

Children's Emotional Interpretation of Synthetic Character Interactions

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Abstract. Using synthetic characters to support children's personal, social and emotional education requires that the emotional response elicited from the children is that desired by educators and stakeholders. This paper discusses an approach to understanding children's emotional interpretation of character's behaviour in a complex social situation. We outline this approach based on Theory of Mind concepts, that we have developed to enable us to understand and analyse children's emotional interpretation of synthetic characters involved in bullying scenarios in a virtual school. We discuss an empirical study of 345 children, aged 8-11 years, and concluded that our approach enabled us to gain a greater understanding of children's emotional interpretations. Results from the study identified that overall children did make appropriate emotional interpretations of characters and story, highlighting the potential of synthetic characters for exploring personal, social and emotional issues.

Keywords: synthetic characters, Theory of Mind concepts, virtual learning environments, personal, social and emotional learning, emotional interpretation

1 Introduction

Children's personal, social and emotional learning is an important factor for academic and non-academic success [14]. Synthetic characters offer high potential for providing such learning and a number of applications have been developed for classroom use. However, it remains difficult to identify and understand children's emotional interpretations of such interactions, and to evaluate whether these interactions do result in the desired personal, social and emotional learning outcomes required by educators and stakeholders.

In earlier work using Classroom Discussion Forums [5], a technique that has been used successfully to help children in vocalising and discussing their views and perspectives, we found that 8-12 year old children had relatively little to say about emotions, either those of the characters or their own emotions. To further understand children's emotional interpretation we have developed an alternative approach

focusing on story and character comprehension using concepts from Theory of Mind (ToM) methods that we discuss in this paper.

This research is occurring as part of a European project, eCIRCUS (Education through Characters with Emotional-Intelligence and Role-playing Capabilities that Understand Social interaction). eCIRCUS will support social and emotional learning within Personal and Social Education through virtual role-play with synthetic characters in a 3D environment that establishes credible and empathic relations with the learners. Our particular focus is on empathy and supporting children in empathic interactions and learning outcomes.

Empathy is essential for personal, social and emotional learning [8] and requires the ability to represent the mental states (thoughts, feelings, desires, hopes) of others. These skills are often referred to as ‘Theory of Mind’ or mentalising [7]. Being able to represent the internal mental state of another is assumed to play an important role in the activation of affective empathy.

Theory of Mind (ToM) is a concept closely interlinked to empathy and can be used to determine user’s perceptions and interpretations of synthetic character behaviours. ToM methods offer considerable potential for determining whether a child has appropriately interpreted the emotional message of an interaction. In this paper we discuss a ToM approach to investigate children’s emotional interpretation of interactions with FearNot (Fun with Empathic Agents to Reachout Novel Outcomes in Teaching), a virtual learning environment, populated by synthetic characters.

FearNot focuses on exploring bullying and coping strategies for 8-12 year olds, and here, we focus on relational bullying, which is bullying typified by social exclusion, verbal and emotional harassment and isolation [2]. In FearNot interactions we are aiming for the child to have an emotional response that indicates not only that they can correctly interpret a character’s emotional state and intent, but additionally that they engage and empathise with this.

In looking at children’s emotional interpretation of various relational bullying interactions within FearNot, we aim to identify if children understand and correctly interpret the actions and behaviours of the synthetic characters. In addition, we are interested in identifying if children’s real-world bullying roles (e.g. victim, bully, neutral) have an impact on emotional interpretation, with research suggesting there could be differences in Theory of Mind responses dependant on children’s bullying role [1].

Section 2 briefly outlines the FearNot scenario used for the empirical study with 345 children. Section 3 discusses the analysis approach we developed that aimed to understand children’s emotional interpretations. Section 4 presents the empirical study and results. Section 5 discusses these results and outlines future work. Finally some brief conclusions are provided.

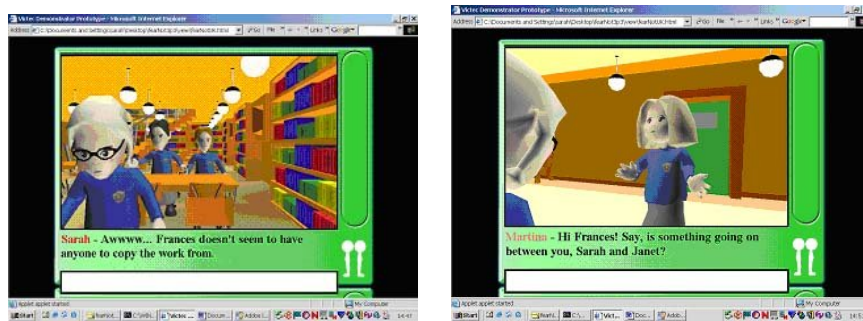
2 FearNot: The relational bullying scenario

The scenario begins with the characters, school and situation being presented to the children, providing them with the context of the bullying. The children then watch an episode, where Frances (the victim) is relationally bullied by Sarah (bully) and Janet

(bully assistant), with the bullying involving verbal harassment and social exclusion (see figure 1).

After the bullying incident, Frances goes to the school library, where she opens up a dialogue with the user. Within the initiated dialogue the user selects an advice from a list of coping strategies (shown as a drop down menu). The user also explains her selection and what she thinks will happen after having implemented the selected strategy, by typing it in.

Children then view Martina (the bystander) offering Frances (the victim) help (see figure 2), with Frances accepting an offer of friendship. At the end of the scenario, a universal educational message is displayed pointing out that “telling someone” is always a good idea.



Figs. 1 & 2: FearNot: the Relational Bullying Scenario

3 Investigating Children's Emotional Interpretation of FearNot

Although we have found that children were unwilling to verbally discuss emotions, the few comments received did appear to identify that they were emotionally interpreting the activities in the scenarios. In that verbal discussions were unsuccessful at gaining information about emotional interpretation, here, we discuss how we have sought to gain further insight into children's emotional interpretations using Theory of Mind with the following analysis approach.

3.1 Theory of Mind Questions

A series of ToM questions based on Happe and Frith (1996)'s first order and second order false belief questions were devised [6]. The questions were presented electronically to the children immediately after interacting with FearNot and were supported with FearNot screen shots, acting as aide memoirs to the characters names and situations within the interaction. The ToM questions required children to infer the emotions, mental states and intentions of the synthetic characters, with responses

including selection and free text entry. For the selection questions, children were presented with 5 emotional responses (neutral, sad, happy, fearful, angry) using facial representations. The child was instructed to click on the face that they thought represented the feelings of the character they are being asked about. They were then asked ‘which emotion to you mean?’ to clarify their interpretation of emotions.

The questions asked children to select how they thought the characters felt (by selecting the appropriate face) followed by a question asking them to explain why the characters might feel like this (free text). Children were asked about their emotional interpretation of characters feelings at specific times in the scenario: at the beginning of the scenario (before bullying had occurred); directly after the main bullying incident(s); and at the end of the scenario after coping strategies had been applied.

3.2 Analysing free text

Extending earlier work [4], here we have focused not only on the generation of frequency and percentage data from the ToM questions, but also on examining the children’s free text responses. A content analysis scheme¹ was developed to code children’s text-based responses for the following questions based on first order and second order theory of mind story comprehension: 1) What do you think is happening in the story you have seen?, 2) What does Sarah (bully) think about Frances (victim)? 3) What does Frances (victim) think about Sarah (bully)? 4) If you were Frances (victim), why do you think that Sarah (bully) is doing this? 5) If you were Sarah (bully), why do you think that Sarah is doing this to Frances (victim)? Questions 1-3 relate to first order theory of mind questions, whilst questions 4 and 5 consider second order theory of mind concepts.

Subsequently, each question was blindly and independently rated by two post-graduate coders. Each rater was supplied with a copy of the coding criteria and had to code each child’s response to the above questions. Kappa coefficients were then computed for each of the questions to ascertain the degree of inter-rater reliability. Kappa statistics of 0.6 or greater are considered highly adequate and indicate high levels of reliability. Table 1 illustrates the kappa coefficient values obtained for each of the questions. High levels of reliability were found for all questions. Therefore, no changes were required to the coding and subsequent analytical framework.

Table 1. Inter-rater reliability values for the story comprehension questions.

Question	Kappa Coefficient Value
1. What do you think is happening in the story you have seen?	0.79
2. What does Sarah think about Frances?	0.81
3. What does Frances think about Sarah?	0.72
4. If you were Frances, why do you think that Sarah is doing this?	0.77
5. If you were Sarah, why do you think that Sarah is doing this to Frances?	0.79

¹ Available at: <http://osiris.sunderland.ac.uk/~cs0lha/tom.htm>

3.3 User Bullying Characteristics and Theory of Mind

FearNot has been developed for exploring bullying and coping strategies. As part of our investigation we have sought to determine whether user bullying characteristics are reflected in interactions, in terms of mental representations as provided through the Theory of Mind. Children’s bullying characteristics were categorized into bullying roles using the School Relationships Questionnaire [11, 12]. Using this data, children were classified as ‘pure’ bullies, ‘pure’ victims, bully/victims or neutral children for both direct and relational bullying behaviour.

Children were classified according to physical bullying roles (bully, victim, neutral) and relational bullying roles (bully, victim, neutral). Table 2 illustrates that a similar proportion of children were classified as physical or relational bullies, victims and neutral.

Table 2. Peer nominated physical and relational bullying roles (%) (N: 319)

	Bully	Victim	Neutral
Physical	55 (17.2)	53 (16.6)	211 (66.1)
Relational	60 (18.8)	46 (14.4)	213 (66.8)

3.4 Emotional Interpretation: Scale of Correctness

A 5-point emotion identification scale ranging from 1 = most correct to 5 = least incorrect was constructed to analyse children’s responses of what the characters in the relational scenario were feeling at various stages throughout the story (Table 2). To construct the scale, 6 people independently watched the scenario and rated the emotional response in relation to each of the emotion related questions. High consensus was found, which allowed the scale to be developed based on what was deemed to be a correct emotional response through to an incorrect interpretation. This scale was subsequently used to investigate for possible differences in emotional interpretations of the characters, and bullying roles.

Table 2. Emotion identification scale ranging from 1 = most correct to 5 = least incorrect.

Question	Angry	Fearful	Happy	Sad	Neutral
Q2 How does Sarah feel at beginning of story?	2	3	1	4	5
Q3 How does Janet feel at beginning of story?	2	4	1	5	3
Q4 How does Frances feel at beginning of story?	3	2	4	1	5
Q5 How does Sarah feel after calling Frances names?	3	4	1	5	2
Q6 How does Janet feel after calling Frances names?	3	4	1	5	2
Q7 How does Frances feel after Sarah and Janet have called her names?	3	2	4	1	5
Q12 How does Frances feel at the end of the story?	3	2	4	1	5
Q13 How does Sarah feel at the end of the story?	2	4	1	5	3

4 Empirical Study and Results

The data used to investigate the children's emotional interpretation of the synthetic characters in FearNot, was collected during a large-scale evaluation with 345 children participating. 172 male (49.9%) and 173 female (50.1%). The sample age range was 8 to 11, mean age of 9.95 (SD: 0.50) and comprised of children from a range of local primary schools. Here, we focus on the relational bullying scenario, with the data relating to the physical bullying scenario having already been partially presented in [4].

4.1 Character Emotional Interpretation

No significant differences emerged between children's physical and relational bullying roles and emotional interpretation for the characters throughout the relational bullying story.

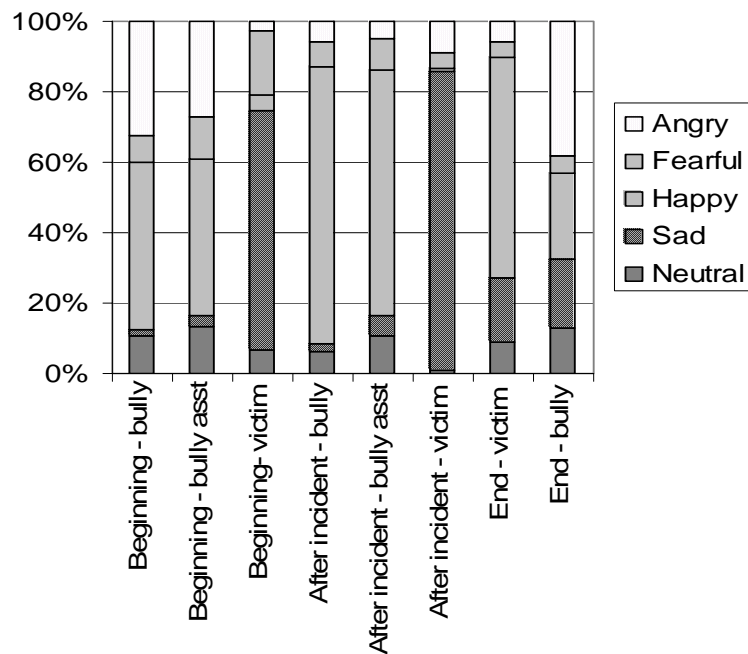


Fig. 3: Character Emotional Interpretation

Figure 3 illustrates the descriptive data for children's emotion interpretation responses for the three main characters in the story, Sarah the bully, Frances, the victim and Janet, the bully assistant. Responses were analysed at the beginning of the story, after a bullying incident had occurred, and at the end of the story.

Nearly 50% of children stated that the bully felt happy at the beginning of the story, followed by feeling angry or neutral. Only 1.5% of children stated that the bully felt sad at the beginning of the story. A similar pattern was found for children’s emotion interpretations for the bully assistant, with 44% stating that she felt happy, followed by 27% stating that she felt angry at the start of the story. Nearly 70% of children interpreted the victim as feeling sad at the beginning of the story, followed by just under 20% stating that the victim felt fearful.

Just under 80% of children responded that the bully character felt happy after having called the victim names, and a similar response pattern emerged for the bully assistant, although to a slightly lesser degree. 85% of children correctly interpreted that the victim felt sad after being called nasty names. With regards to how the characters felt at the end of the story, 63% of children responded that the victim felt happy, whilst just under 20% interpreted that the victim felt sad. The emotional interpretation for the bully character at the end of the story was less distinguishable. 38% stated that the bully felt angry at the end of the story, followed by 25% who said that she felt happy.

4.2 Understanding emotions in the scenarios

Using the content analysis scheme, children’s responses were analysed to see whether there was any relationship with bullying roles, and gender. Although no association was found between bully role and emotional inferences on the theory of mind questions, a number of significant gender differences were found.

Children’s responses to what was happening overall in the story were classified according to 4 categories: 1) bullying, being bullied, 2) being nasty, being picked on, teasing, 3) other reason, 4) don’t know/no comprehension. Chi-square analysis revealed a significant association ($X^2 (3, 320) = 14.38, p = .002$). More boys compared to girls did not understand the overall storyline, and more girls than boys identified the specific nature of the bullying in the form of name-calling, see figure 4.

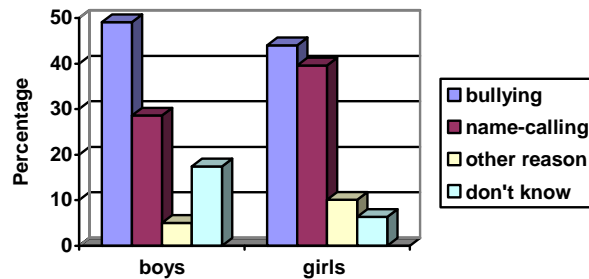


Fig. 4: Storyline comprehension and relationship to gender (N: 320)

Children were initially asked about their interpretation of the events that had happened in the bullying story. These detailed text-based responses were coded

according to three categories – good story recognition, some story recognition, no story recognition, see figure 5. Significant gender differences emerged ($X^2(2, 320) = 11.43, p = .003$). Males had significantly poorer overall story recognition of the relational bullying scenario compared to females.

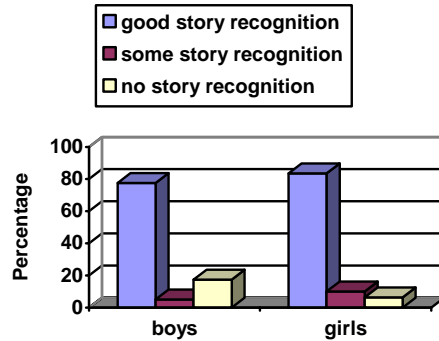


Fig. 5: Storyline comprehension and relationship to gender (N: 320)

A significant relationship was uncovered between gender and children’s responses to the first order theory of mind question ‘What does Sarah (bully) think about Frances (victim)?’ ($X^2(3, 296) = 7.40, p = 0.05$).

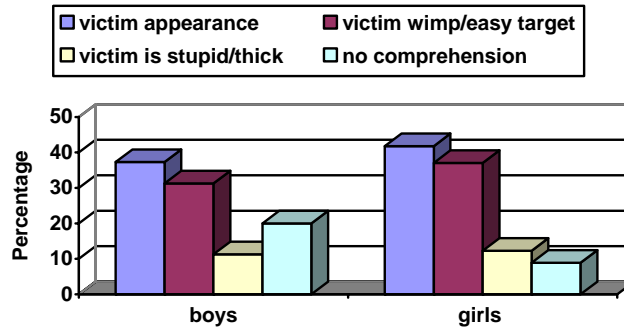


Fig. 6: Relationship between children’s responses to the question ‘What does Sarah (bully) think about Frances (victim)?’ and gender (N: 320)

Responses were related to the appearance of the victim (smelly, ugly, stinks, dirty), that the victim was a wimp and an easy target, that the victim was stupid and thick, or no story comprehension. The same pattern of findings emerged with more boys not fully understanding this question compared to girls. Girls were more likely to respond that the bully thought that the victim was a wimp/easy target, or had something wrong with their appearance (ugly, spotty, stinks, dirty) (see figure 6).

A significant trend was revealed between gender and the first order theory of mind question 'What does Frances (victim) think about Sarah (bully)?' ($X^2(3, 320) = 6.86, p = 0.07$). Responses to this question were coded according to Frances thinking that Sarah is a bully, that the bully is mean, selfish, bad, that the victim dislikes the bully, or no story comprehension. Boys were less likely to fully comprehend the question, and girls were more likely to state that Frances thought that Sarah was selfish, mean, unfair and horrible compared to boys (See figure 7).

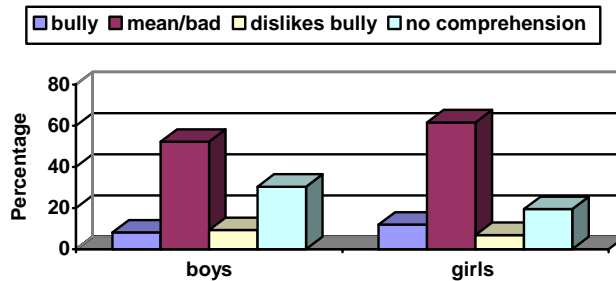


Fig. 7: Relationship between children's responses to the question 'What does Frances (victim) think about Sarah (bully)?' and gender (N: 320)

No further significant relationships were found between gender and children's responses to the second order theory of mind questions 'If you were Frances (victim), why do you think that Sarah (bully) is doing this?' and 'If you were Sarah (bully), why do you think that Sarah is doing this to Frances (victim)?'

4.3 Children's Emotions after the Interaction

At the end of the relational bullying story, children were asked to state how they felt. 57% of children stated that they felt happy at the end of the story, followed by just under 20% who felt neutral at the end. 14% of children felt sad, 8% angry, and 2% felt fearful. No significant association was found between bullying roles and end emotions felt. However, a significant relationship was found for gender ($X^2(4, 311) = 10.26, p = 0.04$). More boys stated feeling neutral at the end of the story compared to girls, and more girls stated that they felt sad at the end of the story compared to boys.

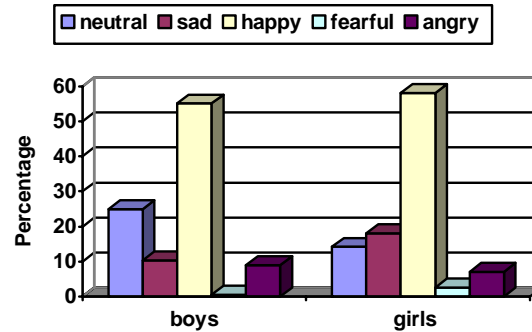


Fig. 8: End of story emotion in association with gender (N: 311)

5 Discussion

With FearNot, appropriate emotional interpretation is essential to permit the children to develop empathy with the characters. The approach discussed in this paper aimed to enable us to investigate children's emotional interpretation of the characters and the scenarios of FearNot. Our analysis focused on emotional interpretation intending to identify whether children were engaging, empathized and understanding the nature of the relational bullying scenario. Through this application of concepts from Theory of Mind methods we are able to identify that overall there was good emotional interpretation, with children understanding the story and how the characters felt at various points of the story. However, a number of our results were unexpected and require further consideration.

Although we anticipated a relationship between bullying roles and emotional interpretation of the characters involvement in the story, we found no significant differences. Emotional interpretations of the story were relatively correct and equivalent across bullying type and roles, a finding counter to the perspective that bullying roles are associated with different levels of emotional understanding and interpretation [1, 9, 10]. We hypothesised that victims would have lower emotion interpretation scores, and theory of mind abilities compared to bullies and neutrals, and that bullies would have superior theory of mind skills compared to victims and neutral children. Further, we have recently found that victims have difficulties detecting the emotions of others [13]. As emotion processing and theory of mind abilities are closely interlinked, in this study we anticipated that victims could have problems interpreting the emotions and intentions of the characters in the relational bullying scenario. However, the results from this present study do not provide any evidence to support these hypotheses.

For the first order theory of mind questions, there were significant gender differences. Fewer boys than girls understood the overall storyline and less boys than girls identified the specific nature of the bullying (name calling). In general girls

revealed a deeper, more insightful understanding of the story, rather than broader, more general interpretations as identified by the boys. However, a surprising finding was that no gender differences emerged for the second order theory of mind questions, which asked children why they thought the bully was doing this and why the victim would think the bully was behaving in this way.

Extensive previous research [3] has consistently found that males are usually poorer at recognising and interpreting emotional information, however, here there appeared to be no difference. This result could be due to the greater experience that boys have of interpreting digital media than girls; or possibly that the immersive nature of interacting with FearNot reduces the boys' levels of distraction and thus allows them to focus on emotional interpretation. However, further empirical work is needed, firstly to see if these results can be replicated and if they can, to try to understand the contributory factors underlying this result.

The results presented in this paper identify that our approach to dealing with a complex, challenging issue such as bullying, is an appropriate one for children in this age group. However, we recognize that a one-day lab interaction with FearNot does not provide us with sufficient data to determine if FearNot can actually have an impact on bullying behaviour. To address this issue in eCIRCUS we will be conducting a large longitudinal study of FearNot in the classroom situation over the next year, in the UK and Germany. This study includes an adapted version of the Theory of Mind framework discussed here, with modifications reflecting long-term use of FearNot.

The approach we have used, based on Theory of Mind concepts, provided us with considerably more information relating to children's emotional interpretation than other approaches we have used, such as questionnaires, interviews and group discussions. It has enabled us to investigate children's emotional interpretation of the scenarios and characters of FearNot, with the results indicating clear understanding and emotional interpretation from the children. We found that children are exhibiting appropriate emotional interpretations and responses to the behaviours of synthetic characters in complex social situations. Our results offer further support for the use of synthetic characters for personal, social and emotional learning.

6 Conclusions

Children's emotional interpretation of interactions with synthetic characters are difficult to determine. The approach outlined here, using questions based on Theory of Mind concepts offers considerable potential for investigating children's emotional interpretations and their comprehension of characters and the story. For FearNot, this approach has resulted in several unanticipated results relating to the impact of both gender and bullying role on children's emotional interpretation of synthetic character interactions. Through use of this approach we have identified that children can understand and emotionally interpret synthetic character behaviours in the complex social situation of relational bullying.

7 References

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