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
and interact with virtual characters in a serious game,
MIXER. The design and development of the Pictorial
Interaction Language is briefly outlined. Results
highlight that children found interacting fun and were
highly positive about the Pictorial Interaction Language.

Author Keywords

Pictorial interaction language; Touch-based Interaction;
Child Interaction Design; Serious Games

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) [1] was created to
support and play a serious game, MIXER [2], developed
in the eCUTE project. eCUTE aims to create and
encourage technology enhanced learning experiences
to promote cultural awareness.

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

Icon Design: for the most frequently used words and phrases.

Figure 1: 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 figures 3 & 4.

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.

MIXER: Scenario

In MIXER, see figure 2, 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 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 2: 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 the yellow team of children, Tom then meets the red team, and plays Werewolves with this different team. 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 cooperation, talking and shared understanding.

MIXER Interaction Modality Requirements

The interaction modality for MIXER aimed to:

▪ Provide an engaging interaction for children which 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 2, the user observes what 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.

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 4.
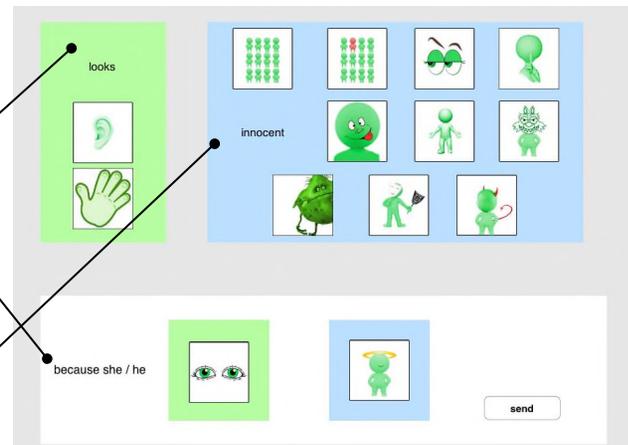

Figure 4: The PIL on the iPad.

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 message 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 an answer. For

example, if Tom is a villager, he may ask the child "Who do you think is the werewolf?" followed by the query "Why do you think Jorden is the werewolf?". The provided sentence structure is strictly followed, as icons are attached automatically to the right area when dragged to the response area. Thus, 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 and learning in a virtual environment, we co-designed and tested our 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. The icons were colored green and red to convey positive and negative respectively. 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 Werewolves game includes questioning why another player might be a werewolf. In response to this question, the user can combine an action and a reason. To help the user understand what kind of answers can be created, the message is initialized by the words "Because she/he ...", followed by two different colored views relating to actions and reasons respectively. Using the structure and icons shown in figure 4 and the sidebar, messages such as "because she/he looks innocent" or "because she/he acts suspicious" could, for example, be constructed.

Do you think the game on the ipad was:

EASY TO USE ... DIFFICULT TO USE
Completely agree   Agree   Not sure   Disagree   Completely disagree

FUN ... BORING
Completely agree   Agree   Not sure   Disagree   Completely disagree
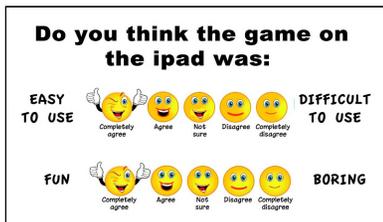
Figure 5: Questionnaire fragment

Children were positive about the PIL, rating it highly with most children finding the PIL easy, fun and a good way to play with MIXER.

PIL Question (N:66)	X^2
Easy/Difficult to use	93.82***
Fun/Boring	41.39***
Good way/Silly way to play	57.23***
Pictures great/Terrible	47.88***
Pics easy/diffic. understand	58.50***

***$p<.001$

Table 1: Chi-Square of ratings

The coloured rows represent the questions (e.g. was PIL fun/boring, etc.). The same colour coding is used for the bars in the following chart: (N:66)
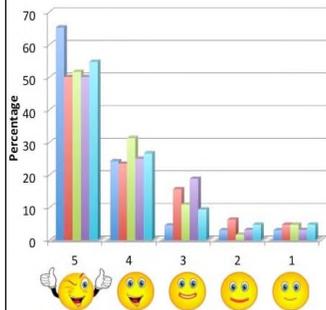

Figure 6: Children's ratings of PIL

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 a questionnaire (see figures 5 and 6), through classroom discussion forums, and observations by the research team.

Results with 66 children have been positive, see table 1. Over three quarters of children reported that the PIL was fun to play with [χ^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%) [χ^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%), [χ^2 (4, 67) = 93.82, $p < .001$ more children rated PIL as 'easy' to use than expected] liked the icons (75%), [χ^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%) [χ^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 to promote cultural awareness and resolve cultural conflict. 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 interaction 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. 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 enjoyed using the PIL.

The PIL provides users with more freedom and fun than traditional screen and keyboard approaches, providing an enhanced educational experience for children. The PIL highlights the potential of tablets and pictorial languages to replace keyboards as input devices for complex dialogue.

Acknowledgements

References
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