Reality Tales: Facilitating User-Character Interaction with Immersive Storytelling

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ABSTRACT

Reality Tales is a platform to facilitate interaction with fictional story characters for readers (13-20 years). The platform leverages binaural audio and multi-voice narration for an immersive story experience. Several paradigms for interactive storytelling have emerged in recent years, involving sequence-based story generation with user inputs. However, the current work in this domain rarely applies to existing fictional stories, with defined characters and plots. Our work introduces voice-based conversational interaction with story characters as a novel dimension to digital interactive storytelling. Through a user-centered process and qualitative studies, we discover that providing users with the agency to directly converse with story characters about their lives makes the users invested in the storyline.

CCS CONCEPTS

• **Human-centered computing → Interactive systems and tools**; *Empirical studies in HCI*; *Empirical studies in interaction design*; *User centered design.*

KEYWORDS

interactive storytelling, user-character interaction, binaural audio, multi-voice narration, user centered design

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1 INTRODUCTION

> *"A reader doesn't really see the characters in a story; he feels them."*
> — Cornelia Funke, Inkdeath [9]

Stories, being a fundamental element of human cognition, exercise human emotions and nurture imagination [2]. Interactive storytelling has emerged as an active research domain. Research suggests that story characters, their interactions with each other, dialogues, actions, beliefs, and emotions tie various events of the plot together [7]. Recent developments in the domain of interactive storytelling focus on involving users to generate new task-based story sequences by interacting with the virtual characters and their environment [3, 19]. A new facet of interactive storytelling is conversational interaction between users and characters of existing fictional stories. There is limited research in this direction, driving us to explore the impact and significance of direct voice-based user-character interaction for the readers.

We follow a user-centered design process [14] and conduct qualitative studies to understand the significance of directly interacting with characters. We focus on readers of age 13-20 years as existing research suggests fiction is the most popular genre of literature in this age group [15]. Similar findings were also echoed in our user survey. Through multiple iterations of prototyping, we develop *Reality Tales*, a platform that facilitates voice-based interaction with story characters enabled via Artificial Intelligence (AI), integrated with an audiobook player. We look at methods to enhance the connection between the readers and the storyline using binaural audio and multi-voice narration for storytelling, where each character has a unique voice.

We evaluate *Reality Tales* through Concurrent Think Aloud (CTA) [4] sessions and user observations. We learn that talking to the characters makes the users invested in the storyline and character's life. It induces positive emotions, such as empathy and curiosity. Binaural audio and multi-voice narration provide an immersive experience to the users.

2 RELATED WORK

With the advancement of technology, traditional storytelling methods have received a makeover with audiobooks. Researchers have explored sounds and audio narratives to facilitate immersive story experience to capture user's attention [6, 17]. The study conducted by Ryan Wagar suggests that audiobook technology engages K-12 learners by increasing their enjoyment of reading and improves their reading comprehension skills [20]. Several commercial products (Audible[1], Google Play Books[2], LibriVox[3]) provide an extensive library of audiobooks, mostly narrated by a single voice.

[1] Audible: https://www.audible.com/
[2] Google Play Books: https://play.google.com/books
[3] LibriVox: https://librivox.org/

Inducing the concept of binaural audio paves the way for a greater immersive experience by removing passiveness from traditional audiobooks. Some commercial applications (Koob[4] and OwlField[5]) are centred around the idea of binaural audiobooks with multi-voice narration. Spatial positioning of characters, to mimic binaural audio, stimulates the listeners' imagination, enabling them to generate vivid images in their minds[6]. Michele Geronazzo et al. utilize dynamic binaural rendering in a virtual environment. Their study indicates an increase in immersion and story-specific emotions in the participants [10]. We utilize the extensive research on binaural audio for immersive story narration in our platform, providing users with an agency to visualize the story and its characters.

Several paradigms have emerged in interactive storytelling, involving user interaction with autonomous virtual characters, for story generation or modification. For instance, users can control the sequence of events or character actions by interacting with objects in virtual surroundings, giving advice to characters, or expressing their feelings as speech interactions [3]. Charles et al. propose an interactive approach to dynamic story modification by prompting users to make decisions from different characters' point of view, resulting in varying story consequences [19]. However, such interactive storytelling systems rarely apply to existing fictional stories with a defined storyline and characters. To the best of our knowledge, this work is the first to focus on the conversational aspect of user-character interactions for existing fictional stories without modifying their plot.

Story characters are at the core of storytelling. Giving users the ability to interact with the story characters can pave the way for immersive and informative experiences. Lissa et al. posit presenting stories in the first person (rather than in the third person) builds empathy and a better understanding of the characters [12], providing us with an opportunity to explore the significance of speech interaction with fictional characters to learn more about their lives, feelings, and the storyline.

3 METHODOLOGY

This work was conducted from August-December 2020 in Delhi, India. For this study, we followed the user-centered design process [14] with 16 key participants (apart from the 118 survey participants) involved in different stages of the design process: semi-structured interviews, prototype testing, and user evaluation. All participants belong to the age group of 13-20 years (median: 16 years). They were recruited using purposive sampling [8] based on their self-declared interest in reading or hearing stories and prior familiarity with audiobooks. Six participants read fiction almost every day (avid readers), six of them read a few times in a year or when they find the time (average readers), and four prefer watching visual media over reading (non-readers). Prior consent was taken from all participants to record our interaction with the participants and use their anonymized quotes for research purposes. Assent was taken from minor participants, and parents' consents were also taken. We refer to participants with pseudonames, using P<participant ID> as the naming convention (P1, P2, ... P16).

We have followed the Double Diamond [11] model to plan, research, and iterate over the prototypes (as seen in Figure 1). In phase-1, we diverge through semi-structured interviews, surveys, and literature review. With the insights from this phase, we converge to gather user requirements. In phase-2, we diverge again by ideating and prototyping iteratively. Finally, we converge to the proposed solution after user evaluation via CTA. This model allowed flexibility in building the application while following the user-centered approach. We now present our research phases in detail, including the insights from each phase.

[4]Koob: https://www.koobaudio.com/
[5]OwlField: https://www.owlfield.com/

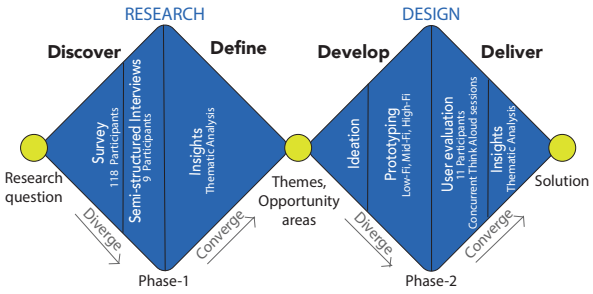


Figure 1: Double Diamond model followed for the study. Phase-1 focused on primary research followed by Phase-2 comprising of prototyping and evaluation.

4 PHASE-1: PRIMARY RESEARCH

4.1 Survey

We conducted an online survey to help us record participant interest in fictional stories and observe patterns in their current reading habits. Sample survey questions include: *"What is your frequency of reading fiction?"* *"What is your preferred genre for reading?"* and *"What are the most noticeable character traits?"* The survey included multiple choice questions, with one subjective question to record participants' favourite fictional character and novel. The survey was designed in English and participants were recruited through email, instant messaging platforms, and word of mouth. A total of 118 people belonging to the 13-20 age group took the survey; 68 participants were male, and 50 were female. People had different frequencies of reading fictional stories, ranging from reading 12 or more fictional books every year to reading a book once in 1-2 years. To analyse the survey responses, we calculated percentages for the objective questions, as well as the subjective question.

4.2 Semi-Structured Interviews

We conducted semi-structured interviews [13] with 9 participants (P1-P9 from 16 key participants) to get in-depth insights into their reading preferences and understand the relevance of character interaction. Four of the participants were female, and five were male. Participants P1-P3 were avid readers, P4-P7 were average readers, and P8-P9 were non-readers. The interviews were telephonically conducted in Hindi or English, depending on the participant's comfort. Sample questions that we asked from participants include: *"What are the traits that you notice about a character in a fictional story?"* and *"What activities do you indulge in (if any) after reading/hearing a story?"* The interviews were audio-recorded and later transcribed and translated for thematic analysis [1]. The transcripts were annotated line by line and open coded to identify primary themes.

4.3 Learnings from Phase-1

We corroborated the data from the two sources to outline the following insights from phase-1.

Building relationships with the characters. Participants associated feelings of happiness, amazement, and luckiness if they could talk to their favourite character. 61.01% of the survey participants found character personality, dialogues, and emotions to be the three most vital attributes for an enriched story experience. P2 reported the character Guts from Berserk[6] as their favourite character, and said, *"I would like to know their purpose of living if such a cruel life is worth it. I know the story explores this question a lot, but we have not seen a clear answer from Guts yet. If I get to know from him that*

[6]More about Berserk (manga): https://en.wikipedia.org/wiki/Berserk_(manga)

he is doing fine, it may give me some closure". These responses helped us understand the significance of direct user-character interaction, giving us insights into what it could mean for the readers.

Enhancing the story experience. We discover that the story experience will be enhanced if someone reads the story to the participants. The ability to interact with scenes and the characters would help enrich stories and develop an immersive experience. P1 said, *"I would like to walk the hall of Hogwarts and listen to Harry tell his story"*. Although participants were keen about visual media, they mentioned that movies and TV shows built upon existing stories often shorten the plot and leave nothing to the imagination of viewers.

Stories beyond the storyline. Through our semi-structured interviews, we found that participants refer to websites such as Quora[7], Fandom[8], and Wikipedia[9] to know more about the storyline, characters, and their perspectives, indicating that participants are inquisitive and curious after having read a fictional story.

Lastly, fiction is the most popular genre among the survey participants (80.50% preferred fiction). 25.42% have Harry Potter as their favorite novel series and Harry Potter as their favorite fictional character. As this was the highest percentage for any story, we decided to create a prototype for direct interaction with Harry Potter and provide excerpts from the Harry Potter series.

5 PHASE-2: PROTOTYPING AND EVALUATION

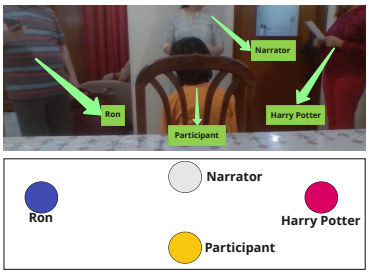
For the second phase of the study, we used the inferences from our surveys, interviews, and literature review to conceptualize *Reality Tales*. We planned and performed three prototyping stages to test the platform's concept, interface, and functionality, as detailed below.

5.1 Low-Fidelity

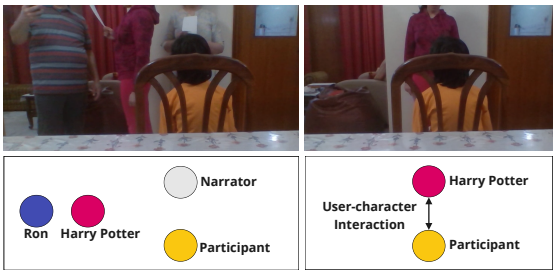
We tested the concept of user interaction with the story characters along with multi-voice binaural audio narration through role-playing [18] and Wizard of Oz [5], with participants: P10, P11, and P14.

5.1.1 Set up. A short excerpt was read out from the *Harry Potter and the Philosopher's Stone*[16]. To conduct the role-play, different people enacted Harry Potter, Ron Weasley, and the narrator. As seen in Figure 2, the story characters (standing) were present in the same physical environment as the participant (sitting on the chair). As the characters narrated the story, they moved around the participants to mimic the effects of binaural audio. The listener was blindfolded to center the focus entirely on listening, avoiding any distractions caused by looking at the role-play. The participants were told beforehand that they will be listening to an excerpt from the Harry Potter and the Philosopher's Stone and that they can use voice commands to control the narration and interact with the character of their choice. We conducted Wizard of Oz to facilitate user-character interaction, as seen in Figure 2c. We observed the participants and their interactions as the activity was conducted and collected data in pictures, field notes, and audio recordings. Our insights are presented in the next subsection.

5.1.2 Learnings. Being able to converse with story characters was informative, engaging, and helpful for the participants. It was easy for them to identify different voices due to the character's personality and the narrator's presence to guide the story. This confirms that participants can easily follow a multi-voice narration. However, P10 said, *"I think that keeping track of voices might become difficult for scenes with more characters."* All participants enjoyed the sense of direction received by the positioning of characters, and



(a) Set up and role of the participants



(b) Characters change positions relative to participant

(c) Wizard of Oz for User-Character interaction

Figure 2: Low-fidelity prototyping (Participant faces have been hidden for privacy).

it made them feel that the events were taking place in their surroundings. P14 said, *"I was able to see Harry and Ron in my room in my mind."*

5.2 Conceptualising *Reality Tales*

To provide a user-interface to stories and character interactions, we planned the design of a web application with easier access to key functionalities. We constructed an Information Architecture of the system, which helped us get a clear idea of where different functionalities of the app should be placed. Figure 3 shows the mid-fidelity prototype, where the red arrows indicate the user-flow based on the planned Information Architecture.

We incorporated different interactions such as selecting books and chapters, playing, pausing, talking to a character, next/previous dialogue, and next/previous chapter. Users can talk to characters at any point during the story narration by using voice commands or clicking on a button. We decided to have a color-scheme using achromatic, high contrast colors.

5.3 High-Fidelity: Combining Interface, Concept, and Functionality

5.3.1 Iteration 1. For the high fidelity prototype, we used two excerpts: *The Third Floor* and *Wingardium Leviosa!* from *Harry Potter and the Philosopher's Stone*. We recorded and prepared binaural audio files for the two excerpts using Audacity[10], a free and open-source digital audio editor and recording application software.

We developed a voice-based interaction interface for users to talk to Harry Potter. We leveraged the open-source *IBM Developer Model Asset Exchange: Question Answering Model*[11] for interacting with the story characters. Based on the two excerpts of the story, we prepared a text corpus with information on different subjects such as various characters (like Hermione,

[7]Quora: https://www.quora.com/
[8]Fandom: https://www.fandom.com/
[9]Wikipedia: https://www.wikipedia.org/

[10]Audacity: https://www.audacityteam.org/
[11]IBM Developer Model Asset Exchange: Question Answering Model: https://github.com/IBM/MAX-Question-Answering

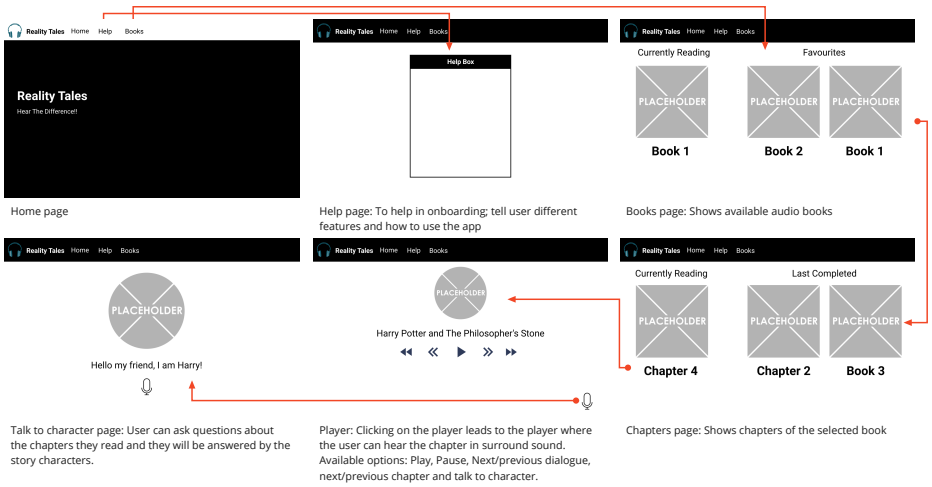


Figure 3: Annotated medium-fidelity prototype with the user-flow indicated using red arrows.

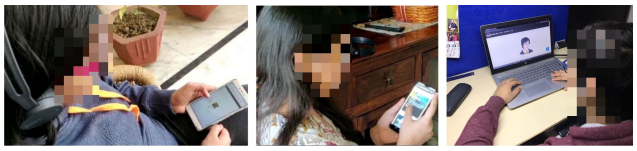


Figure 4: Participants interacting with *Reality Tales* prototype.

Harry, Ron, and Hagrid) and the story elements (like Quidditch, Hogwarts, magic spells). Upon receiving the users' dialogue or question, we perform the speech-to-text conversion and identify the subject and context in the user's speech. We then invoke the IBM MAX Question-Answering service with the appropriately extracted segment of the text corpus. The text response is then converted to speech and played for the user by the application. To ensure consistency with our voice-based interactive system, we provided voice commands (such as 'play', 'pause', 'next/previous dialogue', 'next/previous chapter') to control the story-player.

Evaluation and Learnings. We involved eight participants (P9-P16) for a Concurrent Think Aloud session (Figure 4) and asked them to perform the following task sequence: 1) Open the web application and navigate the prototype for 4-5 minutes. 2) Navigate to the book section for Harry Potter and the Philosopher's Stone. 3) Hear any of these two excerpts: *Wingardium Leviosa!* or *The Third Floor*. Interact with the story-player using voice commands. 4) Talk to Harry Potter and ask any questions related to the excerpt played.

All participants could easily identify that the application was about listening to stories and talking to the story characters. They found the multi-voice narration and binaural sound effects for the audio excerpt to be realistic. They enjoyed it when Harry gave meaningful responses. However, there was a significant lag between asking questions and receiving the character's response due to data transmission overhead from the back-end to the front-end. Some questions to the character had no response as the question's subject did not match any segment of the text corpus, such as *"Which house are you in?"* (asked by P12), or follow up questions such as *"How do you know that?"* (asked by P9).

Participants often skipped the 'Help' section and directly jumped to the story-player, making it significantly difficult for them to use the application. Some features such as voice commands to control the story-player went unnoticed due to lack of discoverability. Other voice commands, such as *"Stop"* and *"Restart"* were not programmed in the story-player and hence provided no output.

5.3.2 Iteration 2: Final Prototype of Reality Tales. We revised our prototype based on evaluation and learnings from the first iteration (Figure 5). We redesigned the home page to include an onboarding slide-show and demonstration video (in place of the 'Help' section) for improved accessibility. To make users familiar with available voice commands, we added certain examples for commands below the story-player. We also incorporated additional voice commands such as *"Stop"*, *"Play from the beginning"*, *"Restart"*, and *"Resume"*. Based on the participants' questions during testing, we expanded the text corpus to enable them to receive responses for a wider set of questions and enhanced conversation with Harry Potter. Finally, we improve the experience of talking to the character by reducing response latency. This was achieved by shifting the computation of response generation to the front-end. The dependency on the centralized server was eradicated while bypassing data transmission overhead. Figure 6 represents the final workflow and technology used for *Reality Tales*.

Evaluation. A final usability evaluation was conducted for this iteration with five participants, three males and two females. We followed purposive sampling, where two participants (P10, P15) were involved in evaluating the first iteration (Section 5.3.1), and three (P1, P3, P4) were involved in the semi-structured interviews (Section 4.2). First, we asked them to hear a 3-minute audio excerpt from *Harry Potter and Philosopher's Stone* with single voice narration, no binaural audio, and no character interaction. The participants were then provoked to note down questions that came to their mind. Next, we provided them with *Reality Tales*, asked them to hear an excerpt and talk to Harry Potter. Sample questions that participants asked, along with the answers that Harry Potter provided can be seen in Table 1. We conducted a one-on-one semi-structured interview to know about their experience and transcribed the interaction to conduct a thematic analysis. Our key learnings are detailed in the following section.

6 LEARNINGS

This study explores conversational interaction between users and characters from fictional stories as a new dimension to storytelling. We identified the following learnings through the user evaluation of *Reality Tales*.

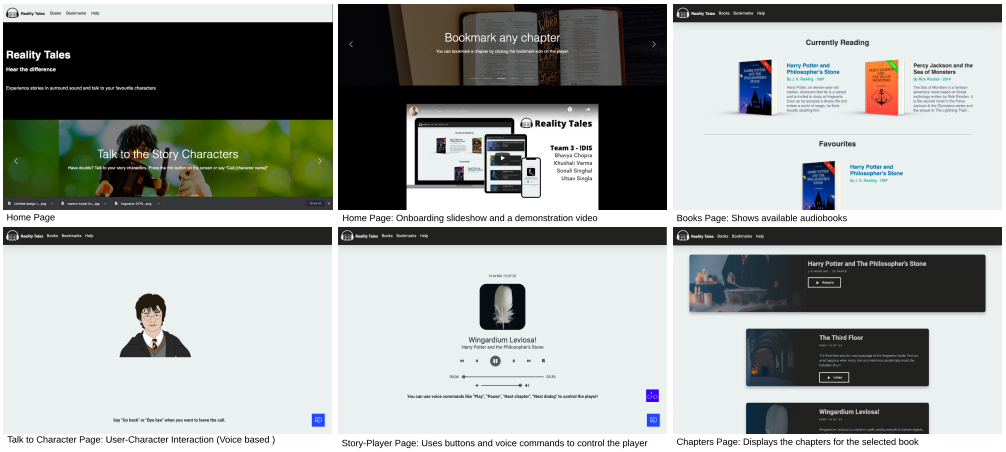


Figure 5: Final High-Fidelity Prototype

Category	Participant's questions	Character's responses
Personal	Do you like Hermione? [P1]	Hermione is a good friend. We first met her on the Hogwarts express and found she is sort of unfriendly.
	Who are your parents? [P10]	I am son of James and Lily Potter, a half blood wizard.
Third character	Who is George? [P4]	Fred and George are elder brothers of Ron. They are twins.
	Who is Hagrid? [P1]	He is really the sweetest man. He is a half giant and half human. He is our gamekeeper.
Story elements	What is Quidditch? [P15]	Quidditch is a wizarding sport played on broomsticks. It is the most popular game among wizards and witches, and, according to Rubeus Hagrid, the equivalent to Muggles' passion for football.
	What is a seeker? [P15]	Seeker is a position in Quidditch sport. There can be only one seeker per team and I was one for Gryffindor. The seeker has to catch the snitch.
Storyline	What is under the trap door? [P3]	No one knows what is under trap door. It is believed to be something from Vault 713.
	What is Wingardium Leviosa? [P10]	Wingardium Leviosa is one of the first spells learnt by any witch or wizard, including me. With the charm they can make things fly with the flick of a wand.

Table 1: The table presents a snippet of questions asked by our participants during voice interaction with Harry Potter.

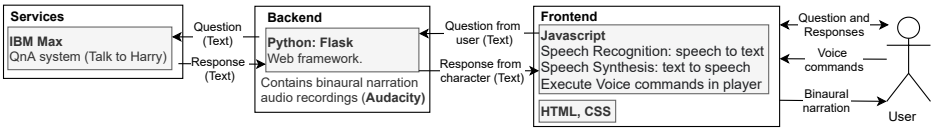


Figure 6: Technical Architecture: An overview of *Reality Tales* prototype workflow.

Character interaction fostered positive emotions. Following their interaction with Harry Potter, participants felt invested in the story and the character's life. We found an increase in levels of empathy, satisfaction, connectedness to the characters, and happiness. P10 said *"I felt good. I had not read the book earlier, but after talking to Harry, I felt the urge to know more and listen to more chapters."*

Character interaction increases curiosity. There was a considerable increase in the number of questions that participants ask from Harry Potter while using *Reality Tales* (Mean: 6.4 questions, Median: 5 questions), as compared to the number of questions that came to their mind while listening to the traditional audiobook (Mean: 1.4 questions, Median: 0 questions). After listening to the traditional audiobook, questions were only based on the

story excerpt's events they heard. However, when provided with the agency to converse with Harry Potter, their questions also focused on the characters' lives. Participants also asked follow-up questions, prompted by the responses that Harry previously gave. For instance, for P15, *"What is a seeker?"* prompted *"What is a snitch?"*

Living the storyworld. Binaural audio helped participants feel that they were present in the same environment as the story characters. P15 said, *"I felt a tickling in my back when I listened to the book, and it was 'ajeeb' [weird]. Then I enjoyed the sound."* Several participants indicated scope for improvement in the correctness of responses, level of detail, and the quality of the character's voice while having a conversation. P9 said *"I would love it if the questions apart from the chapter [more in depth about the character's personal life] could further be answered too."*

7 LIMITATIONS AND FUTURE WORK

Currently, the high-fidelity prototype is limited to two excerpts of Harry Potter and the Philosopher's Stone, and the character interaction is limited to one character: Harry Potter. We aim to include a more extensive set of stories and facilitate conversations with multiple characters. The text corpus is finite and requires to be manually annotated. To provide users with detailed and accurate responses while enabling them to ask a more comprehensive set of questions, we will explore automated methods for preparing the annotations. Further, the text corpus can be prepared to include a greater depth of personal information and feelings of the characters.

Additionally, we aim to make explorations to vividly portray the characters' personalities and voice timbre as the story progresses. Bringing the focus onto emotional and physical changes that characters experience throughout a story might provide a better storytelling experience. Another possible exploration for us could involve supporting a conversation with two or more story characters simultaneously.

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