# Toward Personalized Guidance in Interactive Narratives

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## ABSTRACT

A drama manager is an omniscient agent responsible for guiding players through the story space and delivering an enjoyable experience to the players. Most drama managers only consider the designer's intent. We present a drama manager that can provide personalized guidance while giving players the appearance of full agency. Our system is evaluated on an interactive storytelling game built with Choose-Your-Own-Adventure (CYOA) stories. The human study results show that our drama manager can significantly increase the likelihood that players make choices that lead toward intended story plot points.

## Categories and Subject Descriptors

I.2.1 [**Artificial Intelligence**]: Applications and Expert Systems—*games, Industrial automation*

## General Terms

Human Factors, Design

## Keywords

Interactive Narrative, Drama Manager, Player Agency

## 1. INTRODUCTION

Interactive narrative is a form of digital entertainment in which players create or influence a dramatic storyline through actions, typically by assuming the role of a character in a fictional virtual world or acting as a general director of events in the narrative [2]. There are many ways to achieve interactive narrative in computer games. A common representation for interactive narrative control is the branching story graph, a directed graph in which nodes contain chunks of narrative content and labeled arcs represent options the player can choose from to influence the direction of the unfolding narrative [5]. A *Drama Manager* (DM) is an omniscient background agent that monitors the fictional world and determines what will happen next in the player's story experience. Previous approaches to DM use hints, denier, and causer actions to alter the world so as to increase the likelihood that the player will choose alternatives desirable by the human author [1]. Drama managers historically are surrogates of the author [5].

To date, little work has been performed in personalizing player experiences in interactive narrative. In principle, a DM can utilize a model of an individual player's preferences to guide the player toward experiences that will be more likely to be enjoyed. Thue et al. [4] show how a DM can choose narrative branches based on fixed player types. In prior work [5], we show that data-driven techniques can be used to learn players' preferences over trajectories through a branching story graph. This data-driven approach collects player ratings for partial narrative trajectories through a branching story space and learns to make choices on behalf of the player that are predicted to maximize player enjoyment. While the data-driven approach to personalized DM shows promise, all branching story decisions are delegated to the algorithm, thus eliminating player agency.

In this work, we extend our prior data-driven technique to guide the player to the most preferred story while simultaneously giving the player full agency to make decisions after each plot point. We propose to preserve player agency by extending the branching story graph representation to allow multiple options that point to the same plot points. For example, four options might result in two continuations of the story. We develop a Collaborative Filtering (CF) algorithm that learns a model of player preferences over options available after each plot point. Finally, the Drama Manager will use the player model to guide players toward appealing stories by choosing which subset of options at any given plot point should be presented to the players to increase the likelihood of the drama manager's desired narrative continuation. Compared to prior drama management approaches to guiding players (hints, deniers, etc.), we believe our approach will be non-intrusive while still preserving player agency. We have evaluated our approach in a simplified testbed domain based on the original Choose-Your-Own-Adventure (CYOA) books. The human study results show that our Drama Manager can significantly increase the likelihood the players choose the intended story plot points.

## 2. PERSONALIZED STORY GUIDANCE

Figure 1(left) illustrates a sample branching story graph, where round nodes represent plot points and the links represent available options for the players to choose. A path from

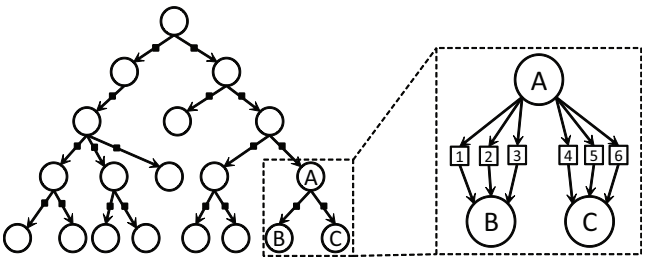


**Figure 1: A sample branching story graph (left) and an enlargement part of the graph showing multiple options for a plot point (right).**

root node to any leaf node is a unique complete story experience for players, but the player never knows whether any given choice will result in a more preferred or less preferred narrative trajectory. Although the concept of a branching story graph is simple, many other AI-driven interactive narrative systems are reducible to branching story graphs [5].

We modify the traditional branching story graph to include multiple options leading from one plot point to children plot points. Figure 1(right) is an enlargement of a portion of the branching story graph on the left in which a set of pre-authored options (square nodes) lead to the same next plot point (e.g., option 1, 2, 3 lead to plot point B, and option 4, 5, 6 lead to plot point C). We assume that players have an ordered preference for options. The task of our drama manager is thus to choose a subset of the options at any given branch to present to the player such that the player is more likely to choose the branch that will result in a more preferred narrative trajectory. For example, if the drama manager wanted the player to transition to plot point C, and it knew that the player's preferences were $1 > 5 > 6 > 2 > 4 > 3$, then it could present options 5 and 3 while suppressing the rest.

We use CF to learn users' preference patterns for options in a branching story graph. CF has been successfully applied in recommender systems to model user preference over movies, books, music, and other products [3]. We ask many players to rate the options presented after each plot point, constructing an option-preference matrix—similar to a product-preference matrix in traditional CF systems—and train the player model on the matrix. The learned player model retains the extracted rating patterns for players of different option preference types and can also be used to predict the player's preference ratings on all the other options. The drama manager uses the technique described in [5] to determine the best narrative trajectory for an individual player. To guide the player while still offering the appearance of player agency, the drama manager rank-orders the options at each plot point and chooses which options to display and which to suppress such that the highest predicted rank option leads to the desired child plot point.

## 3. PRELIMINARY HUMAN STUDY

We developed a simple interactive storytelling system based on a Choose-Your-Own-Adventure book, *The Abominable Snowmen*. We transcribed the plot points and options to construct a branching story graph. To simplify our experiment, we modified the story such that all possible narrative trajectories contain exactly six plot points. We did this only for implementation purpose; the algorithm generalizes to longer and variable-length stories. There are 28 leaf nodes and 19 branching points in the branching story graph.

Our technique requires multiple options per child. For experimentation, we selected one plot point with two children and manually authored additional options such that four options lead to the first child and three options lead to the second child. Each plot point emphasized a different motivation (friendship, safety, money, etc.) that a player might value. To train the model, we recruited 39 players to play through 5 full-length stories. After each plot point, the participant was required to rate each option presented on a scale of 1 to 5 and then make a selection. At the experimental branch four options (two for each subsequent plot point) were randomly picked and presented to the subjects. We selected two options instead of one for each subsequent plot point for the purpose of collecting as many preference ratings as possible. To analyze our system, we randomly selected 80% of the participants data on which to train the player model and tested against the data from the remaining 20%. We repeated this process 50 times. On average our system can correctly predict players' choices at the manipulating branching point for over 82% of the time.

We tested our system on an additional 27 participants. Participants read 4 stories and were then shown the narrative trajectory with the experimental plot point. Without drama manager intervention (options randomly presented), 72.2% of participants chose an option leading to the first child. With DM instructed to guide players to the first child—the DM selects two highest predicted rank options that lead to the first child and selects one lowest predicted rank option that leads to the second child—66.7% of participants chose one of the two options leading to the second child. With DM instructed to guide players to the second child, 95% of participants chose the option leading to the first child. Both results are significant at $p < 0.005$. We conclude that our drama manager can significantly increase the likelihood that players will choose to experience the narrative trajectory desired by the DM.

## 4. ACKNOWLEDGMENTS

We gratefully acknowledge the support of the U.S. Defense Advanced Research Projects Agency (DARPA).

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