of the latter is the description of the clothes as a way to add a signifier to the time period of a story where such information is not indispensable. Another classification proposed is that of dynamic and static motifs, a dynamic motif is that which advances the story while a static motif serves as a motif of exposition. All dynamic motifs are bound, as the story would not be able to advance without them, but not all bound motifs are dynamic as important information may be needed to understand a story completely.

Both Leavitt (2010) and Lemon and Reis (1965) give great importance to the repetition of motifs as the basis from where to infer a theme and the strength of it and as the connector of events into a cohesive story. Cook (2011) goes one step farther and insinuates that all motifs in a story must serve the main theme.

2.2.2. Computational approaches to the study of themes

Most computational works on themes define them in a textual manner for descriptive works, for example Maria et al. (2000) understands themes as a description of the core concept of a news article which is a descriptive work, that means, it's ideas do not have temporal nor causal dependency and can be studied as a whole.

Hargood started trying to measure the thematic relevance of a story in (Hargood et al., 2008) by designing an interpretation of theme which can be seen in the figure 3.2. In his model all motifs are evaluated at the same time. This approach is ill-suited for evaluating stories as ideas in stories can not be described without taking into account the order they appear in (Lemon and Reis, 1965). By Hargood et al. (2010) they had realised the limitations of their model and decided to apply it to descriptive works .They studied images extracted from *flickr*[2], which are categorized as descriptive media. For this reason they are not concerned for the chronological order in which the motifs are presented.

2.3. Previous works in subplot combination

The works on subplot combination can be considered an application of story generation as it is frequent for story generation to build stories combining different structures and these approaches are usually used in subplot combination. Most works describe metrics to measure an aspect of the combination, such as O'Neill and Riedl (2014) which describes suspense as an indicative to measure the change of subplot, or an algorithm intended to combine different plots, like the genetic algorithm implementation given in Gervás et al. (2022a) or the plan-based approach suggested by Porteous et al. (2016) as an application of an author-centered approach to subplot combination.

[2] `https://www.flickr.com/`

Chapter 3

Description of the system

The objective of this work is to define a metric to measure the relevance of themes in a story and to use that metric to extract a story from a large corpus of events generated using a simulation.
This work is divided into four distinct tasks, each with its own section, a schematic representation of this division can be found in figure 3.1:

- **First section:** Explains the authoring process followed to decide the events and the way they are combined to form the event list from where to extract stories. This step returns a considerably long list of events.

- **Second section:** This section is where the largest contributions of this work reside, it describes the thematic model and its application to the extraction and evaluation of stories from the event list. It returns a list of possible plots with thematic evaluations from the events generated in section 1.

- **Third section:** Describes methods and metrics to combine different plots and create more complex stories from the list of plots received from section 2 and an application of the thematic model to multi plot stories. It returns a more complex list of plots with a similar structure as the one received.

- **Fourth section:** Describes the generation of natural language from the narrative generated in section 3.

3.1. Events and their generation

The first part of this project consist in the generation of a large corpus of events. In order to achieve both temporal and causal consistency between a large amount of events, a computationally cheap simulation has been required. The simulation guarantees the consistency while its low computational cost allows the generation of a large number of events in a relatively low time. To build the simulation a group of events to be simulated and an engine to run the simulation have been chosen.

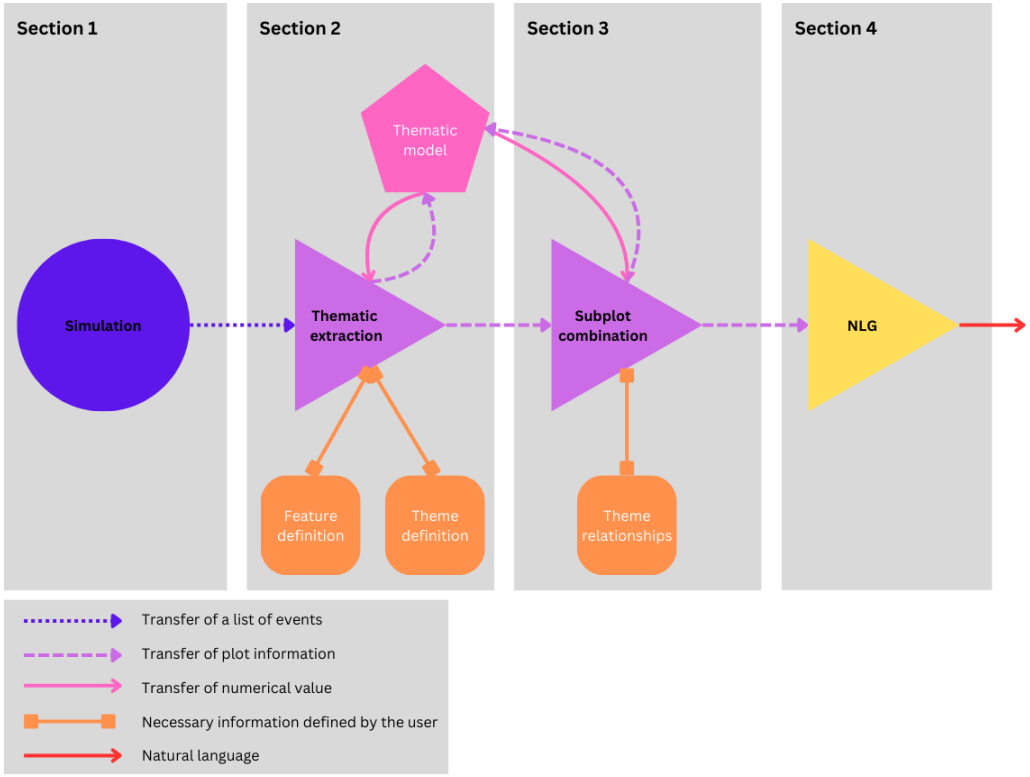

Figure 3.1: Schematic representation of the pipeline describing the story generation system designed in this work

3.1.1. Event selection

Even though a thematic analysis does not restrict us to a concrete granularity, the events have been restricted to simple but important events in the lives of characters which could be described with a single verb such as "Alice and Bob have a child named Charly".

On one hand, a granularity too high, that is, dividing the story in too simple components, words for example, as the minimum unit of the simulation, would reduce the amount of information contained in the corpus of events and, more importantly, this information would be too simple to express any significant meaning on their own. A thematic analysis on information of this kind, even if possible, would require an holistic analysis in the meaning of multiple events as a unit, which is out of the scope of this project.

On the other hand, events such as "Alice fights a hard battle with her conscience; she finds it a losing battle and makes an important revelation in order that she may achieve peace of mind"[1] are usually designed with a certain purpose in a story and as such have been designed to convene a certain theme. An analysis made on a corpus built with the desired objective in mind would be pointless.

[1]Event extracted from (Cook, 2011)

The simulations proposed in (Martin et al., 2018) and (Chen et al., 2021) are interesting as they suggests using neural networks and a huge dataset of stories to generate events and probabilities for the simulation , this approach comes closer to the idea of comparative motif as element repeated in many stories described in (Lemon and Reis, 1965) but uses many stories with well defined themes which would interfere with the thematic analysis this project is conducting. For this reason a simple authored approach has been used, rewriting and expanding the list of events defined in (Johnson-Bey et al., 2022) to allow for a greater expressivity in the stories generated. A description of the events and the actors required in those events, implemented as a plugin of the system described in (Johnson-Bey et al., 2022), can be found in the Appendix A.

3.1.2. Inference engine

The system described in (Johnson-Bey et al., 2022) has been used to generate the events to be processed. It computes events fast as it manifest them randomly where the probability of an event appearing is given by the mean of a base probability, the probabilities described in preconditions. For example an event describing a character A stealing money from a character B may be described as:

```
A staeals money from B:
    base probability=0.2

    precondition name: A doesnt like B
    probability: 1-how much A likes B normalized

    precondition name: A needs the money
    probability: if A needs money ignore else 0.01
```

In this example if the love A professed B was very low, represented as a 0.1 out of 1 for example then if A needed money the probability for A to steal from B would be $(0.9+0.2)/2 = 0.55$ but if A did not need money the probability would be $(0.9+0.2+0.01)/3 = 0.37$. The simplicity of the system makes adding or rewriting events in it simple, making this simulation convenient for experimentation.

There are simulations based on generative AI, such as the one presented in (Park et al., 2023), which are more complex and expressive than the one used in this project, but the complexity adds a difficulty in adding and removing events, a significant increase in computational time and they present an undesirably high granularity.

The simulation models defined as compromises between the simulation and the author-centric approaches are immediately discarded because they would compromise the results of the evaluation under the thematic model as many author-centric techniques are designed using prior narrative works defined to convey a concrete theme.

3.2. Thematic engine

When building a thematic engine the desired system should be able to measure and satisfy the requirements listed in section 2.2.1, that is, the system must extract textual and sub-textual motifs from the atomic elements of the story and infer themes from their combination in chronological order. The repetition of motifs must be an important factor in the calculation of the relevance of a theme. Motifs have been defined by the events of the story as suggested by Lemon and Reis (1965) and Leavitt (2010).

Given the subjective nature of the themes of a story, an AI-based algorithm would not be an efficient option for our system as each interpretation of themes would require the construction of a personalized dataset which would make the authoring process severely inefficient. For this reason a more traditional approach inspired by (Hargood et al., 2010) has been used.

3.2.1. Representation of themes

When representing themes, the representation found in (Hargood et al., 2008), (Hargood, 2009), (Hargood et al., 2010) and (Hargood et al., 2018) is an interesting starting point which draws heavy inspiration from (Lemon and Reis, 1965). This model assumes the story is compiled from small segments of narrative, also known as Narrative-atoms or natoms, for example a paragraph or a word, in this project the events defined in the simulation could be considered these small segments of narrative which compose the story. These natoms are rich with information but the model would only have access to the meaning provided by the author, this meaning is what will be called features. A single natom could contain a myriad of features as there may be more than a single interpretation to the meanings presented in an action, even under a single reader's perception, for example the action "Alice kills Bob" could evoke the corruption of Alice if she was a morally righteous character until this point or a sense of loss if we knew Bob had a lover waiting for him.

The meanings contained in the natoms convey simple ideas, motifs, important for the entire story, the motif represented by "Alice kills Bob" could be "tragic love" for example if we knew bob had a lover waiting for him, was in love or, more generically, the theme of "love" was an important part in Bob's story.

The repetition of basic ideas, or motifs, along a story would, in turn, convey a broader idea encompassing the whole story, in other words, the repetition of motifs convey a theme. For example the repetition of motifs such as "corruption", "broken truth" or "injustice" would create a story whose main theme may be described as "The dark nature of life". The main theme of a story can be inferred from other themes and motifs, for example if the idea of "hope" can be found in a story about "The dark nature of life" the main theme could be reinterpreted as "Hope in the darkest of places". An schematic representation of this model can be found in the figure 3.2.

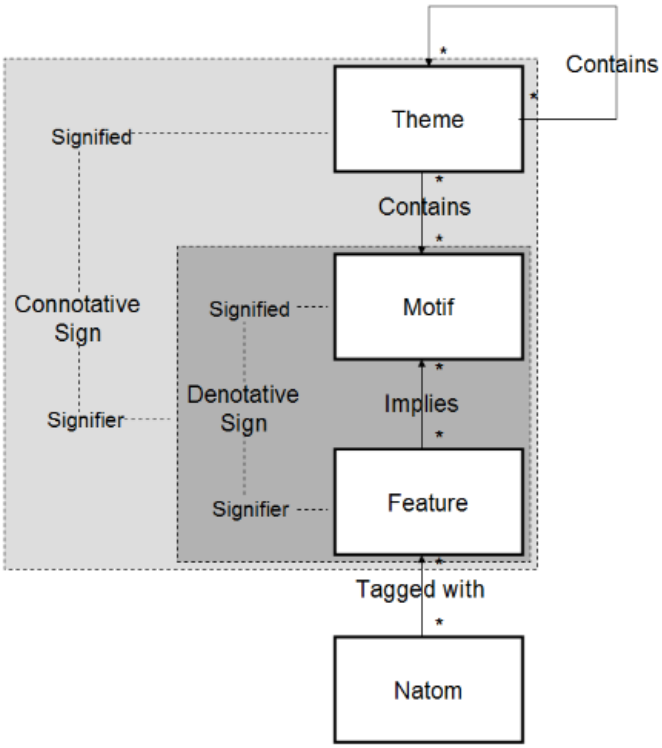

Figure 3.2: Model described in (Hargood et al., 2010) for the representation of themes

The distinction between motifs and themes both in (Hargood et al., 2008) and (Lemon and Reis, 1965) is mostly reduced to the number of natoms needed to represent an idea, if a single natom could represent an idea, that idea is a motif, meanwhile, if a series of natoms is necessary to convey an idea, that idea is a theme. In this context the idea of "tragic love" described in a previous example would be closer to a theme than to a motif as it needs both a feature from where to infer "love" and a feature from where to infer "tragic love" if "love" has already been inferred. This model allows a convenient separation between events and ideas through the concept of features, making the features from where to infer motifs and themes the center of the authoring process while the ideas, motifs and themes, are the building blocks of the central idea of a story and, as such, the main components in its analysis.

The story presented in 3.1[2] can be used as an example of the model in action. The features and ideas used in the example are not necessarily the best at valuing the story but a possible definition intended to make the example easy to follow. We can see the motif "love" has been generated by the features of the natoms "Alice develops a crush for Bob" and "Alice and Bob dissolve their enmity" while the theme "power_of_love" has been formed by the combination of the motif "love" and the

[2]This is a simplification of a story generated with an early model of the one presented in this work.

	seen ideas	event (natom)	features
1		Alice and Bob became enemies	enmity if war: evils_of_war
2	enmity	Alice develops a crush for Bob	love
3	enmity love	Bob goes to war	war
4	enmity love war	Alice and Bob dissolve their enmity	if love: power_of_love love
	enmity love war love power_of_love power_of_love		

Table 3.1: Example of idea acquisition from the features of events

feature of the natom "Alice and Bob dissolve their enmity". The ideas presented by the end of the narrative would be "enmity", "love", "war", "love" and "power_of_love", of which the themes and motifs "enmity", "love" and "love" would form the theme "Complex relationships". The repetition in the ideas found is important as repetition of an idea is what generates a theme but this will be further explore in the next chapters.

3.2.2. Implementation of the inference of motifs

The model proposed by Hargood et al. (2008) and Lemon and Reis (1965) is highly theoretical and as such an implementation is needed. Hargood et al. (2018) Defines an implementation intended for the analysis of themes in images, as defined in (Lemon and Reis, 1965), images are *descriptive works*, works with no temporal nor causal relationship between their ideas, as opposed to *stories* like the ones studied in this work, where the study of themes in their context is essential.

For the implementation, the minimum elements of the story, or natoms, has been defined as the events generated by the simulation, every natom has features: textual or sub-textual information about the motifs it represents, which can be defined by the user of the system. The features define both the motifs, as ideas always extracted from an event, and the themes, in the form of conditional ideas only manifesting if the required ideas have been found before. This distinction allows the author to define ideas instead of having to deal with the abstract distinction between themes and motifs.

For this approach to work, the model needs to process the story sequentially to maintain the order. It carries a multiset of found motifs at every step. The themes

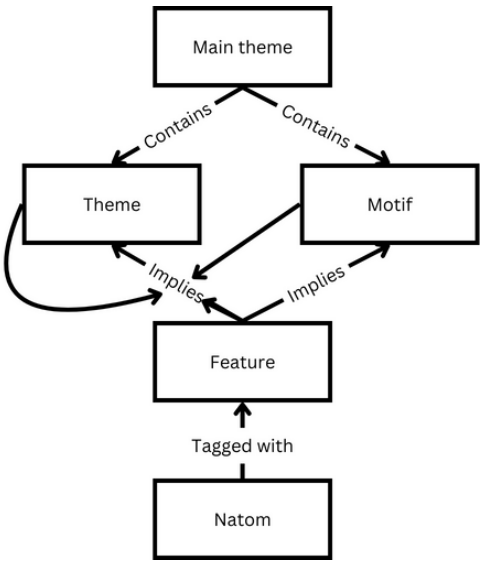

Figure 3.3: Schematic representation of the implementation of the thematic model proposed in this work.

would not be able to manifest if the required motifs are not found in the multiset, the motif “tragic love” could not be found without the motif "love" in the multiset for example. A main theme, the main idea to evaluate the story on, is defined as a set of ideas, for example, one main theme to be evaluated in a story could be “The dark nature of life” which would be represented by the motifs and themes “corruption”, “broken truth” and “injustice” while the theme “tragic love” could be defined by the single idea “tragic love”. An schematic representation of the implementation can be found in the figure 3.3.

Repetition must be the basis to evaluate the relevance an idea has in a story as stated in (Leavitt, 2010). For an idea to stand out, it must appear significantly between the ideas of a story, that is, repetition should be measured as a proportion between desired ideas and found ideas in the story. If the idea of war would appear only once in a story with thousands of ideas, it would be difficult to infer “war” is the theme of the story, meanwhile, if the story only had two ideas and one of them was “war”, it would be natural to think the main theme of the text has something to do with war.

Under this assumption, themes, which require of other motifs and themes to manifest, are evaluated with a considerable disadvantage, as most of the ideas comprising the themes are spent on preparation and are not counted when calculating the proportion. Consider the example given in table 3.1 where “power_of_love” is clearly a main theme because the story has been building to its apparition by introducing love and enmity, but only counts with a single appearance and as such would not be considered an important idea. To solve the problem of the representation of themes, the ideas generating a theme which were already instantiated when the last instance of the theme is being instantiated are duplicated as instances of the theme.

	seen ideas	event (natom)	features
1		Alice steals Bob's car	selfishness if selflessness: corruption
2	selfishness	Alice gifts money to Bob	selflessness if selfishness: redemption
3	selfishness selflessness redemption *redemption	Alice steals Bob's treasure	selfishness if selflessness: corruption
4	2 selfishness selflessness redemption *redemption corruption *corruption	Alice gifts a treasure to Bob	selflessness if selfishness: redemption
5	2 selfishness 2 selflessness 2 redemption corruption *corruption 2 *redemption	Alice gifts a car to Bob	selflessness if selfishness: redemption
	2 selfishness 3 selflessness 3 redemption corruption *corruption 2 *redemption		

Table 3.2: Example of idea acquisition from the features of events after the change introduced to solve the problem in the representation of themes. the themes represented by *idea are the themes introduced to solve the problem.

An example of the solution can be seen in the table 3.2. In step 2 one "*redemption" is added because "selfishness" produces "redemption" and there has been found one instance of "selfishness" when "redemption" was found. in the step 3 one instance of "selfishness" has been added but the extra instances of "*redemption" are not updated as they are only updated when a new instance of "redemption" is found which happens in step 4. In step 5 a new instance of "redemption" is found and as such the extra instances "*redemption" are updated, but because the number of instances of 'selfishness" remain the same so do the number of instances of "*redemption".

The theme associated with an action is dependant on the actor we are following. The ideas produced by Alice making the robbery in "Alice steals Bob's car" may be something similar to "selfishness" while the ideas associated with Bob being robbed could be something closer to "tragedy" or "loss". This information must be taken

	seen ideas	event (natom)	features
1		Alice steals Bob's car	loss if friendship: broken_trust
2	loss	Alice gifts money to Bob	fortune
3	loss fortune	Alice steals Bob's treasure	loss if friendship: broken_trust
4	2 loss fortune	Alice gifts a treasure to Bob	fortune
5	2 loss 2 fortune	Alice gifts a car to Bob	fortune
	2 loss 3 fortune		

Table 3.3: Possible description of the events in table 3.2 from Bob's point of view instead of Alice's.

into account when defining the features and evaluating the ideas. For this reason a multiset of themes similar to the one used for the entire story before will be given to each character in the story, and the evaluation of a theme would be carried out with stories where all the actions involve a protagonist, the most prominent character in a story. This interpretation is similar to the one adopted by (Lemon and Reis, 1965) because *"the protagonist, rather, is the result of the formation of the story material into a plot"*. This reduces the complexity a story can take to a set of events following a single character, but the algorithms in section 3.3 will restore the complexity removed with this concession. While the example presented in table 3.2 would be the one generated by Alice, the example found in table 3.3 would be the ideas generated from Bob's point of view.

The features are represented as a map with the keys being an identification of the type of event and the values a set of unconditional and conditional motifs, the unconditional motifs are represented as a map with key role_of_actor being the role of the actor these ideas are going to affect and value [idea_generated] being a list of ideas added to the multiset of ideas of the actor, and the conditionals are represented as a map with key role_of_actor being the role of the actor these ideas are going to affect and value a list of (conditions_ideas, idea_generated) where conditions_ideas is a list of motifs, this last tuple represents the following instruction:

```
if condition_idea present in the idea multiset of the actor \
   whose role is role_of_actor in this action \
   for every condition_idea in condition_ideas:
        add idea_generated into the actor's multiset
```

These features are generated from a JSON file where they are codified with the following structure:

```
{
    "event_name": {
        "conditional": {
```

```
            "role1":
            [
                [
                    ["condition_idea1", "condition_idea2", ...],
                    "idea_generated"
                ],
            ...],
            "role2": [[["condition_idea"], "idea_generated"], ...],
            ...
        },
        "unconditional": {
            "role1": ["idea_generated", "idea_generated", ...],
            ...
        }
    },
    ...
}
```

This has been done in order to allow changes in the features, the most subjective point of this project, without the need to change the code. As an example the features of the action "kill" as defined in appendix A could be defined in the following manner:

```
1   "Kill": {
2       "conditional": {
3           "subject": [["selflessness", "corruption"]],
4           "other": [
5               [["love"], "tragic_love"],
6               [["selfisness"], "retribution"],
7               [["selflessness"], "injustice"]
8           ]
9       },
10      "unconditional": {
11          "subject": ["selfisness", "death"],
12          "other": ["tragediy", "death"]
13      }
14  }
```

3.2.3. Function for the evaluation of themes

From a thematic point of view an ideal story would be one which expresses all its motifs and themes and only its motifs and themes. A main theme is represented as a tuple of motifs and themes. when evaluating a story in accordance to a main theme we want the story to present the maximum number of ideas of that main theme and we must take into account the relevance of those ideas. To evaluate a main theme, calculating the proportion of ideas which represent the theme, what will be called TP for thematic percentage, works as a first approximation.

$$TP = \frac{\#|\text{ideas in the story belonging to the main theme}|}{\#|\text{ideas in the story}|}$$

Taking the story presented in table 3.2 as an example with a theme "character growth" with motifs and themes "redemption" and "growth", $TP = \frac{5}{12}$ because by the end of the analysis there are 5 instances of "redemption", 0 of "growth" and 12 ideas.

One final measure of the prominence of a theme would come in its completeness. the following expression is multiplied to TP:

$$\frac{\#|\text{different ideas in theme} \cap \text{different ideas in the story}|}{\#|\text{different ideas in theme}|}$$

This factor create a severe penalty to incomplete themes as, ideally, for a theme to manifest, all the motifs and themes which compose it should be present. The final score assigned to a story for a theme therefore is:

$$\frac{\#|\text{different ideas in theme} \cap \text{different ideas in the story}|}{\#|\text{different ideas in theme}|} TP$$

Taking again table 3.2 and the theme "character growth" as defined before, the final thematic value of "character growth" would be $\frac{1}{2} \cdot \frac{5}{12}$ as only one of the ideas necessary to define "character growth" is present in the story.

Being the main themes the other highly subjective elements of this model, they are also definable using a JSON with the following format:

```
{
    "theme_name": {
        "motiffs": ["motif_name", ...]
    },
    ...
}
```

For example, an hypothetical theme for love may look like this:

```
1    "love": {
2        "motiffs": ["love", "tragic_love", "friendship"]
3    }
```

3.2.4. Selection of motifs and themes to be evaluated

Ideally the motifs and themes used in the experiment of the model would come from literary sources but this approach has been found unfeasible. The ideas found in works such as (Thompson, 1955) were too specific as they followed a comparative approach to the extraction of motifs, that is, motifs not as themes for specific events

but as recurring elements seen in many stories. This interpretation of motifs is ill-suited for the model described in this work and complicates the authoring process as they represent specific situations instead of ideas.

The themes used to classify stories, such as the ones presented in (Cook, 2011) or the 20 master plots which can be found in 3.4 presented in (Tobias, 2012), lack the expressivity needed to convey the information given by single actions, as their intent is to classify stories into broad themes, whose generality makes them impossible for any single action or event to express them and there are not enough ideas to generate a decent amount of expressivity to the model.

Given the problems encountered with the definition of motifs and themes and the model's objective to allow the author to define them, a series of well known motifs have been used to test the model. The defined motifs can be found in appendix B. With these motifs it is expected for the model to have enough expressivity to extrapolate different types of stories in order to evaluate the effectiveness of the model.

Some of the ideas represented, like "friendship" or "enemy", are independent and, as such, motifs, while others, such as "redemption" or "tragic_love", depend on others, "selfness" and "love" respectively, so are themes. The JSON describing the features of the events describing these motifs may too be found in the appendix B.

3.2.5. Themes as a tool for the extraction of stories from a large corpus of events

To extract a plot from a large corpus of events the model is maintained but the implementation has needed to change. The extraction has been made under the assumption made in (Cook, 2011) where a story plot is defined as a combination of the pieces which express a theme, in other words, only the events that express the desired motifs are to be extracted.

The plot is then built around a character, as Lemon and Reis (1965) says *"the protagonist, rather, is the result of the formation of the story material into a plot"*. This means the events concerning a character are studied in order and after every instance of the desired motif or theme the events which generates the ideas of the main theme are saved as a plot, then the plots are ordered by relevance according to the metric defined in this section.

This first approach generates and positively values stories such as this one:

```
In 0680-02, Maison Stukes became friends with April Nicholes.
In 0686-02, Maison Stukes became friends with Jayson Hinde.
In 0686-08, Maison Stukes became friends with Kendrick Sloper.
In 0690-05, Alaia Langworthy started dating Maison Stukes.
In 0690-11, Maison Stukes formed a crush on Brynleigh Bramwell.
In 0691-02, Alaia Langworthy became friends with Maison Stukes.
```

Quest	hero sets out to fulfill a quest
Adventure	much like a Quest but with less focus on a particular goal and more action
Pursuit	hero is pursued and eventually manages to escape
Rescue	hero rescues a victim imprisoned by a villain
Escape	like Rescue but the protagonist is the victim and eventually escapes by his own means
Revenge	protagonist sets out to avenge a villainy The Riddle involves solving a riddle (reader should try to solve it before the protagonist)
Rivalry	a protagonist and an antagonist of balanced power clash, protagonist wins
Underdog	as in Rivalry but protagonist is at disadvantage and wins through tenacity
Temptation	maps the fight of protagonist against temptation, from initial fall to eventual success
Metamorphosis	protagonist suffers a curse that transforms him into a beast, but love releases him eventually
Transformation	faced with a crisis, protagonist suffers transformation with important effects (usually at a price)
Maturation	tracks immature character through challenging incidents to maturity (usually achieved at a price)
Love	maps the progress of a love relation from initial obstacles to final fulfillment (if test passed)
Forbidden Love	as in Love but around an unconventional love relation (usually adultery) which ends badly
Sacrifice	tracks transformation of main character from low to high moral state, leading to a final sacrifice
Discovery	protagonist discovers himself
Wretched Excess	traces psychological decline of a character based on a character flaw
Ascension	protagonist faces a moral dilemma and undergoes ups and down till he reaches success
Descension	as in Ascension but followed to final disaster

Table 3.4: 20 Master Plots as presented by Tobias (2012), table extrated from (Gervás et al., 2015).

```
In 0722-05, Emery Ligon started dating Maison Stukes.
In 0724-10, Emery Ligon became friends with Maison Stukes.
In 0729-02, Maison Stukes formed a crush on Miranda Langworthy.
In 0729-03, Maison Stukes formed a crush on Elsie Soloway.
In 0729-05, Maison Stukes formed a crush on Elyse Leal.
In 0729-08, Maison Stukes formed a crush on Anais Mussey.
In 0729-10, Maison Stukes formed a crush on Eden Cowser.
In 0730-01, Maison Stukes formed a crush on Adriana Snow.
In 0730-03, Maison Stukes formed a crush on Alaina Wilsey.
In 0731-06, Maison Stukes formed a crush on Ashley Langworthy.
```

We can see that, apart from the protagonist, no character appears more than twice, giving it a sense of disconnection between the events and a few events comprise the majority of the story, giving it a sense of repetition. This makes sense as the model only measures relevance of a theme, no other metric measuring the interest of a story has been applied. To avoid these problems extra factors have been added.

Two extra factors have been added when evaluating created stories, one of those factors intends to avoid having plots where the same event comprises the majority of them. The TP of a plot is scaled by the factor

$$\frac{|\text{different\_events\_in plot}|}{|\text{events\_in\_plot}|}$$

This imposes a disadvantage to those stories which have repeated events, the more an event repeats the bigger the disadvantage. The other factor is concerned with the amount of side characters in a story, if there is no secondary character reappearing then the story is a mere succession of events happening to the main actor. To avoid this type of stories the value of a plot must be scaled by the mean of the proportion of events every secondary actor appears in. This severely penalizes plots with actors which appear in a relatively small number of events and as such are uninteresting to the story at large.

A small selection of main themes inspired by plots proposed in (Figgis, 2017), (Booker, 2004) and (Tobias, 2012)[3] intended to manifest different type of stories have been used to experiment with the system. They can be found in appendix C.

3.3. Subplot planning and combination

Once a list of plots with their themes and evaluations has been generated, it is important to tackle the problem of subplot combination to allow design the thematic evaluation of narratives with actions that does not share any character and use it to create more complex narratives from the ones created in the last section.

[3]The 20 master plots can be found in table 3.4

3.3.1. Finding compatible subplots

Given the amount of plots that could be generated in the last step, trying every possible combination would be unfeasible, therefore, a selection of possible plots to be combined must be declared first.

The main determinant when deciding if two plots can be combined is the amount of characters they share and, more importantly, the proportion in each story the other protagonist appears in as stated in (Gervás et al., 2022b). When considering the amount of events where the characters are participating, Porteous et al. (2016) defends no two characters can compete for the position of most prominent as a protagonist, the character with more appearances, must be well defined. It is important to consider when combining plots that the main themes of each plot must be the same or complementary, A story defending two different themes will break cohesion and consistency in the story and would not benefit from any other processing done in this work.

3.3.2. Methods and metrics for subplot combination

Suspense, as stated in (Gerrig and Bernardo, 1994), can be described with the following quote *"readers feel suspense when led to believe that the quantity or quality of paths through the hero's problem space has become diminished."*. This definition has an application to subplot combination given by (O'Neill and Riedl, 2014) where they interpret this definition as a negative outcome with no simple paths to be escaped. A good point to change subplot would be a moment of high tension. We will not be able to use their method, as it requires planification for every possible situation with suspense and the number of subplots to be considered may be considerably big. Nevertheless in a theme-based structure a seemingly negative outcome may be understood as a theme presented which contravenes the main theme of the story, for example, to achieve the theme "tragic_love" first the story must show the motif "love" which is opposite, even if complementary, to the theme. In this way tension can be described as a conflict for prominence between themes.

Gervás et al. (2022a) also suggests having a main subplot as that gives cohesion to the entire plot. The main subplot would need to satisfy 3 things:

- It is the subplot centered around the main character, the most prominent character in the story.
- The plot must start and end with this subplot.
- The protagonist of each other subplot must have their last appearance in the main subplot

All of the works mentioned in this chapter are designed as methods and metrics for the combination of plot centric stories in contrast with our simulation approach so no implementation would be directly applicable. Even so these methods and metrics could still be extrapolated an implemented to the desired subplots.

3.3.3. Thematic model application to the valuation of stories with multiple protagonist

Using the interpretation of suspenseful events as events with ideas opposing the main theme of the story a metric to value stories with multiple protagonists can be designed. When evaluating this stories three things must be taken into account:

1. It is important for the theme of every protagonist to remain consistent, this means the thematic value of each subplot defined as all the actions of a protagonists must be taken into account.

2. The themes of the protagonists should not clash with each other, in other words, the themes of the protagonists must be compatible in pairs. Compatibility could be defined using the intersection of ideas between themes, but two similar themes could be defined with different ideas, "love" comprised of the idea"love" and "character growth" comprised of "redemption" and "friendship" for example, or two opposing themes could have ideas in common, "love" and "tragic love" for example. For this reason the relationship between main themes has been left as part of the authoring process.

3. How the themes of the different subplots interact with each other must be taken into account. In this problem the interpretation of suspenseful events as events with ideas opposing the main theme of the story comes into play. Let OP, named from opposing events, be the set of events in which a protagonist is playing a role where an idea opposing the main theme of that protagonist is generated. a metric could be calculated as

$$\frac{\#|OP \cap \text{events preceding a change in protagonist}|}{\#|OP|}$$

Considering the points stated above a metric for stories with multiple protagonist could be defined as the mean between the values of the themes of each protagonist and the metric defined as a thematic interpretation of suspense.

3.3.4. Genetic algorithm for subplot combination

The easiest model to directly apply to a simulation based story is the subplot combination using genetic algorithms described in (Gervás et al., 2022a), (Gervás et al., 2022b) and (Gervás et al., 2023). In their genetic representation they order the different subplots they want to merge and cycle between them when changing subplot. The genes are defined as 2 vectors of length the total number of events in the plot, the first vector, defined as "vector of genes for subplot[4] change" with a 1 in the position of an event when the next event is from another subplot and 0 otherwise. The second vector, defined as "Vector of genes on number of subplots to skip on change" which has an element for each one on the "vector of genes for

[4]in their work they refer to the subplots as AoI(Axes of Interest) because the subplot combination is an intermediate step in their story generation approach and as such are not yet completely formed subplots.

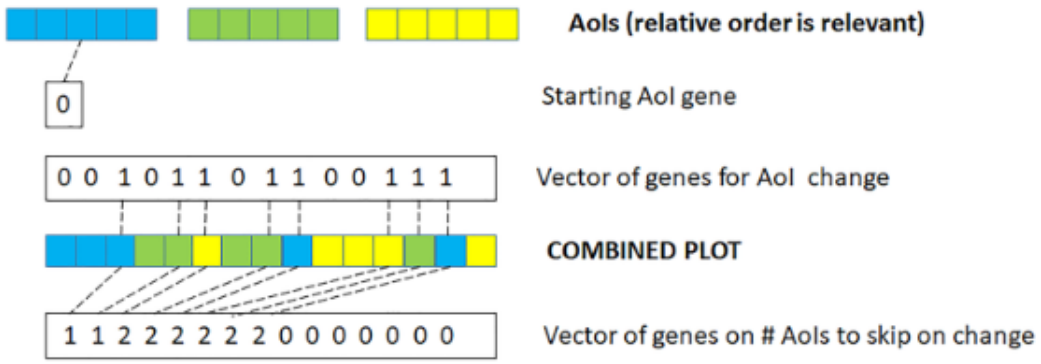

Figure 3.4: Image extracted from (Gervás et al., 2023) representing the way they codify the subplot combination problem into genes for a genetic algorithm.

subplot change", this element n represents a change to the next n subplot in the list, if it reaches the end of the list it starts again. An example of the model can be found in figure 3.4.

By defining the plots this way they can make sure when a 1 is found in "vector of genes for subplot change" the subplot changes as long as no element of "Vector of genes on number of subplots to skip on change" is bigger or equal to the number of subplots. They use an integer to represent the starting subplot, which we will not need as it will be the main subplot, the subplot of the main character, and a third vector to define the characters who are not yet instantiated in their model, as this is not the case in this model this third vector will be omitted.

The function to generate random genes has been simplified from the original paper to better suit a set of already constructed plots as some extra steps were required for the starting subplot gene and the third vector which are not required in this work:

- For the vector of decisions on whether to switch, random choice between 0 and 1 is suitable.
- For the vector of decisions on skip size at each switch, random choice between 1 and N-1 (with N the total number of plots being combined) is suitable.

The mutation of this algorithm is equally simplified from the original paper and defined by the following operations:

- For the switch point vector, values at a single point chosen at random are mutated.
- For the skip size vector, values at a single point chosen at random are mutated to a value chosen at random within the required range.

The new combination is defined in the following way:

- For the switch point vector, a point in the vector is chosen at random and the corresponding halves of the vectors for the two individuals are swapped over.
- For the skip size vector, a point in the vector is chosen at random and the corresponding halves of the vectors for the two individuals are swapped over.

This methods does not ensure a the number of events in a subplot is maintained, that means the gene may require the event number $n+10$ of a subplot with n events, to avoid this a post process after each of the previous operations will be ran:

- Whenever a subplot is in its last event a 1 will be written in the "Vector of genes on number of subplots to skip on change" and a one will be written on the "vector of genes for subplot change".
- Whenever a subplot is going to change to an empty subplot 1 will be added to the "Vector of genes on number of subplots to skip on change".

3.3.5. Implementation of subplot combination

With the subplots created in section 3.2.5 the combination process can be implemented. Firstly, possible subplots to be combined must be selected, when experimenting with the model only two subplots of less than thirty events each have been combined at once to ensure fast readability of the stories, but any number of subplots may be combined with the methods described in this section. To consider subplots apt for combining they must satisfy:

- The intersection of characters between all the subplots must be above a certain threshold.
- The percentage of appearance, that is, the percentage of events in which it appears, of one of the protagonists (the one we are calling main character) must be above the percentage of appearance of any other character by a certain threshold.
- The protagonists who are not the main character must appear in the main character's subplot after their subplots have ended.
- The main themes of all the subplots must be related, for that a set of pairs are defined in appendix C where a pair of themes will be related if a pair containing both is in the set.

When creating the tuples it must be assured the events of each subplot are independent, in the case of intersection the longer subplot will be the only one to maintain the event as the longer a subplot is the more principal it is, being the longest subplot the one called the main subplot.

Once the tuples have been formed, the genetic algorithm described in the previous section will be applied to combine them. The fitness function to evaluate the possible combinations will be defined in the following way:

1. The themes of the subplots and their evaluations will be retrieved.
2. For each character, the tension will be measured as the number of events generating ideas opposing the main theme of a character involved in the event where a jump is taken divided by the number of events generating an idea opposing opposing the main theme of a character involved in the event, if no motif opposing the theme exists in the story the value of this metric will not be taken into account.
3. The time consistency will be measured similarly to how (Gervás et al., 2023) measures it:
   - Assigning 1 to any precedence constraint that is met (for A + B, A appears before B in the discourse sequence).
   - If a required precedence constraint is not met, a partial score between 0 and 1 is assigned corresponding to the number of positions that one of the elements would need to shift for the constraint to hold (normalised over the length of the sequence).
   - The average of all sequencing constraints is taken as the total sequencing score.
4. Finally, the mean of the scores will be taken to decide a final score.

3.4. Generating natural language to express plots

The events generated are capable of representing the narrative but to make the narrative more digestible a presentation is necessary. For this the AI model ChatGPT3 will be used.

The model will be given a description of every event and the roles each actor plays in them, similar to the descriptions shown in appendix A and a simple textual representation of the events which form the narrative. The representation has been asked with the following query:

```
Narrate this set of events, no extra information must be
added, the dates are irrelevant, add conectors between the
sentences
```

Chapter 4

Conclusiones y trabajo futuro

A lo largo de este trabajo se ha presentado tanto una métrica para medir temas en historias que siguen a un único personaje y una ampliación para historias con varios personajes, como una aplicación de esta a la extracción de historias interesantes a partir de eventos.

Ya solo queda explicar la situación actual del trabajo, discutir su viabilidad y proponer caminos sobre los que expandir esta investigación para, con suerte, generar ideas fructíferas para el campo de la generación de historias.

El trabajo, en su estado actual, Es capaz de evaluar historias con uno o varios protagonistas. Este modelo permite al autor introducir sus conceptos de ideas importantes para una historia así como sus temas principales y relaciones de complementariedad y oposición entre estos para estudiar narrativas. Algo menos fructífero ha sido el uso del modelo para la extracción de historias ya que, aunque funcional, la calidad de las historias generadas no es comparable a la de sistemas mas completos. Esto se discutirá con mas detalle en la próxima sección.

4.1. Conclusiones sobre el estado actual del modelo

Las historias generadas por este sistema, aunque a veces puedan llegar a ser interesantes, no pueden compararse a trabajos anteriores como (Swartjes and Theune, 2008). En el apéndice D se pueden encontrar tres ejemplos de historias generadas con este sistema. Como se puede ver en el ejemplo D.1 las modificaciones en la métrica para evitar múltiples acciones repetidas no fueron suficientes para eliminar el problema completamente. Es bastante probable que esto se deba a una combinación de una probabilidad muy alta para ciertos eventos en la simulación, y una definición de característica e ideas que favorecen la aparición de estos eventos. Siendo este el caso, es probablemente un error fácilmente subsanable sin cambios significativos en el modelo gracias a la facilidad de edición de características y temas.

Un error más esencial se puede ver en el ejemplo D.3. Se trata de una historia

perfectamente funcional que ha representado dos temas a la perfección, sin embargo, un tema bien definido no hace necesariamente a la historia interesante. Un buen tema es necesario para generar una historia interesante pero no es suficiente. Este problema es una consecuencia de depender casi por completo del modelo temático para generar la historia, decisión tomada específicamente para poder hacer estas valoraciones. Desde un punto de vista más positivo, es un problema muy interesante para una posible continuación de este proyecto.

Un punto en el que el sistema ha funcionado mejor de lo esperado es el ilustrado en el ejemplo D.2. El cambio de subtrama en la boda del personaje trágico es muy efectivo, la boda de Dakota genera ideas de felicidad que contrastan con su inevitable tragedia. Esto sugiere que las suposiciones hechas para el análisis temático de historias con varios protagonistas, en especial aquella que relaciona suspense y oposición de temas, no van desencaminadas.

El modelo temático como componente independiente, por otro lado, ha resultado bastante efectivo. Es más flexible que modelos anteriores y permite una mayor expresividad de historias. Cumple con creces los objetivos propuesto, un modelo capaz de valorar el enfoque temático de una historia, no restringido por el número de protagonistas, y fácilmente editable por un autor gracias a la cantidad de información expresable en archivos auxiliares como los descritos en los apéndices B y C.

A pesar de que el modelo cuenta con mucha expresividad y es fácilmente personalizable, carece de toda la expresividad que se podría tener pues, eventos, temas y rol de los actores, no son siempre información suficiente para considerar el valor correcto de un tema. Véase el ejemplo 3.1 donde el hecho de que aparezca la enemistad entre Bob y Alice le da mucha relevancia al momento en que esta acaba, pero esto no puede ser capturado con temas generales. Las ideas generadas por un evento no solo dependen del evento, otras ideas encontradas antes y el rol del personaje en el evento. Información de contexto, como quienes tienen otros roles en el evento y que relación hay entre los personajes, son piezas clave para entender las ideas generadas que este modelo es incapaz de estudiar.

4.2. Comparación con el estado del arte

Considerando la relevancia que han tenido trabajos pasados para el desarrollo de este es interesante discutir que aportaciones se ha hecho en este trabajo y el resultado de estas en comparación con trabajos pasados.

4.2.1. Comparación del modelo temático propuesto con otros modelos

En el campo de la generación de historias y la clasificación de estas por el estudio de temas literarios el trabajo realizado es poco y disperso. Como se comentó en el capitulo 2 esto se puede deber a varias razones, principales probablemente

siendo la falta de un consenso sobre una definición de tema de una historia, tanto a nivel narrativo como computacional, la falta de interés debida a la prominencia de modelos basados en extrapolación de otras historias con temas integrados por un autor humano previamente, y la subjetividad de temas, entendidos como ideas importantes para una narrativa.

Trabajos como Maria et al. (2000) usan una interpretación mas superficial del tema prescindiendo del subtexto y evaluando las ideas textuales. Estas suposiciones hacen que puedan definir un modelo relativamente objetivo usando redes neuronales, como tal es más rápido de configurar, pues apenas requiere configuración y más simple pues es construido sobre modelos ya conocidos de redes neuronales. A cambio es un modelo muy poco flexible pues para introducir nuevos temas se requiere de generar y entrenar un nuevo conjunto de datos y tiene dificultades para analizar el subtexto de una obra artística.

De entre los trabajos sobre el estudio computacional de los temas con los que se podría hacer una comparación, los estudios de Hargood et al. (2018) son los más cercanos a lo que se ha hecho en este proyecto. Su modelo, aunque inicialmente pensado para el análisis de historias ((Hargood et al., 2008),(Hargood, 2009)), esta diseñado e implementado para el análisis de imágenes (Hargood et al., 2010). Su modelo es igual de expresivo que el comentado en este trabajo salvo por los componentes causales y temporales. Al ser un modelo diseñado para imágenes, que no contienen información temporal ni causal, esa información no puede ser representada por su modelo. Su implementación es una interpretación más literal de las ideas de Lemon and Reis (1965) y por ello hacen el modelo conceptual ligeramente más simple, pero con ello hace el trabajo de autoría mas complicado pues, como se ha visto en este trabajo, la distinción entre tema y motivo no es tan clara en la practica y forzarla sobre el modelo complica el trabajo del autor.

Un ultimo grado de expresividad que añade este trabajo sobre el anterior es la generada por la hipótesis de que el tema no es independiente de la presentación de la historia, en el modelo introducido en este trabajo se ha hecho encape en forzar una distinción del punto de vista de una acción a la hora de asignarle un tema, una distinción inexistente en trabajos anteriores.

En cuento a la interpretación de suspense utilizada en este trabajo, no es tan efectiva como la propuesta en (O'Neill and Riedl, 2014) en la que se basa, pero es otra heurística que puede ser complementable y podría llegar a ser más fácil de implementar. Parece un campo de estudio prometedor.

4.3. Trabajo futuro

Como se ha visto en las secciones anteriores, aunque se han hecho avances sobre trabajos anteriores estas ideas y tecnologías están lejos de alcanzar su máximo potencial. En esta sección se introducirán posibles aplicaciones para el sistema actual

y posibles vías de investigación que seguir para mejorarlo.

4.3.1. Posibles aplicaciones para el modelo temático

La aplicación mas evidente es continuar con el trabajo descrito en este documento y usar el modelo temático para mejorar y estudiar historias generadas por otros modelos. Pues el mayor error en la generación de historias de este trabajo es depender casi exclusivamente del modelo temático para la extracción de historias.

El modelo temático se puede usar, y podría llegar a ser una herramienta poderosa, como métrica para la evaluación de otras historias. Aunque para ello unos eventos más expresivos y un estudio literario profundo de temas serán necesarios, por suerte el modelo hace ambas cosas muy sencillas de cambiar lo que permitirá bastante experimentación.

Por ultimo la aplicación del modelo como métrica de suspense podría ser una aportación interesante al campo de combinación de subtramas.

4.3.2. Mejoras propuestas para el sistema

En lo que respecta a la extracción de eventos usando el modelo temático, tres tareas requieren un importante estudio.

- Para la obtención de eventos usar más variedad de eventos y sistemas mas expresivos como el descrito en (Park et al., 2023) o los descritos en (Martin et al., 2018) y (Chen et al., 2021) podrían mejorar considerablemente el sistema.
- Un estudio de ideas eficaces para expresar información importante sobre una narrativa será necesario.
- Sistemas auxiliares y métricas probadas deben ser aplicadas para hacer la extracción viable pues mantener un tema, aunque necesario, no es suficiente para garantizar una buena historia, véase el ejemplo D.3.
- Cuando se combinen historias hay muchas formas que no se han podido valorar en este trabajo para añadir profundidad, como la introducción de una subtrama cuya única tarea sea añadir contexto como se sugiere en (Porteous et al., 2016).
- Se ha de dedicar mas investigación a la presentación de los eventos.

Para la mejora del modelo temático es necesario dar mas expresividad a la definición de ideas, muchas ideas son incompletas si no pueden tener en cuenta las situaciones que llevan a esas acciones, y otras ideas anteriores no son siempre información suficiente. El contexto, como se conocen los actores, que relación tienen, porque esta ocurriendo dicha acción,... Es una parte esencial del tema que debe ser estudiada.

El estudio literario sobre como se comportan los temas es muy amplio y es bastante probable que ideas importantes no se hayan encontrado y usado en este trabajo con lo que más investigación es necesaria. También es importante considerar la forma en la que los lectores absorben información para juzgar correctamente la efectividad de las ideas generadas por un texto, para esto la aplicación de estudios psicológicos como el presentado en (Zhang, 2005) puede resultar muy beneficioso para un avance en el modelo.

Finalmente un modelo temático completo debería tener la capacidad de estudiar como se asocian temas en una historia internamente, por ejemplo, el tema de la navidad queda asociado al personaje Ruby Sunday por repetición en la serie británica de televisión Doctor Who, siempre que aparecen motivos navideños como la nieve se sabe que en ese momento algo relacionado Ruby esta teniendo lugar. El modelo, en su estado actual, no es capaz de valorar referencias temáticas internas en una historia directamente.

Chapter 4

Conclusions and Future Work

Throughout this work, it has been presented both a metric for measuring themes in stories that follow a single character and an extension for stories with multiple characters, as well as an application of this metric to extract interesting stories from events.

Now all that remains is to explain the current state of the work, discuss its feasibility, and propose paths to expand this research to, hopefully, generate fruitful ideas for the field of story generation.

The work, in its current state, is capable of evaluating stories with one or multiple protagonists. This model allows the author to introduce their concepts of important ideas for a story as well as its main themes and the relationships of complementary and opposition between them to study narratives. The use of this model for story extraction has been less fruitful since, although functional, the quality of the generated stories is not comparable to that of more complete systems. This will be discussed in more detail in the next section.

4.1. Conclusions on the Current State of the Model

The stories generated by this system, although sometimes interesting, cannot be compared to previous works like (Swartjes and Theune, 2008). Appendix D contains a set of examples of stories generated with this system. As seen in example D.1, the modifications imposed in the metric to avoid multiple repeated actions were not enough to completely eliminate the problem. This is likely due to a combination of a very high probability for certain events in the simulation to manifest and a definition of characteristics and ideas that favor the appearance of these events. In this case, it is probably an error that can be easily corrected without significant changes to the model due to the ease of editing features and main themes.

A more fundamental error can be seen in example D.3. It is a perfectly functional story that is representing two themes perfectly; however, a well-defined theme does

not necessarily make the story interesting. A good theme is necessary to generate an interesting story but is not sufficient. This problem is a consequence of relying almost entirely on the thematic model to generate the story, a decision made specifically to enable these evaluations. From a more positive perspective, it is a very interesting problem for a possible continuation of this work.

An aspect where the system has performed better than expected is illustrated in example D.2. The subplot change at the tragic character's wedding is very effective; Dakota's wedding generates ideas of happiness that contrast with his inevitable tragedy. This suggests that the assumptions made for the thematic analysis of stories with multiple protagonists, especially the one linking suspense and theme opposition, are not misguided.

The thematic model as an independent component, on the other hand, has proven quite effective. It is more flexible than previous models and allows for greater expressiveness in stories. It fully meets the proposed objectives: a model capable of valuing the importance of a theme in a story, not restricted by the number of protagonists, and easily editable by an author thanks to the amount of information expressible in auxiliary files, as the ones described in appendices B and C.

Despite the model's expressiveness and ease of customization, it lacks the full expressiveness it could manifest. Events, themes, and the roles of the actors are not always sufficient information to find the correct value of a theme. See example 3.1, where the enmity between Bob and Alice gives much importance to the moment it ends, but this cannot be captured with general themes. The ideas generated by an event depend not only on the event itself but also on previous ideas and the character's role in the event. Contextual information, such as who else is involved in the event and the relationships between characters, are key pieces for understanding the generated ideas this model cannot express.

4.2. Comparison with the State of the Art

Considering the relevance that past works have had for the development of this project, it is interesting to discuss the contributions made in this work and their outcomes compared to past works.

4.2.1. Comparison of the Proposed Thematic Model with Other Models

In the field of story generation and their classification through the study of literary themes, the work done is sparse and scattered. As discussed in Chapter 2, this may be due to several reasons, primarily the lack of consensus on the definition of a story's theme, both from a narrative and a computational point of view, the lack of interest due to the prominence of models based on extrapolation from other

stories with themes previously integrated by a human author, and the subjectivity of themes, understood as important ideas for a narrative.

Works like Maria et al. (2000) use a more superficial interpretation of the theme, ignoring the subtext and evaluating textual ideas. These assumptions allow for a relatively objective model using neural networks, which is faster to configure, requires minimal setup, and is simpler as it is built on already known neural network models. However, it is very inflexible as introducing new themes requires generating and training a new dataset, and has difficulties analyzing the subtext of an artistic work because it has been designed to study descriptive media.

Among the works on the computational study of themes with which a comparison could be made, the studies by Hargood et al. (2018) are the closest to what has been done in this project. Their model, although initially intended for the analysis of stories((Hargood et al., 2008),(Hargood, 2009)), is designed and implemented for image analysis (Hargood et al., 2010). Their model is not as expressive as the one discussed in this work as it can not express causal and temporal relationships among other things. Being a model designed for images, which do not contain temporal or causal information, that information cannot be represented by their model. Their implementation is a more literal interpretation of the ideas proposed by Lemon and Reis (1965), and for that reason the conceptual model is slightly more simple but makes tha authoring process more complicated as, how it has been seen in this document, the distinction between theme and motif is not as clear in practice and forcing the author to make that distinction is detrimental to his work.

A final degree of expressiveness added by this work over the previous one is generated by the hypothesis that the theme is not independent of the story's presentation. In the model introduced in this work, emphasis has been placed on forcing a distinction in the point of view of an action when assigning a theme, this distinction is nonexistent in previous works.

Regarding the interpretation of suspense used in this work, it is not as effective as the one proposed in (O'Neill and Riedl, 2014) on which it is based, but it is another heuristic that can be complementary and might be easier to implement. It looks like a promising field of study.

4.3. Future Work

As seen in the previous sections, although advances have been made over previous works, these ideas and technologies are far from reaching their full potential. This section will introduce possible applications for the current system and potential research paths to follow in order to improve it.

4.3.1. Possible Applications for the Thematic Model

The most obvious application is to continue with the work described in this document and use the thematic model to improve and study stories generated by other models. The biggest error made in this work when generating stories has been relying almost exclusively on the thematic model for story extraction.

The thematic model can be used, and could become a powerful tool, as a metric for evaluating other stories. Although this will require more expressive events and a deep literary study of themes. Fortunately, the model makes both things very easy to edit, allowing significant experimentation.

Lastly, the application of the model as a suspense metric could be an interesting contribution to the field of subplot combination.

4.3.2. Proposed Improvements for the System

Regarding event extraction using the thematic model, three tasks require significant study.

- To obtain events, using a greater variety of events and more expressive systems like those described in (Park et al., 2023), (Martin et al., 2018) and (Chen et al., 2021) could considerably improve the system.
- A study of effective ideas to express important narrative information will be necessary.
- Auxiliary systems and proven metrics should be applied to make extraction viable, as maintaining a theme, although necessary, is not sufficient to guarantee a good story, see example D.3.
- When combining stories, there are many this work has not been able to consider to add depth, such as introducing a subplot whose sole task is to add context, as suggested in (Porteous et al., 2016).
- More research has to be made into the presentation of the events.

To improve the thematic model, it is necessary to give more expressiveness to the definition of ideas. Many ideas are incomplete if they can not consider the situations leading to those actions, and previous ideas do not always give sufficient information. Context, such as how the actors know each other, what relationship they have, and why a particular action is occurring, is an essential part of the ideas and their relationship needs to be studied.

The literary study of how themes behave is very broad, and it is quite likely that important ideas have not been found and used in this work so more research is needed. It is also important to consider how readers absorb information to correctly judge the effectiveness of ideas generated by a text. For this, the application of

psychological studies like the one presented in (Zhang, 2005) can be very beneficial in the advancement of the model.

Finally, a complete thematic model should have the capacity to study how themes are associated within a story. For example, the theme of Christmas is associated with the character Ruby Sunday through repetition in the British TV series Doctor Who. Whenever Christmas motifs, like snow, appear, it is known that something related to Ruby is happening. The current model cannot directly assess internal thematic references in a story.

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Appendix A

Definition of events in the Neighborly simulation

In this appendix I will name the full list of events considered with a brief description of what they represent and their actors as this are necessary to define the features of the events using the model described in 2.2.1:

- **BecomeAdolescentEvent**: Transition event when a character becomes an adolescent.
  Actors:
  - **subject**: the actor reaching adolescence.
- **BecomeAdultEvent**: Transition event when a character becomes an adult.
  Actors:
  - **subject**: the actor reaching adulthood.
- **BecomeEnemies**: Event representing two characters becoming enemies.
  Actors:
  - **subject**, **other**: the enemies.
- **BecomeFriends**: Event representing two characters becoming friends.
  Actors:
  - **subject**, **other**: the friends.
- **BecomeSeniorEvent**: Transition event when a character becomes a senior.
  Actors:
  - **subject**: the actor reaching seniority.
- **BecomeYoungAdultEvent**: Transition event when a character becomes a young adult.
  Actors:

  - **subject**: the actor reaching young adulthood.

- **BirthEvent**: Event triggered when a new character is born.
  Actors:

  - **subject**: the actor being born.

- **BreakUp**: Event representing the end of a romantic relationship.
  Actors:

  - **subject**, **Other**: actors breaking the relationship.

- **BuildTreasure**: Event representing the creation of a treasure. The build events have been designed to put into circulation into the world objects that can be stolen or gifted.
  Actors:

  - **subject**: the builder.

- **BuildVehicle**: Event representing the construction of a vehicle.
  Actors:

  - **subject**: the builder.

- **BuildWeapon**: Event representing the construction of a weapon.
  Actors:

  - **subject**: the builder.

- **BusinessClosedEvent**: Event triggered when a business is closed down.
  Actors:

  - **subject**: the actor who closes the business.
  - **business**: The business being closed.

- **BuyTreasure**: Event representing a character purchasing a treasure from another character.
  Actors:

  - **buyer**: Actor who buys.
  - **seller**: Actor who sells.

- **BuyVehicle**: Event representing a character purchasing a vehicle from another character.
  Actors:

  - **buyer**: Actor who buys.
  - **seller**: Actor who sells.

- **BuyWeapon**: Event representing a character purchasing a weapon from another character.
  Actors:

  - **buyer**: Actor who buys.
  - **seller**: Actor who sells.

- **ChangeResidenceEvent**: Event triggered when a character changes their place of residence.
  Actors:

  - **subject**: Actor who changes residence.
  - **new residence**: Where the actor is moving to.

- **Death**: Event triggered when a character dies.
  Actors:

  - **subject**: the actor who has died.

- **DepartDueToUnemployment**: Event triggered when a character leaves due to unemployment.
  Actors:

  - **subject**: the actor leaving.

- **DepartSettlement**: Event triggered when a character leaves a settlement.
  Actors:

  - **subject**: the actor leaving.

- **DissolveEnmity**: Event represents when enmity between two characters ends.
  Actors:

  - **subject**, **Other**: the ex-enemies.

- **DissolveFriendship**: Event represents when friendship between two characters ends.
  Actors:

  - **subject**, **Other**: the ex-friends.

- **FiredFromJob**: Event represents a character being fired from a job.
  Actors:

  - **subject**: The actor being fired.
  - **business**: The job being fired of.
  - **job_role**: the job role the subject no longer has.

- **FormCrush**: Event represents a character forming a crush on another character.
  Actors:

  - **subject**: The actor forming a crush.

  - **other**: The actor who subject has a crush on.

- **GetDivorced**: Event representing a divorce.
  Actors:
  - **subject**, **ex_spouse**: The actors getting divorced.
- **GetMarried**: Event representing a marriage.
  Actors:
  - **subject**, **subject**: The actors getting married.
- **GetPregnant**: Event triggered when a character becomes pregnant. Actors:
  - **subject**: The actor getting pregnant.
  - **partner**: The other parent.
- **GiftTreasure**: Event representing a character gifting a treasure to another character.
  Actors:
  - **gifter**: Actor who makes a gift.
  - **gifted**: Actor who receives a gift.
- **GiftVehicle**: Event representing a character gifting a vehicle to another character.
  Actors:
  - **gifter**: Actor who makes a gift.
  - **gifted**: Actor who receives a gift.
- **GiftWeapon**: Event representing a character gifting a weapon to another character.
  Actors:
  - **gifter**: Actor who makes a gift.
  - **gifted**: Actor who receives a gift.
- **HaveChildEvent**: Event triggered when a character has a child.
  Actors:
  - **subject**, **subject**: The parents.
  - **child**: The child.
- **JoinSettlementEvent**: Event triggered when a character joins a settlement.
  Actors:
  - **subject**: the actor entering the settlement.
  - **settlement**: Settlement being joined.

- **Kill**: Event representing a character killing another character.
  Actors:
  - **subject**: The actor who killed.
  - **other**: The actor who was killed.
- **LaidOffFromJob**: Event representing a character being laid off from a job.
  Actors:
  - **subject**: Actor leaving the job.
  - **business**: The business the subject was working on.
  - **job**: The job the subject had.
- **LeaveJob**: Event representing a character leaving a job.
  Actors:
  - **subject**: Actor leaving the job.
  - **business**: The business the subject was working on.
  - **job**: The job the subject had.
- **PromotedToBusinessOwner**: Event representing a character being promoted to business owner.
  Actors:
  - **subject**: Actor being promoted.
  - **business**: The business the subject is working on.
  - **former_owner**: The actor who was the owner before.
- **Retire**: Event triggered when a character retires from work.
  Actors:
  - **subject**: Actor leaving the job.
  - **business**: The business the subject was working on.
  - **job**: The job the subject had.
- **StartANewJob**: Event representing a character starting a new job.
  Actors:
  - **subject**: Actor entering the job.
  - **business**: The business the subject is going to work on.
  - **job**: The job the subject will have.
- **StartBusiness**: Event representing a character starting a new business.
  Actors:
  - **subject**: Actor creating the business.
  - **business**: The business the subject is creating.

  - **district**: district where the business is located.
  - **settlement**: Settlement the business is being created on.

- **StartDating**: Event triggered when characters start dating.
  Actors:

  - **subject**, **partner**: Actors starting to date.

- **StealMoney**: Event representing a character stealing money from another character.
  Actors:

  - **stealer**: Actor who is stealing.
  - **stolen**: Actor who from who the object is being stolen.

- **StealTreasure**: Event representing a character stealing treasure from another character.
  Actors:

  - **stealer**: Actor who is stealing.
  - **stolen**: Actor who from who the object is being stolen.

- **StealVehicle**: Event representing a character stealing a vehicle from another character.
  Actors:

  - **stealer**: Actor who is stealing.
  - **stolen**: Actor who from who the object is being stolen.

- **StealWeapon**: Event representing a character stealing a weapon from another character.
  Actors:

  - **stealer**: Actor who is stealing.
  - **stolen**: Actor who from who the object is being stolen.

- **TryFindOwnPlace**: Event representing a character looking for a place to live.
  Actors:

  - **subject**: Actor searching for a place to live.

Appendix B

Description of features assigned to the events

In this appendix the features of the events described in appendix A are presented. Before, a comprehensive list of motifs must be provided:

- **Ambition**: The drive to achieve success, power, or fame, and its consequences.
- **Beginning**: The beginning of something new.
- **Broken Trust**: The loss of trust between characters, often leading to betrayal and conflict.
- **Corruption**: The moral or ethical decay of characters or institutions.
- **Creation**: The act of bringing something new into existence, often highlighting human ingenuity or divine inspiration.
- **Death**: The end of life and its implications.
- **Ending**: The end of something, a story, a place or a person.
- **Enmity**: Hostility or animosity between characters or groups.
- **Failure**: The experience of not achieving goals or expectations.
- **Friendship**: The bonds of companionship and support between characters.
- **Injustice**: The occurrence of unfair treatment or a lack of justice.
- **Isolation**: Characters feeling alone, detached, or separated from others.
- **Love**: The profound affection and connection between characters, encompassing various forms of love.
- **Peace**: The pursuit of harmony and the resolution of conflict.
- **Redemption**: Characters seeking forgiveness or making amends for past wrongs.
- **Requited Love**: Love that is reciprocated and returned between characters.
- **Retribution**: Punishment inflicted in return for a wrong or crime.

- **Selfishness**: Placing one's own needs and desires above those of others.
- **Selflessness**: The act of prioritizing others' needs and well-being over one's own.
- **Tragic Friendship**: A friendship that ends in tragedy, often due to external circumstances or internal conflicts.
- **Tragic Love**: A love story that ends in sorrow or loss.
- **Trust**: The reliance on the goodness of humanity.
- **Wealth**: The pursuit, accumulation, and impact of money and material possessions.
- **Work**: The role of labor, professional life, and the struggles associated with work.

With the motifs enumerated the JSON containing the features with the structure defined in section 3.2.2 will be presented:

```
{
    "StartBusiness": {
        "conditional": {
            "subject": [
                [
                    [
                        "failure"
                    ],
                    "redemption"
                ]
            ],
            "business": [],
            "district": [],
            "settlement": []
        },
        "unconditional": {
            "subject": [
                "begining",
                "risk",
                "work"
            ],
            "business": [],
            "district": [],
            "settlement": []
        }
    },
    "StartANewJob": {
        "conditional": {
            "subject": [
                [
                    [
```

```
                        "failure"
                    ],
                    "redemption"
                ]
            ],
            "business": [],
            "job_role": []
        },
        "unconditional": {
            "subject": [
                "begining",
                "work"
            ],
            "business": [
                "begining"
            ],
            "job_role": [
            ]
        }
    },
    "Retire": {
        "conditional": {
            "subject": [],
            "business": [],
            "job_role": []
        },
        "unconditional": {
            "subject": [
                "peace",
                "ending",
                "work"
            ],
            "business": [
                "ending",
                "peace",
                "work"
            ],
            "job_role": [
                "ending",
                "peace",
                "work"
            ]
        }
    },
    "LeaveJob": {
        "conditional": {
```

```
            "subject": [
                [
                    [
                        "work"
                    ],
                    "peace"
                ]
            ],
            "business": [],
            "job_role": []
        },
        "unconditional": {
            "subject": [
                "work"
            ],
            "business": [],
            "job_role": []
        }
    },
    "PromotedToBusinessOwner": {
        "conditional": {
            "subject": [],
            "business": [],
            "former_owner": []
        },
        "unconditional": {
            "subject": [
                "wealth",
                "work",
                "ambition"
            ],
            "business": [
                "work"
            ],
            "former_owner": [
                "work"
            ]
        }
    },
    "FiredFromJob": {
        "conditional": {
            "subject": [],
            "business": [],
            "job_role": []
        },
        "unconditional": {
```

```
            "subject": [
                "failure",
                "work"
            ],
            "business": [],
            "job_role": []
        }
    },
    "BusinessClosedEvent": {
        "conditional": {
            "subject": [],
            "business": []
        },
        "unconditional": {
            "subject": [
                "failure",
                "work",
                "ending",
                "peace"
            ],
            "business": [
                "failure",
                "work",
                "ending"                ]
        }
    },
    "LaidOffFromJob": {
        "conditional": {
            "subject": [],
            "business": [],
            "job_role": []
        },
        "unconditional": {
            "subject": [],
            "business": [],
            "job_role": []
        }
    },
    "JoinSettlementEvent": {
        "conditional": {
            "subject": [],
            "settlement": []
        },
        "unconditional": {
            "subject": [
                "begining"
```

```
            ],
            "settlement": []
        }
    },
    "ChangeResidenceEvent": {
        "conditional": {
            "subject": [],
            "new_residence": []
        },
        "unconditional": {
            "subject": [
                "begining"
            ],
            "new_residence": [
                "begining"
            ]
        }
    },
    "BuildVehicle": {
        "conditional": {
            "subject": []
        },
        "unconditional": {
            "subject": [
                "ambition",
                "creation"
            ]
        }
    },
    "BuyVehicle": {
        "conditional": {
            "buyer": [],
            "seller": []
        },
        "unconditional": {
            "buyer": [
            ],
            "seller": [
                "wealth"
            ]
        }
    },
    "DepartDueToUnemployment": {
        "conditional": {
            "subject": [
                [["selfishness"], "retribution"]
```

```
            ]
        },
        "unconditional": {
            "subject": [
                "failure",
                "ending"
            ]
        }
    },
    "DepartSettlement": {
        "conditional": {
            "subject": []
        },
        "unconditional": {
            "subject": []
        }
    },
    "BuildWeapon": {
        "conditional": {
            "subject": []
        },
        "unconditional": {
            "subject": [
                "death",
                "creation"
            ]
        }
    },
    "BuyWeapon": {
        "conditional": {
            "buyer": [],
            "seller": []
        },
        "unconditional": {
            "buyer": [
                "death"
            ],
            "seller": [
                "wealth"
            ]
        }
    },
    "BuildTreasure": {
        "conditional": {
            "subject": []
        },
```

```
        "unconditional": {
            "subject": [
                "wealth",
                "creation"
            ]
        }
    },
    "GiftVehicle": {
        "conditional": {
            "gifter": [
                [
                    [
                        "selfishness"
                    ],
                    "redemption"
                ]
            ],
            "gifted": [
                [
                    [
                        "selflessness"
                    ],
                    "redemption"
                ],
                [
                    [
                        "selfishness"
                    ],
                    "injustice"
                ]
            ]
        },
        "unconditional": {
            "gifter": [
                "selflessness"
            ],
            "gifted": [
                "friendship"
            ]
        }
    },
    "BecomeFriends": {
        "conditional": {
            "subject": [],
            "other": []
        },
```

```
        "unconditional": {
            "subject": [
                "friendship"
            ],
            "other": [
                "friendship"
            ]
        }
    },
    "GiftTreasure": {
        "conditional": {
            "gifter": [
                [
                    [
                        "selfishness"
                    ],
                    "redemption"
                ]
            ],
            "gifted": [
                [
                    [
                        "selflessness"
                    ],
                    "redemption"
                ],
                [
                    [
                        "selfishness"
                    ],
                    "injustice"
                ]
            ]
        },
        "unconditional": {
            "gifter": [
                "selflessness",
                "friendship",
                "trust"
            ],
            "gifted": [
                "trust",
                "gifted",
                "friendship"
            ]
        }
```

```
    },
    "GiftWeapon": {
        "conditional": {
            "gifter": [
                [
                    [
                        "selfishness", "death"
                    ],
                    "redemption"
                ]
            ],
            "gifted": [
                [
                    [
                        "selflessness"
                    ],
                    "redemption"
                ],
                [
                    [
                        "selfishness"
                    ],
                    "injustice"
                ]
            ]
        },
        "unconditional": {
            "gifter": [
                "selflessness",
                "friendship"
            ],
            "gifted": [
                "death",
                "gifted",
                "friendship"
            ]
        }
    },
    "BuyTreasure": {
        "conditional": {
            "buyer": [],
            "seller": []
        },
        "unconditional": {
            "buyer": [
                "wealth"
```

```
            ],
            "seller": [
                "wealth"
            ]
        }
    },
    "StealVehicle": {
        "conditional": {
            "stealer": [
                [
                    [
                        "selflessness"
                    ],
                    "corruption"
                ]
            ],
            "stolen": [
                [
                    [
                        "selfishness"
                    ],
                    "retribution"
                ]
            ]
        },
        "unconditional": {
            "stealer": [
                "selfishness",
                "travel"
            ],
            "stolen": [
                "broken_trust"
            ]
        }
    },
    "StealWeapon": {
        "conditional": {
            "stealer": [],
            "stolen": [
                [
                    [
                        "selfishness"
                    ],
                    "retribution"
                ]
            ]
```

```
        },
        "unconditional": {
            "stealer": [
                "selfishness",
                "death"
            ],
            "stolen": [
                "broken_trust"
            ]
        }
    },
    "StealMoney": {
        "conditional": {
            "stealer": [],
            "stolen": [
                [
                    [
                        "selfishness"
                    ],
                    "retribution"
                ]
            ]
        },
        "unconditional": {
            "stealer": [
                "selfishness",
                "wealth"
            ],
            "stolen": [
                "broken_trust"
            ]
        }
    },
    "StealTreasure": {
        "conditional": {
            "stealer": [
                [
                    [
                        "selflessness"
                    ],
                    "corruption"
                ]
            ],
            "stolen": [
                [
                    [
```

```
                        "selfishness"
                    ],
                    "retribution"
                ],
                [
                    [
                        "trust"
                    ],
                    "broken_trust"
                ]
            ]
        },
        "unconditional": {
            "stealer": [
                "selfishness",
                "wealth"
            ],
            "stolen": [
                "broken_trust"
            ]
        }
    },
    "BecomeSeniorEvent": {
        "conditional": {
            "subject": []
        },
        "unconditional": {
            "subject": [
                "wealth",
                "work",
                "ambition"
            ]
        }
    },
    "Death": {
        "conditional": {
            "subject": []
        },
        "unconditional": {
            "subject": ["death"]
        }
    },
    "BecomeAdultEvent": {
        "conditional": {
            "subject": []
        },
```

```
        "unconditional": {
            "subject": []
        }
    },
    "BecomeEnemies": {
        "conditional": {
            "subject": [
                [
                    [
                        "love"
                    ],
                    "tragic_love"
                ],
                [
                    [
                        "friendship"
                    ],
                    "tragic_friendship"
                ]
            ],
            "other": [
                [
                    [
                        "love"
                    ],
                    "tragic_love"
                ],
                [
                    [
                        "friendship"
                    ],
                    "tragic_friendship"
                ]
            ]
        },
        "unconditional": {
            "subject": [
                "enmity"
            ],
            "other": [
                "enmity"
            ]
        }
    },
    "FormCrush": {
        "conditional": {
```

```
            "subject": [
                [
                    [
                        "love"
                    ],
                    "tragic_love"
                ]
            ],
            "other": [
                [
                    [
                        "love"
                    ],
                    "tragic_love"
                ]
            ]
        },
        "unconditional": {
            "subject": [
                "love"
            ],
            "other": [
                "love"
            ]
        }
    },
    "StartDating": {
        "conditional": {
            "subject": [
                [
                    [
                        "love"
                    ],
                    "requited_love"
                ]
            ],
            "partner": [
                [
                    [
                        "love"
                    ],
                    "requited_love"
                ]
            ]
        },
        "unconditional": {
```

```
            "subject": [
                "love"
            ],
            "partner": [
                "love"
            ]
        }
    },
    "GetMarried": {
        "conditional": {
            "subject": [
                [
                    [
                        "tragic_love"
                    ],
                    "redemption"
                ]
            ]
        },
        "unconditional": {
            "subject": [
                "love",
                "trust",
                "requited_love"
            ]
        }
    },
    "Kill": {
        "conditional": {
            "subject": [
                [
                    [
                        "selflessness"
                    ],
                    "corruption"
                ],
                [
                    [
                        "wealth"
                    ],
                    "ambition"
                ]
            ],
            "other": [
                [
                    [
```

```
                        "love"
                    ],
                    "tragic_love"
                ],
                [
                    [
                        "friendship"
                    ],
                    "tragic_friendship"
                ]
            ]
        },
        "unconditional": {
            "subject": [
                "selfishness",
                "death"
            ],
            "other": [
                "death",
                "ending",
                "broken_trust"
            ]
        }
    },
    "GetPregnant": {
        "conditional": {
            "subject": [],
            "partner": []
        },
        "unconditional": {
            "subject": [],
            "partner": []
        }
    },
    "HaveChildEvent": {
        "conditional": {
            "subject": [],
            "child": []
        },
        "unconditional": {
            "subject": [
                "begining"
            ],
            "child": [
                "begining"
            ]
```

```
        }
    },
    "BirthEvent": {
        "conditional": {
            "subject": []
        },
        "unconditional": {
            "subject": []
        }
    },
    "BecomeAdolescentEvent": {
        "conditional": {
            "subject": []
        },
        "unconditional": {
            "subject": []
        }
    },
    "BecomeYoungAdultEvent": {
        "conditional": {
            "subject": []
        },
        "unconditional": {
            "subject": []
        }
    },
    "DissolveFriendship": {
        "conditional": {
            "subject": [
                [
                    [
                        "trust"
                    ],
                    "broken_trust"
                ]
            ],
            "other": [
                [
                    [
                        "trust"
                    ],
                    "broken_trust"
                ]
            ]
        },
        "unconditional": {
```

```
            "subject": [
                "tragic_friendship"
            ],
            "other": [
                "tragic_friendship"
            ]
        }
    },
    "DissolveEnmity": {
        "conditional": {
            "subject": [
                [
                    [
                        "enmity"
                    ],
                    "redemption"
                ]
            ],
            "other": [
                [
                    [
                        "enmity"
                    ],
                    "redemption"
                ]
            ]
        },
        "unconditional": {
            "subject": [
                "friendship"
            ],
            "other": [
                "friendship"
            ]
        }
    },
    "TryFindOwnPlace": {
        "conditional": {
            "subject": []
        },
        "unconditional": {
            "subject": []
        }
    },
    "GetDivorced": {
        "conditional": {
```

```
            "subject": [
                [
                    [
                        "trust"
                    ],
                    "broken_trust"
                ]
            ],
            "ex_spouse": [
                [
                    [
                        "trust"
                    ],
                    "broken_trust"
                ]
            ]
        },
        "unconditional": {
            "subject": [
                "failure",
                "tragic_love"
            ],
            "ex_spouse": [
                "failure",
                "tragic_love"
            ]
        }
    },
    "BreakUp": {
        "conditional": {
            "subject": [],
            "ex_partner": []
        },
        "unconditional": {
            "subject": [
                "tragic_love"
            ],
            "ex_partner": [
                "tragic_love"
            ]
        }
    }
}
```

Appendix C

Description of themes used and their relationship

The themes used to experiment with the system are defined in a JSON as follows:

```
{
    "Crime Pursued by Vengeance": {
        "motifs": ["retribution", "redemption", "failure"
           , "death", "injustice", "broken_trust", "
           corruption"]
    },
    "Rivalry":{
        "motifs": ["enmity", "ambition"]
    },
    "Love And Hatred": {
        "motifs": ["enmity", "tragic_love", "love"]
    },
    "Remorse": {
        "motifs": ["redemption", "failure", "injustice",
           "broken_trust", "corruption"]
    },
    "Liberation From Work": {
        "motifs": ["work", "tranquility", "failure"]
    },
    "Injustice of Life": {
        "motifs": ["failure", "death", "injustice", "
           broken_trust", "corruption", "tragic_love", "
           tragic_friendship"]
    },
    "Profesional Ambition": {
        "motifs": ["ambition", "work", "wealth", "
           corruption"]
    }
}
```

And their relationships are defined as a JSON below:

```
{
    "related":[
            ["Crime Pursued by Vengeance", "Rivalry"],
            ["Crime Pursued by Vengeance", "Love And Hatred"],
            ["Crime Pursued by Vengeance", "Remorse"],
            ["Crime Pursued by Vengeance", "Injustice of Life"],
            ["Rivalry", "Love And Hatred"],
            ["Rivalry", "Profesional Ambition"],
            ["Love And Hatred", "Remorse"],
            ["Love And Hatred", "Injustice of Life"],
            ["Love And Hatred", "Profesional Ambition"],
            ["Remorse", "Injustice of Life"],
            ["Remorse", "Liberation From Work"],
            ["Profesional Ambition", "Liberation From Work"],
            ["Injustice of Life", "Liberation From Work"]
    ],
    "opposite": {
            "Crime Pursued by Vengeance": ["friendship", "love", "peace", "failure"],
            "Rivalry": ["friendship", "requited_love", "peace", "faith"],
            "Love And Hatred": ["tragic_love", "tragic_friendship", "selfishness", "death", "enemy", "failure"],
            "Remorse": ["creation", "begining", "death", "selfishness", "failure"],
            "Liberation From Work": ["wealth", "ambition", "work", "begining", "failure"],
            "Injustice of Life": ["friendship", "love", "peace", "wealth"],
            "Profesional Ambition": ["friendship", "love", "peace", "failure"]
    }
}
```

Appendix D

Examples of stories generated using the system described in this document

Listing D.1: The problem with lack of variaty is consistent even after the adjustments in the metrics to avoid it.

```
('Injustice of Life', 'Love And Hatred'): 0.3755606522743312

2632-03:
    BecomeEnemies (
        subject = Kayleigh Gold(23521),
        other = Callen Amerson(23362)
    )
2642-08:
    FormCrush (
        subject = Dominick Hamblett(23406),
        other = Kayleigh Gold(23521)
    )
2642-08:
    BecomeEnemies (
        subject = Kayleigh Gold(23521),
        other = Kayleigh Gold(23521)
    )
2643-08:
    StartDating (
        subject = Dominick Hamblett(23406),
        partner = Kayleigh Gold(23521)
    )
2643-10:
    GetMarried (
        subject = Dominick Hamblett(23406),
        subject = Kayleigh Gold(23521)
    )
2648-09:
    BecomeEnemies (
        subject = Kayleigh Gold(23521),
```

```
        other = Enrique Gold(23630)
    )
2651-05:
    BuildWeapon (
        subject = Estrella Jinkerson(23646)
    )
2651-06:
    BuildWeapon (
        subject = Estrella Jinkerson(23646)
    )
2651-12:
    GiftWeapon (
        gifter = Estrella Jinkerson(23646),
        gifted = Antonella Icke(23574)
    )
2652-06:
    GiftWeapon (
        gifter = Antonella Icke(23574),
        gifted = Estrella Jinkerson(23646)
    )
2652-07:
    GiftTreasure (
        gifter = Estrella Jinkerson(23646),
        gifted = Antonella Icke(23574)
    )
2652-09:
    GiftWeapon (
        gifter = Estrella Jinkerson(23646),
        gifted = Alden Blackaby(23635)
    )
2652-10:
    GiftWeapon (
        gifter = Estrella Jinkerson(23646),
        gifted = Kayleigh Gold(23521)
    )
2652-11:
    GiftTreasure (
        gifter = Estrella Jinkerson(23646),
        gifted = Alden Blackaby(23635)
    )
2652-12:
    GiftTreasure (
        gifter = Estrella Jinkerson(23646),
        gifted = Blair Hoar(23606)
    )
2653-01:
    GiftWeapon (
        gifter = Estrella Jinkerson(23646),
        gifted = Antonella Icke(23574)
```

```
    )
2653-06:
    GiftVehicle (
        gifter = Alden Blackaby(23635),
        gifted = Estrella Jinkerson(23646)
    )
2653-08:
    GiftTreasure (
        gifter = Alden Blackaby(23635),
        gifted = Estrella Jinkerson(23646)
    )
2653-09:
    BecomeFriends (
        subject = Estrella Jinkerson(23646),
        other = Kayleigh Gold(23521)
    )
2654-05:
    GiftWeapon (
        gifter = Estrella Jinkerson(23646),
        gifted = Kayleigh Gold(23521)
    )
2654-05:
    Death (
        subject = Estrella Jinkerson(23646)
    )
2658-12:
    Kill (
        subject = Kayleigh Gold(23521),
        other = Kayleigh Gold(23521)
    )
2658-12:
    BecomeEnemies (
        subject = Estrella Jinkerson(23646),
        other = Kayleigh Gold(23521)
    )

Textual representation:

Kayleigh Gold and Callen Amerson became enemies. Later, Dominick Hamblett devel

During this time, Estrella Jinkerson built a weapon and then built another weap

Furthermore, Estrella Jinkerson gifted a weapon to Alden Blackaby and also gift

Following this, Alden Blackaby gifted a vehicle to Estrella Jinkerson and also

Unfortunately, Estrella Jinkerson died. Eventually, Kayleigh Gold killed herse
```

Listing D.2: Example showing the efectivness of understanding suspense as clashing themes.

```
('Rivalry', 'Love And Hatred'): 0.4853982721133222
2266-09:
    StartDating (
        subject = Dakota Scowden(20730),
        partner = Sam Calcote(20880)
    )
2270-04:
    FormCrush (
        subject = Sam Calcote(20880),
        other = Erin Buley(20630)
    )
2282-08:
    GetMarried (
        subject = Dakota Scowden(20730),
        subject = Sam Calcote(20880)
    )
2283-11:
    BuildVehicle (
        subject = Megan Men(21059)
    )
2283-12:
    BuildVehicle (
        subject = Megan Men(21059)
    )
2284-01:
    BuildTreasure (
        subject = Megan Men(21059)
    )
2284-07:
    StealTreasure (
        stealer = Megan Men(21059),
        stolen = Dallas Stringham(20986)
    )
2284-08:
    BuildTreasure (
        subject = Megan Men(21059)
    )
2285-06:
    StealTreasure (
        stealer = Megan Men(21059),
        stolen = Dallas Stringham(20986)
    )
2286-10:
    BecomeEnemies (
        subject = Megan Men(21059),
        other = Dallas Stringham(20986)
    )
```

```
2287-07:
    BecomeEnemies (
        subject = Megan Men(21059),
        other = Sam Calcote(20880)
    )
2288-02:
    Kill (
        subject = Megan Men(21059),
        other = Sam Calcote(20880)
    )
2289-01:
    BecomeEnemies (
        subject = Cedric Scowden(20929),
        other = Megan Men(21059)
    )

Textual representation:

Dakota Scowden and Sam Calcote started dating. Later, Sam Calcote developed a c

In the meantime, Megan Men built a vehicle and then built another vehicle. Sub

Eventually, Megan Men and Dallas Stringham became enemies. Later, Megan Men and
```

Listing D.3: This example shows a strong theme is not sufficient to guarantee an interesting story

```
('Liberation From Work', 'Professional Ambition'): 0.48278886249443476

0003-09:
    StartANewJob (
        subject = Felicity Marston(306),
        business = farm(95)
    )
0003-09:
    Retire (
        subject = Nellie Lashley(114),
        business = farm(95)
    )
0015-06:
    Retire (
        subject = Louis Felton(356),
        business = farm(95)
    )
0042-07:
    PromotedToBusinessOwner (
        subject = Felicity Marston(306),
        business = farm(95),
        former_owner = Bryce Jewel(117)
    )
0042-07:
    Retire (
        subject = Bryce Jewel(117),
        business = farm(95)
    )
0042-07:
    LeaveJob (
        subject = Felicity Marston(306),
        business = farm(95)
    )
0043-06:
    BecomeSeniorEvent (
        subject = Felicity Marston(306)
    )
0043-10:
    Retire (
        subject = Felicity Marston(306),
        business = farm(95)
    )
0043-10:
    LeaveJob (
        subject = Felicity Marston(306),
        business = farm(95)
    )
```

```
0043-10:
    BusinessClosedEvent (
        subject = Felicity Marston(306),
        business = farm(95)
    )
```

Textual representation:

Felicity Marston started a new job at a farm. At the same time, Nellie Lashley

Years later, Felicity Marston was promoted to business owner of the farm, takin

The following year, Felicity Marston became a senior. Subsequently, Felicity M