

# **Interactive Storytelling via Intelligent Agents**

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December 8, 2008

## **ABSTRACT**

Interactive storytelling systems are systems that allow the user to take on the role of a single character in a story and manipulate the world however they choose while going through a story. The area has become increasingly popular in recent years. Such systems generally have two major components – a drama manager, that oversees the entire world and makes sure the story doesn't go off-track, and believable agents, which are the life like non-playable characters (NPCs) that make up the story's cast. Efficient, well-working drama managers have been created, but these systems have difficulty creating truly believable characters and working on cohesive narratives. This paper proposes the development of a system that will allow an author to quickly and easily work any plot into such a system.

## **1. Introduction**

Stories have been told throughout history, but for a computer, storytelling is a very complex procedure as it requires both solid, continuous plots and multiple believable characters. The demand for interactive storytelling – that is, a system that is capable of telling a story while giving the user complete control of his or her character and being able to compensate for his or her actions – has been on the rise in recent years, as it can be used not only for entertainment purposes, but for high-quality military training programs as well.

The goal of research in this area is to provide the means to create interactive storytelling systems that are robust – that is, the user's actions cannot completely derail the plot to the point of being unable to continue – and still provide a coherent and meaningful story. One common problem among all implementations of interactive storytelling, however, is the issue of how difficult it may be for an author to create a pleasing narrative that will fit into such a system.

My proposal is to implement a text-parsing system, called the Plot List Original Transcription System (PLOTS), which will allow an author to input a summary of their plot in plain English, then will break the summary into its main plot points and will use them to form its story. This work is significant to the area of interactive storytelling because without a cohesive, pleasing plot, an interactive storytelling system is meaningless. In addition, it will make the area of interactive storytelling much more attractive, for it will be much easier to create a system with a cohesive plot this way.

## **2. Background**

We start with some background on interactive storytelling components, and then discuss my methods to conduct the proposed work.

Several implementations of interactive storytelling systems already exist, such as IN-TALE [2] and Mimesis [4], [6]. Other examples include the work of Pizzi et al., Fabulist, and an independent, nameless system also developed by Mark Riedl [8], [9], [10].

Although different, all of these systems implement two major components – drama managers, which handle the mechanics of the story, and believable agents, the non-playable characters that make up the story – in order to act out a cohesive plot.

### **2.1. Plot**

Perhaps the most important piece of any storytelling experience is the plot of the story. Without a plot, there is no meaning to the characters of the story or their actions. Mateas [1] quotes Lajos Egri, in saying: “No idea, and no situation, was ever strong enough to carry you through to its logical conclusion without a clear-cut premise. If you have no such premise, you may modify, elaborate, vary your original idea or situation, or even lead yourself into another situation, but you will not know where you are going. You will flounder, rack your brain to invent further situations to round out your play. You may find these situations – and you will still be without a play.” [11] Roberts and Isbell [3] explain that a plot is generally represented within the drama manager by two components – first, there is a series of plot points that represent different events that need to happen over the course of the story. Then, there is a model of the author’s intent, which the drama manager uses to coordinate what should happen in the story. In other words, the basic plot is still written by a human author, and the interactivity comes from the user being able, in theory, to deviate from the path the author has set.

Interactive storytelling systems are used for many different purposes, and thus have many different kinds of plots. For instance, Riedl and Stern’s system, IN-TALE, [2], focuses on a captain of the U.S. Army, played by the user, sent on a peacekeeping mission to a foreign country. While there, the captain gets caught up in a fight between two merchants, one of whom ends up planting a bomb in the other store. The bomb goes off, but it turns out to be a dud. Another example is the sitcom-like plot designed by Charles et al. [5]. In that plot, the user’s character, Ross, has to ask the main female character, Rachel, out on a date. As you can see, the types of plots that these interactive storytelling systems can use are very different, but they still can be broken down into the same types of parts that can be interpreted by a drama manager. For instance, the plot acted out in IN-TALE [2] can be broken up into plot points such as “engage the two merchants” or “break up their fight”. On the other hand, the plot in the prototype developed by Charles et al. [5] has plot points such as “ask Rachel out” or “acquire information about her”. So, despite the drastic differences in the plots of the two systems, they can still be broken down in the same way and can be represented in an interactive storytelling system. Because of this feature, such systems have a wide variety of potential uses – not just for gaming, as one might initially think.

### **2.2. Drama Managers**

A drama manager (DM) is an essential component of any interactive storytelling system. It is a subsystem that coordinates the actions of the believable agents in reaction to the player's actions, as well as the plot itself. Roberts and Isbell [3] set forth a number of criteria for evaluating the quality of a drama manager, which include speed, coordination, replayability, authorial control, player autonomy, ease of authoring, adaptability, soundness, and invisibility. Drama managers normally have a number of components, in addition to the two – a series of plot points and a model of the author's intent – mentioned in Section 2. Other components include a set of actions that the DM can take, and a model of player responses, which the DM uses to try to predict what the player will do in response to any given action. There are many different types of drama managers, some of which are discussed in [3]. For instance, there are optimization-based systems that use a pre-made evaluation function which, when optimized, will simulate an author's intent for a plot. Such systems include search-based drama managers and declarative optimization-based drama managers (DODMs). There are also planning-based systems that use statistical machine learning methods, such as Interactive Drama Architecture (IDA) and narrative meditation systems, which define a story in terms of a linear plot progression and user choices. Finally, systems that are not based on optimization or planning exist, such as the U-Director [12] and OPIATE [13].

### **2.2.1. The Oz Drama Manager**

Mateas [1] introduces the Oz drama manager, which takes a set of plot points and examines every possible move it could make on the story world and determines which move would be best based on an evaluation function. It begins its evaluation at any given point in the story where the plot moves forward by looking at the history of plot points that have already happened. It then determines every possible sequence of events that could possibly happen from that point on, and combines each of those with the sequence of events that has already happened to form a series of "total histories". The evaluation function is then used on each of these total histories, and the best one is chosen and acted upon. The Oz drama manager uses global information (that is, information regarding the entire story) to determine its next move, which gives it a very high degree of control, and manages less specific plot points instead of managing highly-detailed events, giving the user a high degree of autonomy, but in exchange, the DM is restricted to its plot points – it cannot generate a whole new story on its own.

### **2.2.2. Mimesis**

Riedl et al. [4], [6] develop a narrative planning system called Mimesis, which is built into a 3D game engine called Unreal Tournament. Mimesis takes any user action within the story and places it in one of three categories – the action is constituent, consistent, or exceptional. A constituent action is one that is exactly in line with the narrative plan. A consistent action is one that, while it isn't in exactly line with the narrative plan, it is not destructive to it either, and will still allow the story to go on. An exceptional action, however, is one where if it is allowed to occur, there will be catastrophic effects on the story's plot. Mimesis has two basic responses to exceptions – accommodation and intervention. Accommodating an action simply alters the narrative plan slightly so that, despite the exceptional action, the plot can go on. Intervention, however, as its name implies, does not allow the event to happen by counteracting it with a "failure mode" – an action that looks identical to the exceptional action to the user but that has effects that do not interfere with the narrative plan. In addition to having such responses to exceptional actions, Mimesis plans out many possible sequences of events to better prepare for

possible user exceptions. Mimesis works well in that it allows more freedom for the user, as well as having an excellent approach for repairing potential issues that arise. However, it is not always subtle, and its actions can sometimes be noticed by the user.

### **2.3. Believable Agents**

Believable agents are the characters that inhabit the story world in any interactive storytelling system. Contrary to what their name may imply, they are not agents that tell the truth, or that are somehow “trustworthy” – rather, they are agents that display believable personalities. Although not technically a believable agent, some of the first technology to implement an interactive personality was shown in ELIZA [7], a program that was designed to simulate human conversation.

Mateas [1] defines some characteristics that all believable agents should have – these include personality, emotion, self-motivation, change, social relationships, and the illusion of life. In order to begin implementing believable agents, one natural research area to explore is artificial intelligence (AI) – either classical AI or behavioral AI. But the goals of AI are more problem-oriented than the goals for believable agents. Regardless, Riedl and Stern’s IN-TALE system [2] creates its believable agents using ABL (A Behavioral Language) technology, which is based on AI theory, and in which everything the agent does is a goal with various behaviors assigned to it that enable its completion. The agents have two types of behavior – Local Autonomous Behaviors, which are selected by each individual agent, and Narrative Directive Behaviors, which are assigned to them by the drama manager.

### **3. Proposed Work – PLOTS**

My proposal is to create a system called the Plot List Original Transcription System (PLOTS) that will take a plain-English summary of a plot written by an author and separate it into its plot points, so that a drama manager can use them.

In order to carry out this research, I will be using a Natural Language Processing (NLP) system developed called Gemini by Dowding et al. [14]. The main goal of NLP is to have programs be able to read and interpret natural language. Gemini takes this concept farther and implements Natural Language Understanding (NLU), which implements the goals of NLP but also strives for the program to derive specific meaning out of it.

Gemini uses NLU to take spoken language as input and to produce it as text on the computer. I plan to examine this system in detail and alter it in order to mold it to my needs of the PLOTS system – that is, accepting text as input and outputting the plot points in a form that a drama manager can understand. In order to implement this last step, however, I will need to do additional work to allow the system to be able to determine what is relevant to the plot and what is not. In order to do this, I plan to implement an evaluation function that will analyze each sentence of the plot summary and determine whether or not it is relevant to the plot. If it is, it will be added as a plot point; otherwise, it will be disregarded. PLOTS will do this by analyzing the text for words that are used frequently (and that aren’t common words), and it will use those words as keywords that are relevant to the plot.

As an undergraduate in Computer Science at Villanova University, I feel that my coursework experience here has made me given me enough background to successfully conduct the proposed research work. I plan to use my experiences in Machine Learning and Analysis of Algorithms to help me analyze and create the evaluation function, and my Algorithms & Data Structures I, II, and III and Computing Systems I and II courses to help me program the whole system.

In order to complete work on PLOTS in an 8-week time period, I plan to adhere as closely as possible to the following timeline:

Week 1	Find a prototype of Gemini and analyze it to gain understanding of how it works.
Week 2	Adapt Gemini to take text as input instead of spoken word and to output relevant sentences (determining what is relevant will be done later).
Weeks 3-5	Develop an evaluation function to analyze the textual input and determine which sentences are plot points and which are not.
Weeks 6-8	Work the evaluation function into the system and develop a fully functional prototype.

#### 4. Conclusion

Although it has its share of problems, such as creating truly believable agents and implementing a cohesive, pleasing narrative, the latter of which PLOTS plans to deal with, interactive storytelling is an area of research with a lot of practical applications, not only in entertainment but various simulation training programs as well, and is actively being researched. The papers that I have covered in detail are only a few of the papers that have been written on the subject; some other papers that I have not covered in detail include [6], [8], [9], and [10]. Between all the work being done in the area and the working prototypes already implemented, along with the aid of PLOTS, it will not be long before we have true interactive storytelling systems with pleasing narratives.

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