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Towards A Virtual Peer that Writes Stories with Children

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Abstract: Children encounter more difficulty in writing than in sharing their stories verbally. This difficulty may be due to the need for them to organize their thoughts and express them in the written language. A software agent can be designed to mimic the support given by a human teacher or peer, such as asking questions, giving directives, and recommending possible story text. We describe how these tasks can be achieved by our software agent, Alice, using a combination of computational text understanding and generation techniques. Children found Alice's prompts to be useful in situations when they were having a hard time writing their story. Those children who opted to include Alice's suggested story text did so because they found the peer to state certain facts that can add new details to their stories.

Keywords: Virtual Peer, Story Writing, Text Understanding, Text Generation

1. Introduction

A common practice in the classroom setting is to ask children to write stories, usually on a variety of topics. This presents them with an opportunity not only to build their vocabulary and grammar, but also to express their ideas while constructing and extending their knowledge on a particular area. Their decision-making and creativity skills are enhanced as well when they think about what can happen next in the story. However, children usually encounter more difficulty in meeting the demands of writing stories than its verbal counterpart. The problem lies in having to organize their thoughts, the need to use appropriate language to communicate their ideas through the written text, and their lack of knowledge about writing and the writing process (Englert, 1988). Verbal storytelling also affords children with an opportunity to engage in a fun activity with peers and caretakers, whereas a writing task usually involves individual work.

Research in virtual agents have designed them to communicate with their human users through different modalities and interfaces, including written text and spoken dialogue, facial expressions, and body gestures. Interaction is promoted through creative collaborations with the user through social engagements and communication, which are vital in literacy learning (Cassell, 2004), language development (Cassell et al., 2005), reasoning (Blair, 2006), and critical thinking. Advances in natural language processing research have also extended the capabilities of virtual agents to enable them to mimic natural conversations with human users (Ong, 2016). In this paper, we describe our virtual peer, named Alice, who collaborates with a child in the story writing task. Alice uses natural language processing techniques to understand a partial story text and to generate responses.

2. Designing Alice

Alice supports children in writing stories by serving two roles – facilitator and collaborator, using the story writing space shown in Figure 1. Instead of a turn-taking approach, the child user is given control to decide when to ask Alice for help ("*Ask Me*" button), and the type of help needed from the virtual peer (Figure 2). However, Alice imposes certain restrictions on the story being written. The story plot must follow the three-act-structure, as depicted in Figure 3.

The three-act structure divides a story into three main parts - the beginning, the middle and the end. The beginning part introduces the characters and the location. The conflict is also revealed in this part. The conflict is the problem faced by the characters that creates tension and makes the plot move forward (Cox, 2016). In children's stories, a conflict can be depicted with a story text that introduces a negative emotion or tension. Alice detects the presence of a conflict by looking for a concept that produced the least negative polarity, with the use of SenticNet (Cambria et al., 2014).

Figure 1. Space for Co-Authoring Stories

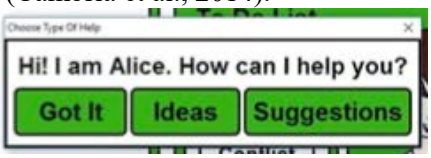

Figure 2. Asking Help from Alice

Figure 3. Checklist for Parts of a Story

The middle part focuses on narrating a series of events involving the protagonist that may lead him/her to the resolution of the conflict. At least two events must be detected. Events are identified by the use of verbs that denote actions, such as *eat*, *play* and *read.*

The end part is the climax that narrates how the character resolves the conflict. At least one of the characters that caused the conflict must experience the resolution. Resolutions are determined by looking at two factors. First, a resolution must be related to the conflict previously introduced in the beginning part of a story. Second, the resolution has a positive polarity. The commonsense ontology is used to determine if the resolution concept is related to the conflict concept. *Related* means the path from the conflict concept to the resolution concept contains no more than three (3) edges. Finally, the resolution must also be experienced by the character who was involved in the earlier conflict.

Alice can generate two types of responses: story text or dialogue. Dialogues are prompts in interrogative or imperative form to encourage the user to provide more details about a character, an object, a location, or an event. In story text generation, Alice needs to provide additional details to the nouns or events that it has previously detected from the user's story.

3. Results and Discussion

Alice was validated through two iterations of end-user testing comprising of 24 students as participants, who are between the age of seven to nine years old. Each participant used Alice to write his/her story. The participant's stories and Alice's responses were internally logged for further analysis. A debriefing interview was conducted with each of the participant to solicit feedback regarding their experience.

52.9% of the participants claimed that they were able to finish writing their stories. However, an analysis of the internal logs showed that none of them actually did. This is because Alice failed to detect some story elements, such as location, conflict, character and resolution. Part of the problem lies in Alice's reliance on Stanford CoreNLP's named entity recognizer, which did not treat a common noun as a possible story character or a location. The frequency with which Alice failed to detect the story elements is summarized in Table 1.

The presence of a sentence with any concept that has a negative polarity is used to identify a conflict. However, most participants in the first iteration describe their experiences without using any words bearing a negative sentiment. During the second iteration of testing, most children wrote a story

whose theme centers on what the main character "*hates*". This conflict can then be easily resolved by writing a sentence containing the word "*likes*". Thus, 28.6% of the participants wrote stories that Alice deemed as complete. On the other hand, 42.9% were able to reach the end part of their stories, but were not able to give a resolution that is "acceptable" to Alice's criteria.

Table 1: Frequency of missing story elements

Missing Story Element	Frequency
Location	15
Conflict	11
Character	4
Resolution	17

In the usability aspect, 91.7% of the overall participants asked Alice for help at least once during their writing session. Their reasons for doing so include the following: (i) they were having a hard time in writing their story; (ii) they want to know more options on how their story may happen; and (iii) they find Alice's prompts and suggested story segments amusing. Participants who already have a story in mind claimed that they did not need the help of Alice, so they did not ask for help.

4. Further Work

In this research, we applied text understanding and text generation techniques to enable Alice, a virtual agent, to facilitate and even co-author with a child while the latter is engaged in story writing. We showed how Alice afforded opportunities for each child to write at his/her own space, using a theme that is of interest to him/her, and to work with a peer as deemed necessary by the child.

Story writing touches on many aspects, from general themes that may apply to all children, to specific stories that narrate a child's personal experiences. Alice should be able to possess a vast domain of knowledge to cater to these individual differences. Alice can be designed to utilize story starters or prompts. These ready-made scripts on common themes and familiar life events can give children an initial idea that they can build on in their stories.

The internal logs also showed that the stories written by the children contained numerous spelling and grammar errors. Alice currently does not address linguistic concerns as part of its scope. Future research should extend Alice to assume the role of a language teacher in order to correct these errors. Furthermore, Alice can use this opportunity to enrich the vocabulary of the individual writer by suggesting various synonyms, using advanced words when generating a suggested story text, and demonstrating the differences of word usage.

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