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A Goal-Based Model of Personality for Planning-Based Narrative Generation

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Abstract

We present an approach to incorporate interesting and compelling characters in planning-based narrative generation. The approach is based on a computational model that utilizes character actions to portray these as having distinct and well-defined personalities.

Well-developed characters have features that enable them to significantly enhance the believability and quality of a story. In this paper we present a computational model aimed at facilitating the inclusion of compelling characters in narratives that are automatically generated by a planning-based system. In this model, personality is operationalized as behavior that results from choices made by a character in the course of a story. This operationalization uses the taxonomy defined in the Five-Factor Model (FFM) (Goldberg 1990) and results from behavioral psychology that link behavior to personality traits (Mehl, Gosling, and Pennebaker 2006).

The model focuses on the role that actions performed by characters play over the course of a narrative in the construction of the mental model of the story that the audience forms when experiencing it. In this model, the mechanism that generates the story is designed to ensure that the story structure and its contents promote the existence of choices for character's actions and make such existence evident to the audience by including contrasting options available to the character. The actions that characters perform are chosen by an intelligent mechanism that ensures their consistency with the personality traits assigned to the character by a human author prior to story generation.

Related Work

The use of AI planners to generate stories goes back to systems such as Tale-Spin (Meehan 1977) and UNIVERSE (Lebowitz 1984). More recently, the IPOCL planning algorithm by Riedl and Young (2010) focused on character intentionality by identifying goals that explain a character's actions. Other approaches have centered on characters' immediate reactions to events (e.g., (Mairesse and Walker 2007)) and systems that direct the interaction among semi-autonomous characters (e.g., (Assanie 2002)).

A number of researchers have also worked on the operationalization of personality models, in particular the FFM, to create richer and more expressive characters (e.g., (Doce et al. 2010)). Even though these models create characters that can adjust to changing situations and express emotion, they do not fully address character personality as an integral part of a story generation process. Specifically, they do not address the issue of the construction of the story to support the expression of a character's personality. In contrast, our work focuses on the story as a whole and in particular the construction of a story that supports choices made by characters as a means for an author to express their personality.

Model Overview

We posit that the choices made by characters at points where a story could branch into multiple alternatives can be used in narrative generation to enable the perception of specific personality traits. An audience that is made aware of the existence of multiple potential choices available to a character will form an opinion of the character's personality based on their perception of the available choices, the choice selection, and the events that provide a context to the choice.

The model we propose uses a declarative approach to enable the portrayal of personality traits with enough detail to elicit a predictable attribution of personality traits from the audience. In this model, character properties inform the selection of the actions they perform in the course of a story. The action selection mechanism reasons about the effects of a character's actions upon other story characters to gauge whether they produce behavior consistent with the character's personality traits. The mechanism also ensures that the story structure promotes the presence of contrasting choices, making their existence clear to the audience.

We use a plan-based story representation similar to that utilized in IPOCL; however, we extend it to incorporate elements specific to the action-selection mechanism described here. We begin by making a distinction between the representation of general elements of the story world and that of elements directly related to the actions of characters:

Definition 1 (Character Name). *A character name is a unique constant symbol that represents a story agent.*

Definition 2 (Character Value). *A character value is a tuple $\langle c, g \rangle$ where c is a character name and g is a literal used*

to describe a condition of the state of the story world.

Character values represent states that a character aims to achieve or preserve in the course of the story.

Definition 3 (Action Schema). *An action schema is a template for an action possible in the story world, described by a tuple* $\langle a, \mathsf{Pre}, \mathsf{Eff}, V, MainChar \rangle$ *where* a *is a unique action ID,* Pre *is a set of literals that must be true prior to executing the action (preconditions),* Eff *is a set of literals established by the execution of the action (effects), V is the list of free variables used in the template, and MainChar designates the story character that performs the action.*

Definition 4 (Planning Problem). *A planning problem* Π *is a tuple* $\langle \Lambda, S_0, S_G, C, G \rangle$ *where* Λ *is a set of action schemata,* S_0 *is a set of literals that specify an initial state of the story world,* S_G *is a set of literals that specify a goal state,* C *is a set of character names available in the story, and* G *is a set of character values specified for the story.*

Definition 5 (Plan). *A plan P for a planning problem* Π *is a tuple* $\langle S, B, O \rangle$ *where S is a totally ordered set of steps—a step describes an instance of an action schema that occurs in a plan—, B is a set of binding constraints on free variables in S, and O is a set of ordering constraints.*

Definition 6 (Positive and Negative Effects). *In the context of a plan P and a planning problem* Π*, we say that an effect* e_i *of a step* $s_j \in S$ *in plan* P *is a positive (resp. negative) effect for character* $c_k \in C$ *when* $\exists \langle c_k, g_l \rangle \in G$ *such that* e_i *and* g_l *(resp.* $\neg g_l$*) unify in the context of B.*

We also extend the plan-based story representation to model the choices made by characters during a story:

Definition 7 (Narrative Branching Point). *In the context of a plan* P *and a problem* Π*, a narrative branching point* BP *is a tuple* $\langle b, p \rangle$*, where* $b \in \mathbb{N}$*, and for* $s_{b+1} \in S$*,* $p \in \mathsf{Pre}_{s_{b+1}}$*. We say that* BP *is a branching point in plan* P *just when* $\exists s_b \in S$*, such that* $p \in \mathsf{Eff}_{s_b}$ *and two or more actions* $a_i \in \Lambda$ *can be instantiated after* s_{b-1} *to produce effect p.*

Definition 8 (Choice). *In the context of a plan* P *and a problem* Π*, a choice* $\langle \mathsf{BP}, s_i, c_i \rangle$ *designates a specific step, performed by character* c_i *at the narrative branching point.*

Alternative Possible Worlds Typical narratives may describe or imply events that have not yet or that may never occur (Ryan 1991). These events can be the result of a character's choice whether or not to perform a specific action. Points in the narrative structure where multiple choices for character action exist create the possibility of alternate versions of the story, which are represented by different branches of the search space explored by the planner as it generates a story. In the context of this work, an alternate version of the story that results from a specific character choice constitutes an Alternative Possible World (APW).

Narrative Generation Mechanism

We modify an algorithm, described in previous work (Bahamón and Young 2013), to include a mechanism that evaluates the effect of a character's actions on the individual values of other story characters. Instead of using a non-deterministic method to select action schemata during plan construction, the mechanism utilizes individual character values and the personality traits of the protagonist to guide the selection. Additionally, this mechanism treats the goals defined in the planning problem differently from the individual values of story characters. Even though character values are not necessary for the construction of a complete plan, they inform the search process.

The mechanism first determines whether more than one action schema is viable for instantiation as a plan step to achieve a needed precondition. When this is the case, a narrative branch exists and the alternate versions of the story produced by each viable action schema are explored and analyzed. The result is a ranking of each alternate version based on how consistently the effects of steps included in the branch portray the personality of the character that performs the action at the beginning of the narrative branch. Only effects that are unique to the branch with respect to the common set of steps produced by all the branches are considered. The branch whose effects most consistently depict the personality of the character is chosen and its initial operator is instantiated as a plan step at the point where the branch was identified. Additionally, the plan structure is modified to ensure that the branch whose effects are least consistent with the personality of the character is a possible path that the story could follow. Finally, the planning problem is further constrained to prevent the viability of story branches that are not clearly consistent or inconsistent. This last step is intended to ensure that clear contrasting options are available in the resulting story, thus conveying to the audience that the character had a choice in action.

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