Engaging with Virtual Characters using a Pictorial Interaction Language

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Abstract
Providing fun, engaging child-centric approaches to interaction is challenging. The Pictorial Interaction Language was developed for children to communicate interact with virtual characters in a serious game, MIXER. The design, development of the Pictorial Interaction Language is briefly outlined. Results highlight that children found interaction fun and were highly positive about the Pictorial Interaction Language.

Author Keywords
Pictorial interaction language; touch-based interaction; child interaction design; serious game

ACM Classification Keywords
H.5.2 User Interfaces (Input devices and strategies / Interaction styles).

Introduction
This paper presents an interaction modality developed for 9-11 year old children for use in schools. The Pictorial Interaction Language (PIL) was created to support and play a serious game, MIXER, developed in the eCUTE project. eCUTE aims to create and encourage technology enhanced learning experiences to promote cultural awareness. The focus of MIXER is to encourage children to learn how to recognize and resolve cultural differences.
**MIXER: Scenario**

In MIXER, see figure 1, the user plays the role of an invisible friend to provide advice and support to a virtual character, called Tom. During the game, Tom visits a summer camp and plays a game called Werewolves [1] with a group of virtual characters. Each player is assigned a role, as either a werewolf or a villager. The aim of the game is to deduce which character in the group is the werewolf, before the werewolf kills all of the villagers.

**Figure 1**: Children playing MIXER

During the game, Tom asks the child user for advice. For example, which of the other characters he should accuse and why, and how he should react when he is accused. After playing with one group of children, the yellow team, Tom then meets the red team, a different group to play Werewolves with. During the interaction with the red team, Tom and the user are confronted with crucial changes to the Werewolf game’s rule set, leading to a critical incident. This leads to a potential conflict situation that the child user helps Tom to resolve. MIXER’s message is that different cultures, as represented by the red and yellow teams, have different rule sets. Secondly, that conflict arising from rule differences can be understood and resolved by cooperating with one another through talking and shared understanding.

**MIXER Interaction Modality Requirements**

The interaction modality for MIXER aimed to:

- Provide an engaging interaction for children that overcomes the limited freedom of choice of traditional menu-based approaches, but that does not require using a keyboard.
- Support meaningful interaction with the virtual characters that inhabit the MIXER environment, enhancing cognitive and affective engagement with Tom and the resolution of the critical incident.
- Increase children’s immersion and engagement in the story and their perception of play, fun and novelty when engaging with MIXER.
- Facilitate and increase engagement to support the children’s experiential learning, allowing them to concentrate on the content and experience.
- Create a language that would enable a child to help a virtual character playing a game of werewolves with other virtual characters.

**Interaction Device for PIL: iPad**

For interaction with MIXER we used Apple iPads. The iPad is connected via Wi-Fi and sends and receives messages to and from our virtual character engine. The iPad was selected as the appropriate input device as using it adds to the user’s sense of fun and play. It also reinforces the user’s role as Invisible Friend to Tom. As can be seen in figure 1, the user observes what

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**Pictorial Interaction Language Development**

*Speech acts*: collected from 70 children during real life playing of Werewolf game.

*Icons Designed*: for the most frequently used words and phrases.

- Sounds, Defend, Calm

*Co-design workshop*: 30 10-11 year old children improved the icons’ understandability.

*Focus group*: 25 children with no prior exposure of PIL, identified all icons.

*Interface design*: only icons relevant to answering Tom’s current question provided. Users drag the icons forming a sentence, see figure 2.

*Piloting*: A short interaction with PIL was piloted with 60 children. Children also played a menu-based version. Children found PIL more fun and interesting than selecting from a standard menu.
happens in the MIXER virtual environment on the desktop, whilst interaction takes place on the tablet. This ensures that information that only the user should view is on the iPad, whilst MIXER action is visible for everyone in the immediate classroom area. This supports the impression of being an invisible friend.

**Supporting Dialogue and Interaction with Tom: Pictorial Interaction Language (PIL)**

The Pictorial Interaction Language (PIL) enables children to communicate with Tom during the Werewolves game. The PIL provides children with a set of icons on the iPad, see figure 2).

**Figure 2:** The PIL as seen on the iPad.

The icons are combined to create dialogue, through dragging and dropping the icons into a user response area. The icons enable the user to construct a wide range of different sentences. By pressing the send button, the constructed sentence is sent to the virtual environment for further processing in the agent minds.

Dialogue with the child occurs in a question and answer style, with the friend character asking for advice and the child user answering by constructing a message. For example, if Tom is the werewolf, he may ask the child ‘who do you think is the werewolf?’ followed by the query “Why do you think Jorden is the werewolf?” With the icons and sentence structure provided, only well formed sentences can be created by the child, whilst a variety of responses are provided.

With MIXER’s focus on children playing the Werewolves game we could not acquire a set of validated open source icons. Instead, we co-designed and tested our own icon set with children, as detailed in the sidebar. Our aim was to design icons to be sufficiently intuitive for children to construct meaningful messages. The final PIL comprised a set of over 60 icons co-designed with children, a sample is provided in the sidebars.

The PIL supports gameplay and enables the child to discuss choices with Tom. Apart from icons of the werewolf and other character, the majority of the icons showed a small green character, in different positions to convey the different action or reason states that were identified (see sidebar). The icons were colored green and red to convey positive and negative respectively, for example a green tick means ‘yes’ while red cross represents ‘no’. To ensure children’s comprehension of the icons, when they are moved, a text label is visible.

An example of a standard situation in the Werewolf game includes questioning why another player might be a werewolf. In response to this question, an action and a reason can be combined by the user. To help the user understand what kind of answers can be created, the
message is initialised by the words “You should / they…”, followed by three different colored views relating to actions and reasons respectively. Using the icons shown in the sidebar, messages such as “You should feel angry, they cheated” or “because he/she acts suspicious” could, for example, be constructed.

**Pictorial Interaction Language Evaluation**

Children interacted with the MIXER game and PIL in a classroom setting. Their views and responses to the PIL were evaluated using the questionnaire in figure 3, through classroom discussion forums, and observations by the research team.

Results with 66 children have been very positive with over three quarters of children reporting that the PIL was fun to play with \( \chi^2 (4, 65) = 41.39, p < .001 \), higher proportion of children rated the PIL as ‘fun’ than expected given equality across cells, and a good way to play the MIXER game (83%) \( \chi^2 (4, 65) = 57.23, p < .001 \), higher proportion of children than expected rated PIL as ‘a good way to play’ with MIXER. Children found the PIL easy to use (90%), \( \chi^2 (4, 67) = 93.82, p < .001 \) more children rated PIL as ‘easy’ to use than expected] liked the icons (75%), \( \chi^2 (4, 64) = 47.88, p < .001 \), more children than expected rated PIL icons as looking ‘great’, and found the icons easy to understand (80%) \( \chi^2 (4, 64) = 58.5, p < .001 \), more children than expected rated the PIL icons as ‘easy’ to understand.

No gender or age differences emerged, demonstrating that collectively children had a ready understanding of how to use the PIL, which in turn provided a novel, engaging and exciting experience with MIXER to promote cultural awareness and resolve cultural conflicts. During use of the PIL children quickly grasped the concept of dragging and dropping the icons into the corresponding response areas. Children were highly engaged and showed disappointment when the interaction was over.

**Discussion**

The PIL used on a tablet is well suited to provide an engaging and exiting experience for 10-11 year old children, engaging with virtual characters in a serious game. The PIL offers an interesting, effective modality to enable children to engage with virtual characters within an educational setting. Children found the PIL obvious and intuitive, rarely asking for any help. Children were able to construct sophisticated dialogues explaining their ideas and thoughts. Both results and observations highlight that the children really enjoyed using the PIL.

The Pictorial Interaction Language provides users with more freedom and fun than traditional screen and keyboard approaches, providing an enhanced educational experience for children and educationalists. The PIL highlights the potential of tablets and pictorial languages to replace keyboards as input devices for complex dialogue. The PIL could be modified for use across a range of applications targeting children, such as digital storytelling, learning and gaming.

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**References**