

## Collaborative learning through story envisioning in virtual reality

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**Abstract.** We developed a story creation platform that allows for collaborative content creation in a 3D environment by utilizing avatars, animations, objects, and backgrounds. Our story envisioning platform provides a shared virtual space that promotes collaborative interaction for story construction, involving a high degree of learner input and control. It allows the L2 learners to perform as actors and directors to create the story and supports offline or online collaboration (online chatting). Using state-of-the-art technologies, the system creates 3D stories from text to be presented in virtual reality. The learner can choose premade assets and input the story script for conversion into story elements and timelines. Experiments with 35 intermediate learners of English on the usability of the system and user engagement confirmed the system's effectiveness to promote learner collaboration, peer support, negotiation, opinion exchange, and critical thinking. Learners found the system to be a powerful tool to visualize their thoughts, and revise/expand their stories, according to questionnaire results. This system brings an interesting and intense language practice that encourages learners to actively participate in the learning process through collaboration.

**Keywords:** digital story creation, collaborative learning, natural language processing.

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## 1. Introduction

Storytelling is an effective language practice that promotes learners' literacy skills, motivation, creativity, communication skills, and critical thinking (Ohler, 2013; Yang & Wu, 2012). Developments in multimedia technologies have led to the emergence of digital storytelling, which provides learners with accessible tools to create multimodal stories (Brunvand & Byrd, 2011; Russell, 2010). Such platforms (e.g. Second Life) are increasingly utilized in the Computer Assisted Language Learning (CALL) domain, making learning through storytelling a practical reality (Ribeiro, 2015; Sanchez, 2009).

With technology advancements, digital stories have entered into a new level of immersion and engagement with extensive freedom and control over the content generation. We developed a story creation platform that uses state-of-the-art technologies to receive learners' scenarios as input and convert them into 3D animated stories for further presentation in virtual reality (see the following section). This platform visualizes the story content made by the learners, enables role-play to modify or generate new content, and orchestrates the presentation of the story to control the tone, narration, and perspective. It also allows the learner to envision the story by adding meta-explanations about the characters' feelings and mental states (Figure 1).

Figure 1. Screenshot of a story generated by the system in the 3D environment (Meta-explanation about the character's feeling is added by the learner)



This platform can be utilized to (1) create personalized stories for sharing with others, (2) collaborate with peers to generate an integral story, (3) expand the storyline by building on top of each other's stories, (4) work on disjoint parts of a story in a group and integrate them, and (5) work in different groups to make multiple stories for a given situation. It reinforces self-expression and practical knowledge use by providing personally meaningful practice and feelings of self-inclusion.

Moreover, learners are engaged in meaning construction and content generation, and are encouraged to collaborate not only to generate the stories, but also to play the roles in their stories, to traverse back and forth in the storyline, to navigate between branches of the story, and to expand/revise those branches. Learners can switch between first-person and third person views to experience the story from different perspectives. The platform supports content and language integrated learning as well as situated and experiential learning, where learners are immersed in a virtual situation and interact to generate the content using the L2 (Coyle, Hood, & Marsh, 2010).

This paper investigates the platform's effectiveness in promoting collaboration, motivation, and engagement as well as the system's usability by inviting learners to create stories, observing their interactions with the platform, and asking them to give qualitative feedback via a questionnaire.

## 2. Story creation tool

Our proposed system analyzes the input from the user to extract different pieces of information that form the story (Figure 2). It extracts the characters of the story and assigns proper avatars to them, resolves their relative location based on the scene description and its arrangement, identifies the actions, and retrieves proper animations. It also handles character interaction in the form of speech and gestures, and classifies the mental process, feelings, and thoughts of the characters provided by the learner as meta-explanations. It allows for the selection of the cameras' point-of-view (first or third person) and cinematography profile to effectively convey the intended message and enable experiencing the situation.

The storyline is then formed as the succession of sequential and parallel actions, enabling learners to create alternative storylines as branches of the main story. Using such features, the system creates a 3D story in Unity3D®, supporting virtual reality to provide a sense of immersion (Figure 3).

Figure 2. System components and process flow

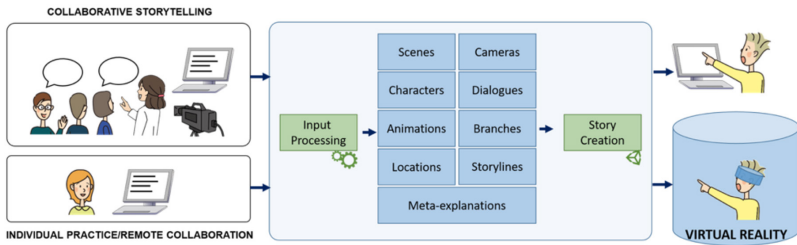
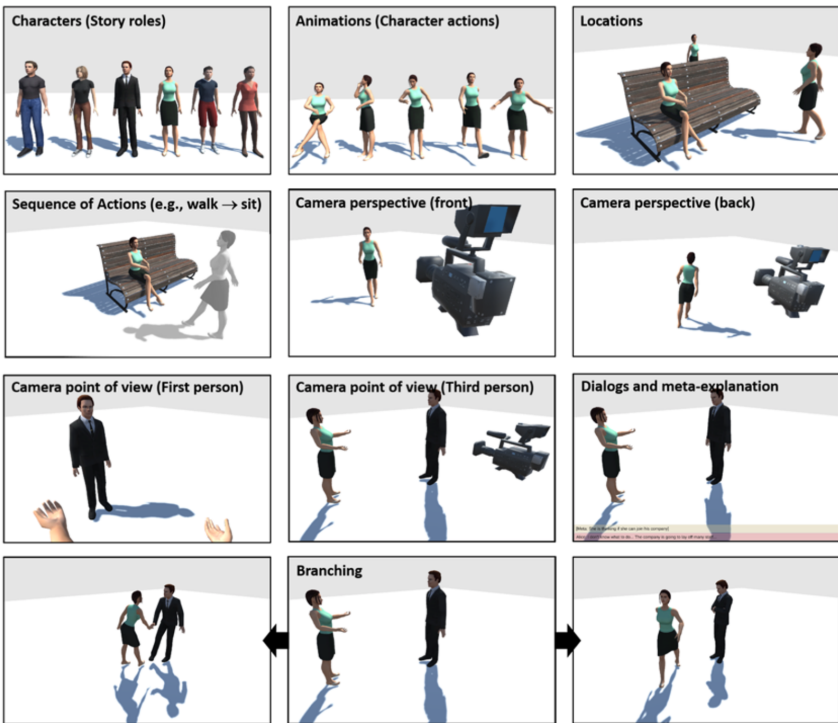


Figure 3. Characteristics of the system



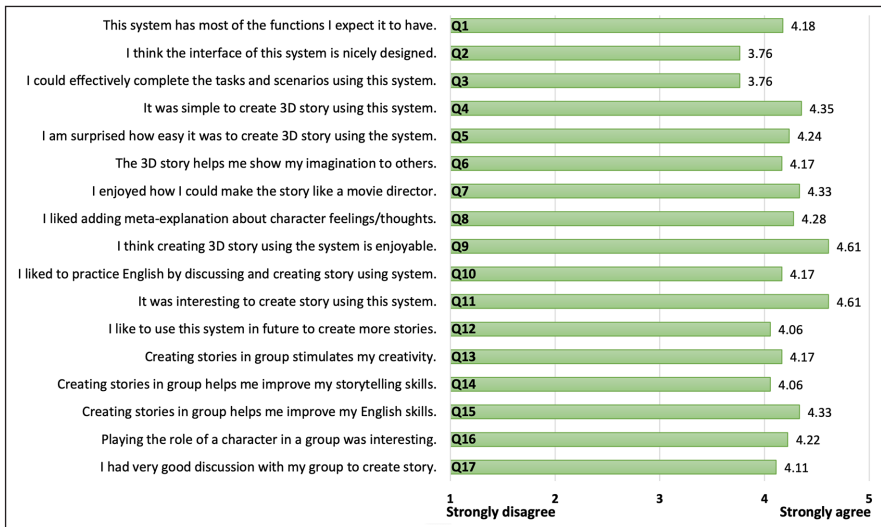
### 3. Preliminary evaluation and discussion

We asked 35 intermediate learners of English who were graduate students of Kyoto University to use our system in a CALL class and provide feedback. The participants

were divided into seven groups and were asked to collaborate to complete a short story. They were given a short opening of the story and the instructions on using the system. The story consisted of five characters and each participant was supposed to play one role. The participants were asked to discuss within the group to draft the final story including characters, actions, dialogs, and meta-explanation. They were instructed to use our tool for generating 3D animated stories and control the camera to make cinematic scenes as a director. The participants then shared their 3D stories with other groups. Finally, learners were asked to do a 5-Likert scale questionnaire, followed by an open-ended question (Figure 4).

As the data suggests, overall, learners were satisfied with the design of our system (Q1-2) and found it easy to use (Q3-5). Participants enjoyed it as the system visualized their imagination, allowed them to act as a director, and enabled inputting meta-explanations (Q6-8). Learners’ feedback on Q9-12 showed a high level of learner engagement. Finally, learners acknowledged that they benefited from collaboration in creating stories (Q13-17).

Figure 4. Learner feedback on the questionnaire



In the open-ended question about using the system, learners repeatedly linked their motivation to the system’s ability to create 3D stories and giving life to the characters (e.g. “It is so fun to see characters move”, “I like such an easy system to make a 3D story”). The system provided an atmosphere of collaboration, creativity, and critical thinking, with interesting instances of attempting to reach an

agreement (e.g. “I don’t think she should be kind to him because he was so mean to her”), negotiation of meaning (e.g. “What do you mean by he is unconscious?”), self-expression (e.g. “If I were her, I would leave him”), and especially creative reflection using the system’s ability to include meta-explanations (e.g. “I think she felt heartbroken, but not angry”). Moreover, the learners enjoyed watching other groups’ stories (e.g. “I liked their storyline”, “Surprising idea, it was very original”).

Monitoring the session, we observed a high level of learner engagement and motivation as they began to co-construct meaningful scenarios and using the system together. The degree of control over the system’s input motivated the participants to actively use this tool for the whole session by generating branches of the story and using different features to direct their story. Moreover, learners actively collaborated to create meaningful and realistic scenarios and used the system as a means of self-expression (Sanchez, 2009). Most learners emphasized that they enjoyed practicing English through story creation using our system. However, they had certain demands that the system could not fulfill at this stage, such as adding voice to the characters, modifying the main scene, and including effects (e.g. explosions).

## 4. Conclusions

We developed a 3D story creation system to convert learners’ scenarios into 3D animations using the scene as the environment, avatars as characters, animations as actions, cameras as different perspectives, dialogs or meta-explanations as narratives, and sequences of actions as the storyline. Learners’ feedback revealed a high degree of learner satisfaction, engagement, and motivation in using the system for generating collaborative stories. Moreover, the system promotes learner input by providing control over the story content, stimulates learner creativity by visualizing learner thoughts in 3D, and fosters collaborative learning to create and direct the stories. It is anticipated to be used as a platform for collaborative storytelling and story creation. Future work is to provide synthesized character voices, scene modifications, and adding fine-tuned actions.

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