A Demonstration of Loose Ends, a Mixed-Initiative Narrative Instrument

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Abstract. We present a demonstration of Loose Ends, a mixed-initiative creative interface for playful storytelling that assists players in managing plot threads to achieve storytelling goals related to high-level story structure. From a design perspective, Loose Ends is an example of a *narrative instrument*: an expression-oriented playable system that can be played to produce narrative, in much the same way that musical instruments are played to produce music.

Keywords: Narrative instruments · Mixed-initiative co-creativity · Interactive emergent narrative · Story sifting.

1 Introduction

One line of research in interactive storytelling aims to construct computational systems that assist the human interactor in making up a story of their own [9]—for instance by providing the interactor with a storytelling partner in the form of an artificially intelligent storytelling system, resulting in a *mixed-initiative co-creative* [10] approach to storytelling. Systems like Say Anything [13], Creative Help [11], and TaleBrush [1] enable collaborative human/AI storytelling at the level of the prose that constitutes a written story, while systems like *Writing Buddy* [12] and *Why Are We Like This?* [6, 5] enable collaborative storytelling at the level of the plot events that constitute an abstract narrative structure.

Though these systems are in some ways successful at facilitating mixed-initiative storytelling (particularly by helping interactors to overcome short-term writer's block through the provision of suggestions as to how a story might be immediately continued), they have historically struggled to help users overcome a sense of long-term *structurelessness* in the stories they write. In terms of the creativity support needs experienced by creative writers [8], these systems are broadly effective at getting interactors unstuck, but less effective at helping them craft a satisfying overall plot arc.

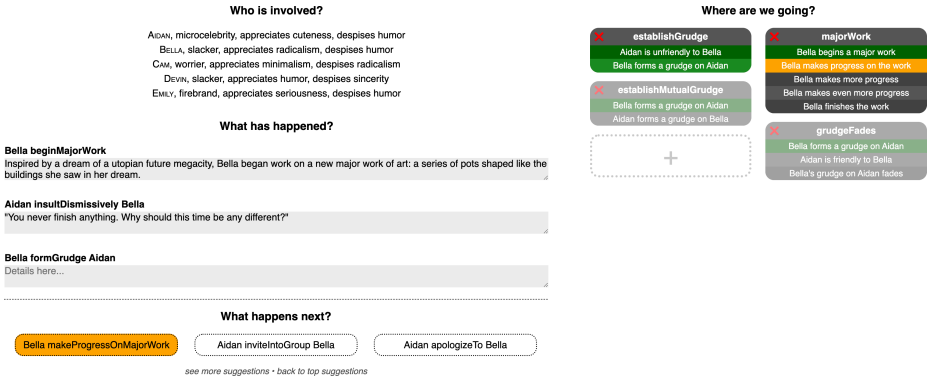

Fig. 1. The Loose Ends user interface. The **Who is involved?** section displays basic information about a generated cast of five characters. The **What has happened?** section lists plot events that have taken place in the story so far, along with player-written text giving more details about these events. The **What happens next?** section shows AI-generated suggestions for what might happen next in the story. The **Where are we going?** section shows active storytelling goals, including transparent goals that have been suggested by the AI system rather than added by the player. One action suggestion (highlighted in orange in the bottom left) is being hovered over by the player; consequently, the impact this suggestion would have on the active storytelling goals if accepted (i.e, advancement of the `majorWork` goal) is also highlighted in orange on the right.

Our new mixed-initiative storytelling system—Loose Ends—attempts to address this issue of long-term structurelessness in mixed-initiative co-creative storytelling through innovations in both AI system implementation and user interface design. In this paper, we briefly describe the design and implementation of Loose Ends, with a focus on the overall human/AI interaction loop that assists it in achieving this goal.

Loose Ends is open source[4] and can be played online in a web browser.[5] For a longer-form description of Loose Ends that also presents a preliminary evaluation of the system, see Kreminski et al. 2022 [7].

2 System Description

Loose Ends (Figure 1) is a mixed-initiative creative interface [2] for playful storytelling. Much like several previous systems in this area of research [13, 11, 12, 6, 1], Loose Ends is an interactive system that assists users in producing non-interactive stories. We specifically conceive of Loose Ends as an AI-based *narrative instrument* [9]: a system that can be played to produce narrative, in much the same way that a musical instrument can be played to produce music.

[4] https://github.com/ItsProbablyFine/LooseEnds
[5] https://itsprobablyfine.github.io/LooseEnds

In the Loose Ends interaction loop, a human player repeatedly selects *action suggestions* furnished by the underlying AI system to continue the plot of a running story, using *storytelling goals* to steer the narrative toward player-desired long-term outcomes. Actions selected by the player are added to a running *story transcript*, and each action can be annotated with additional text by the player—for instance to narrate the action in greater detail.

The AI system that powers Loose Ends consists of two major components. First is a **storytelling goals tracker** that updates a pool of active and possible storytelling goals as new plot events are added. Second is an **action suggestion generator** that generates and ranks potential suggestions for the next plot event in the story based on the currently active storytelling goals.

2.1 Storytelling Goals Tracker

Storytelling goals in Loose Ends are used to set and maintain the high-level direction of the story. Every goal is an instance of a *goal template*: a story sifting pattern written in the domain-specific logic programming language Winnow [4].

Goals represent *plot threads* that the player wants to be included in the story they are writing. Since a story often consists of several parallel plot threads bound together, multiple goals are generally active at the same time. The current version of Loose Ends includes goal templates for plot threads that introduce or develop character relationships (e.g., friendship or rivalry); internal conflicts (e.g., artistic or career struggles); and high-level narrative themes (e.g., moral themes related to the virtues of persistence in the face of adversity). There are 12 goal templates total in the version of Loose Ends presented here.

As players select action suggestions (generated by the action suggestion generator) that advance these plot threads toward completion (or cut them off by making them impossible to complete), the storytelling goals tracker UI visibly updates to indicate the current completion progress of each goal. This allows players to see which goals are near completion, which goals are still a long way from being completed, and what kinds of actions should be taken next to advance various incomplete goals.

The Loose Ends user interface permits players to add goals manually (by selecting a goal template to instantiate as a goal, from a library of all available goal templates) and to remove goals that have already been established at any time. In addition, the AI system in Loose Ends constantly tracks and evaluates a pool of partial matches that the player has not established as goals. If one of these partial matches advances beyond a certain threshold (33% completion in the current version of Loose Ends), the system will automatically promote it to an active goal, rendered in a transparent style to indicate that this is a system-suggested goal rather than a player-added one. These goals can be removed by the player like any other (enabling the player to veto the system's suggestions of additional storytelling goals), or the player can click on them to remove the transparency effect and notionally "lock them in" as player-intended goals.

2.2 Action Suggestion Generator

Action suggestions in Loose Ends are drawn from two pools of actions. The *basic actions pool* contains actions that are possible for any character at any time, regardless of social state, and remains fixed at all times. The *dynamic actions pool* is recalculated whenever a new event is added to the story, and contains actions that are only possible because of active storytelling goals that are in an appropriate state. For instance, when a complete `establishGrudge` goal between the characters Cam and Devin is active, the dynamic actions pool will contain actions that Cam can only take toward Devin because of their active grudge on Devin (such as sabotaging Devin's most recent artwork). There are 32 action types total in the version of Loose Ends presented here: 20 basic actions and 12 dynamic actions.

Action suggestions are recalculated every time the set of active storytelling goals changes. When calculating action suggestions, the action suggestion generator first iterates over all possible next actions (in both the basic and dynamic action pools) and determines, for each action, which storytelling goals would be impacted (either advanced or cut off) by the addition of this action to the story. Each action is then given a priority score, which is the sum of three factors:

- The number of active storytelling goals that this action would advance
- A constant factor (0.5) if this action is from the dynamic actions pool—i.e., if it is only possible because of an active storytelling goal
- A random factor (between 0 and 0.5) to randomly permute the priority of actions with the same base score

Actions are sorted by their score and displayed in order, with the three highest-scoring actions being pulled to the top of the action suggestions list. In this way, actions that relate most strongly to the active storytelling goals are prioritized for display, with randomness ensuring a degree of alternation between suggestions that advance parallel plot threads. When the user hovers over an action suggestion to consider it, the precalculated information about which storytelling goals this action would advance or cut off is used to display the ramifications of accepting this action in the storytelling goals pane on the right side of the user interface.

3 Interaction Examples

In conjunction, the Loose Ends AI and user interface permit several desirable interactions that are not possible in other mixed-initiative creative interfaces for storytelling. Four especially interesting examples of novel mixed-initiative interactions enabled by Loose Ends are presented below.

Discovering New Storytelling Goals Beyond simply suggesting action-level continuations to a running story in accordance with player-provided storytelling

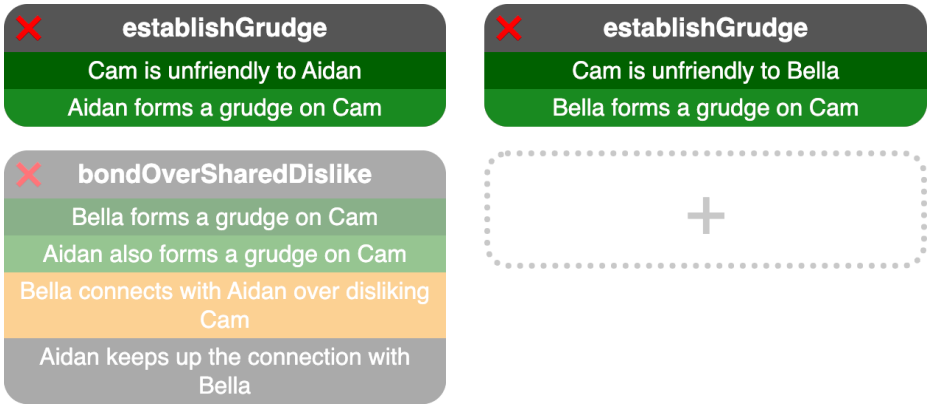

Fig. 2. Based on events that were added to the story to complete two `establishGrudge` goals, Loose Ends has automatically discovered and surfaced a suggestion for another author goal (the `bondOverSharedDislike` goal) to spin off a new plot thread initiated by these events.

goals, Loose Ends can also infer new storytelling goals that are consistent with the story so far and proactively suggest these goals to the player. This often results in interactions where a player who would otherwise become uncertain of what to do next is inspired by, and begins pursuing, a system-discovered storytelling goal instead.

For instance, in Figure 2, the player has just completed two `establishGrudge` goals targeting the same character (Cam) have both been completed. At this point, Loose Ends automatically discovers and surfaces a successive character relationship development goal, in which Aidan and Bella (who both have grudges on Cam) bond over their shared dislike. The first two steps of this goal are already complete, because the system has been tracking the possibility of surfacing this goal in the background, but it has only just now progressed far enough to be displayed.

Discovering Thematic Conflicts Loose Ends can make it apparent when a conflict has arisen between two active storytelling goals. For instance, in Figure 3, the player is simultaneously working toward two distinct thematic goals for the story and considering an action that will reward Emily with career success after she completes a major artwork. This would support the theme that persistent work on a single major project leads to success (`slowAndSteady`) but undermine the competing theme that the way to success is to create a rapid succession of more minor artworks (`quantityOverQuality`). When the impact of the considered action on all active author goals is visualized, the conflict between these goals is revealed to the player.

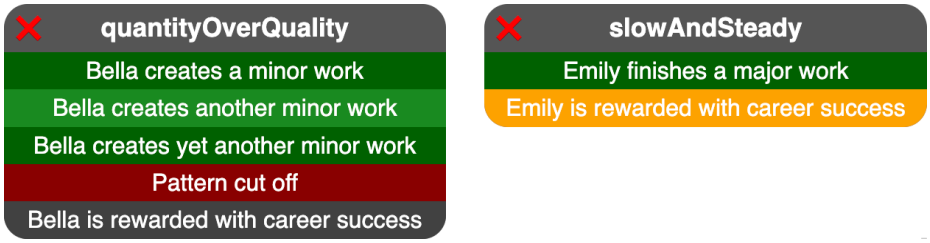

Fig. 3. As the player considers an action that would advance one of their thematic goals but undermine another, the impact of the action on both thematic goals is highlighted, making the conflict apparent.

Resurfacing Dormant Plot Threads Because Loose Ends can maintain a larger set of active storytelling goals than the player can hold in their head all at once, action suggestions can serve to remind players of incomplete plot threads that they would otherwise forget to revisit. For instance, long-term storytelling goals like the `tryTryAgain` thematic goal (which requires a single character to repeatedly release artworks that are poorly received, before finally releasing one that is well-received) may temporarily fade into the background as the player focuses on another subplot that weaves together a few distinct storytelling goals at once—but once this more pressing subplot is complete, actions advancing the earlier thematic goal will again rise to the top of the action suggestions pool, reminding the player to return to the previously initiated thread.

Interleaving Parallel Plot Threads When multiple parallel plot threads are active and none of these threads has storytelling priority, the slight random permutation of equally ranked action suggestions means that Loose Ends by default tends to promote actions that alternately advance different threads. This can help players escape fixation [3], in which they develop a narrow and premature focus on one plot thread or set of characters and forget about the possibility of developing others.

4 Conclusion

Loose Ends is a narrative instrument that can be played to produce narrative, much as musical instruments can be played to produce music. It includes several technical and design innovations aimed at helping players to achieve coherent long-term structure in the stories they produce, and the novel interaction patterns it enables can hopefully be retained and extended in other AI-based narrative instruments in the future.

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