Building Empathic Lifelike Characters: the proximity factor

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Abstract

To achieve believability in embodied lifelike characters, developers must consider the empathic relations established between users and characters. Empathy can be defined in broad terms as "an observer reacting emotionally because he perceives that another is experiencing or about to experience an emotion". Thus empathy as such is an important element to consider when designing relations between users and synthetic characters. But do our characters elicit any emotional reactions? Are we able to build autonomous lifelike characters that, as people do, lead users to feel sad, angry, happy or disgusted? As pointed out in [11], creating technically perfect animations "is not enough to make us laugh and isn't what makes the tears come".

In this paper we will focus on the role of empathy in the construction of embodied lifelike characters in particular to, what we call, the proximity factor. This factor is based on the evidence in literature that people experience more empathic emotions when the incidents are associated with people with whom they have a communal relationship. Thus, designing agents for empathic interactions, we should careful address how close the user will feel with the synthetic character. In order to illustrate this factor in eliciting emotional reactions to synthetic characters, we will present a specific system called FearNot!. FearNot! was developed to address the difficult and often devastating problem of bullying in schools. By using role playing and empathic synthetic characters in a 3D environment, FearNot! allows children from 8 to 12 to experience a virtual scenario where they can witness (in a third-person perspective) bullying situations. To build empathy into FearNot! we have considered the following components: agent's architecture; the characters' embodiment and emotional expression; proximity with the user and emotionally charged situations. In this paper we will focus primarily on the proximity factor and report some results achieved in the evaluation done with 127 children and 95 adults on the system.

1. Introduction

Virtual Environments (VEs) populated with animated characters offer users a safe environment where they can explore and learn through experiential and entertaining activities [6]. Ranging from different application areas, such as computer games, e-commerce or virtual storytelling, synthetic characters in VEs are now moving from the purely academic research into the commercial world. This growth is certainly associated with the need to enrich the communication between people and computers. Indeed, we expect that the introduction of new modalities in the communication between humans and machines will bring a degree of richness to the interaction, leading to a more and natural communication, inspired by the way we interact with each other. Animated characters offer a high level of engagement, through their use of expressive and emotional behaviours [9], making them intuitively applicable for exploring personal and social issues. However, the design and implementation of VEs populated with animated characters are complex tasks, involving an iterative development process with a range of stakeholders, requiring expertise from diverse areas such as psychology, artificial intelligence, computer graphics, computer science, design, facial and gesture movement studies, theater, among others. Bringing all these competencies together is what gives synthetic characters the richness needed to be believable.

In particular, one important factor that leads to believability is the perceivable actions and expressions of the characters. According to Thomas and Johnston [11], animators from Disney, there are three important points when expressing emotions: (1) the emotional state of the character must be clearly defined, in such a way that is undoubtedly perceived by the viewer; (2) the emotional state affects the reasoning process and consequences must be perceivably reflected in the actions of the characters; and (3) emotions can be accentuated or exaggerated, to clearly communicate to the viewer the emotional state of the character. Another element is personality. A coherent character, that acts according to its personality will be more believable than a character that has no long term coherence in its behaviour.

Thus it is not so much one property or another that matters but the combination of all these factors, that together providing ingredients for the building of the believability in a synthetic character.

Furthermore, when we watch a film, or read a book, we do not only suspend our disbelief and look at the characters as "alive", we also establish emotional relations with the characters, even if they are ducks, ants, cartoon or realistic. We feel sad when they are sad, angry when something unfair is done to our favourite character, and so on. That is, we put ourselves in the shoes of the characters, and feel emotions about what is happening to them. Who does not remember the emotional power of the situations created in Disney's Ugly Duckling film, when the poor duckling fails everything, the other characters ridicule him, leading him to fail again and again. The emotion felt when he finally succeeds, in a unique and heartbreaking way, is such, that everyone feels like cheering [11]. So, together with emotional expression, autonomy and personality, we believe that "empathy" is also an important factor that can lead characters to become believable.

Empathy can be defined in broad terms as "An observer reacting emotionally because he perceives that another is experiencing or about to experience an emotion". Another, less broad, definition is given by Wispé that described empathy as "the process whereby one person 'feels her/himself into the consciousness of another person" [13].

Although animators and film makers have been doing it for years, creating embodied lifelike autonomous characters that have the power to make the user feel emotional reactions is still an unexplored and hard research challenge. There are several factors to take into account and each one of them is, per se, a research topic. In this paper we will discuss the role of empathy in the construction of synthetic characters, focusing primarily on how to build characters to evoke emotional responses (empathic responses) and in particular to the aspect of "proximity" to achieve it. To illustrate the problem we will present a specific system (FearNot!) developed for addressing bullying problems in schools using an interactive virtual storytelling environment.

2. Example Application: FearNot!

Bullying behaviour is characterised as *"a repeated action that occurs regularly over time, and usually involves an imbalance in strength, either real or perceived"* [2]. Bullying has associated with it a wide variety of behaviours such as hitting, kicking or punching, in the case of direct bullying, or, in relational bullying, social exclusion or malicious rumor spreading. It is this a repetition of violent pressure over time (physical or verbal) that distinguishes bullying from other types of violence, making its consequences so potentially dangerous and enduring.

A wide range of anti-bullying initiatives have been developed, focusing on the victim, the bully or the whole problem. One approach uses live performance to dramatize the problem, with actors presenting a narrative, followed by workshops in which groups discuss the story. In an extension of this, Boal's Forum Theatre [1] allows each group to take responsibility for one of the characters and to meet with the actors 'in role' between episodes of the story. Such an approach is however expensive and hard to organise, while the presence of the group is often intimidatory (some members may be bullying others) and can even emphasize existent conflicts.

Virtual learning environments can be a solution to such problems. Through the implementation of a virtual Forum Theatre, one can hope to create a safe environment in which individual children can explore different perspectives on bullying behaviour. These were the main foundations that forged the VICTEC project.

The overall pragmatic objective of the project is the development of *FearNot!*, an anti-bullying demonstrator in which children age 8-12 experience a virtual scenario where they can witness (from a third-person perspective) bullying situations. To avoid group pressure and enable individualized interaction, the experience is for a single user. The child acts as an invisible friend to a *victimized* character, discussing the problems that arise and proposing coping strategies. Note that in bullying situations there are quite clear identifiable roles: the *bully*, the *victim*, *bully-victim* (a child that is sometimes the victim and sometimes the bully) and bystander.

The scenario begins by introducing the child to the school environment and the characters, providing a starting context. The whole session is developed one episode after another. After each episode, the child takes the role of a friend of the victim advising her on what to do. Within an episode, the child is mostly a spectator of the unfolding events (the narrative emerges from the actions of the participant characters). After each episode, however, the victim

Figure 1. A first prototype of the fearNot demonstrator

will seek refuge in a resource room (identified as a library) where a personalized conversation with the user can occur. Here, a short dialogue takes place where the victim raises the main events that occurred in the previous episode and asks for the child's (user) opinion and suggestions for future behaviour. Nevertheless, note that the victim is clearly recognized as a *believable self*, with its own personality and behaviour, and thus may decide to reject the user's suggestions (see Figure 2.
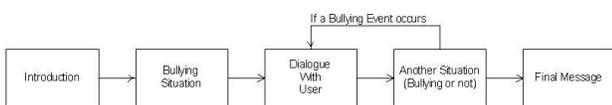

Figure 2. Interacting with FearNot!

Each dialogue finishes with a decision that influences the character's behaviour in future episodes. Thus, episodes are not pre-scripted, and the characters act autonomously, performing their roles *in character*. To ensure a user-centered experience, the overall characteristics of each episode are decided by an external entity, a *stage manager* (see [10] for more details). This entity selects appropriate places and characters that *potentiate* the occurrence of certain events favouring an authored educational purpose. Nevertheless, the characters autonomously decide their actions.

Bullying, like many of our everyday problems, has no 'magic wand' solution - only more or less frequently successful strategies. The only universally accepted message is that passivity is no solution, and one should never suffer in silence. The purpose of the system is not to deliver a 'right answer' but to present a multitude of options to the child, and allow him or her to explore possible consequences for certain courses of action. The use of an intelligent virtual

environment with characters and emergent narrative gives us that possibility.

3. Empathy in Embodied Lifelike Characters

The term "empathy" stems from Titchener [12], who derived it from the Greek "empatheia" which means "passion", "passionate affection" or "to be much affected" (Levy, 1997). Titchener used "empathy" as a translation of the German term "Einfühlung" which means "feeling into" somebody. In general, defined as "the capacity of participating in or vicarious experiencing of another's feeling, volitions, or ideas and sometimes another's movements to the point of executing bodily movements resembling his", (Dictionary). This definition implies that, firstly, empathy is an internal state similar to an emotion; and secondly that emotional state can sometimes be recognised through imitative bodily movements. As reported by Plutnick [8] empathy is also found in animals and is a widespread phenomenon in the animal world, involved in a wide variety of behaviour patterns such as schooling or flocking. All these behaviours involve mimicry and affective communication. In general, empathy refers not to processes between a person and an object, but to processes between two persons, where one person perceives the other. The perceiving person, or the persons who "feels into" the other person, is called the "observer", and the perceived person is called "target".

Most contemporary psychologists agree that there are two aspects of empathy that have to be distinguished. The first one is the *mediation of empathy* and the second the *outcome of the empathic process*. Concerning the mediation of empathy, one can distinguish two different ways of mediating: (1) via the situation and (2) via emotional expressions. When empathy is mediated via the situation, the observer concludes the emotional state of the target from the situation the target is dealing with. For example, if the observer perceives the target being hit by another, he may think that he would be very angry in that situation himself. So the target will probably feel angry, too. Empathy may also be mediated via emotional expressions of the target. This occurs when the observer interprets the behaviour of the target, as for example, assuming that when a target smiles he/she is probably happy.

These two aspects give rise to the empathic process, which in turn may have an outcome. According to Davis [4] empathic process's outcomes can either be cognitive or affective. A cognitive outcome involves cognitive activity of the observer, such as obtaining more information about the target or acting to help the target , whereas an affective outcome (the one we usually consider as empathy) means that

the observer experiences an emotion because of his/her perception of the target.

Our main focus in this paper is on how to build characters to evoke emotional responses (empathic responses) from the user.

Our main hypothesis is based on the idea of *proximity*. There is evidence in literature that people experience more empathic emotions when the incidents are associated with people with whom they have a communal relationship (where communal relationships are friendship, romantic love or family relationship). Also, people who perceive themselves to be similar to another also perceive themselves as having stronger communal relationships with the other, and in turn, experience more empathic compassion when the other is in need. For example, if the target is of the same age and with similar features and attitudes. These findings suggest that one way for the user to feel empathy and put him/herself in the place of a character is to find similarities with between the user and the character, so that the user feels similar to the character. So, what we call the proximity factor, tells us that, in order for a synthetic character to evoke affective and cognitive empathy, users must feel close to the character. Further, we argue that this is achieved by designing the whole environment and situations in a way that users feel some degree of familiarity and closeness with the characters, environment and situations.

Based on this hypothesis in FearNot! we took several decisions where proximity was taken into the whole design process. From the start of the project we have involved children and teachers, and the characters were evaluated by the children from their creation. This evaluation was aimed at obtaining characters children will relate and at the same time identify with. To do that, proximity was considered at several levels of design as described bellow.

3.1. Evoking empathy: The character's behaviour

One of the most important aspects to consider is the characters' behaviour. In FearNot! the behaviour of the characters is generated autonomously based on an architecture that contains a way to appraise situations (whether actions or expressions of the other characters or situations) that will lead an emotional state to become active (appraisal module). It also contains a representation of others, in particular their emotional state and an action selection mechanism that leads the characters to act according to a certain emotional state. The main aspects of this architecture are:

- A model of the world that includes a model of the self with emotions representation and a model of the other agents (also an affective model);

- The emotional model is parameterized for agent based in a personality profile (see below);

- An appraisal component;

- An action selection component that depends on action tendencies associated with the emotions represented;

- A coping mechanism;

- An affective expression component including body, facial expressions and speech.

The appraisal component is responsible for appraising the situations (events) of the character and generating an emotional state. In the case of FearNot!, events are appraised based on the Ortony, Clore and Collins' Cognitive Theory of emotions [7], which considers appraisal as a subjective evaluation of a given event according to the character goals, standards and beliefs. Our model uses two of the OCC goal types (the active-pursuit goals and interest goals), where the active-pursuit goals are goals that the characters actively try to achieve, like going to the football match in school. Thus, as in [5], the creation of emotions is handled by an automated mechanism, which launches emotions according to the events perceived and the emotional characterization of the characters. For each character it is therefore necessary to specify the events to which it reacts emotionally. This is done by providing values or functions for the several appraisal variables defined by OCC, such as for instance, the unexpectedness variable. Each time an emotion is created, a potential value for the emotion is calculated from the appraisal. Each character has a set of emotional thresholds and emotional decay rates (one for each emotion type) according to his personality and more importantly its role (bully, victim, bully-victim, or bystander). These emotional thresholds are the emotional profile of that character.

In order to follow the proximity principle we parameterized each character taking into account data we have about the characteristics of the different roles (bully, victim, bully-victim and bystander), we are able to parameterize the characters according to their role. The emotional profiles of our characters are based on studies done by bullying specialists that provided us some guidance on particular characteristics of both bullies, victims, bully-victims and bystanders. The rational is that these roles are familiar to the child and that making these roles transparent somehow increases familiarity, and thus empathy. Real victims of bullying are thus more likely to empathize with the virtual victim, and by doing so, the final message given by the system *"Tell someone you trust"*, will more likely be followed in real life. To create these roles we will parameterize the emotional profile of the agents, in particular its emotional threshold and decay rate. The threshold represents the character's resistance to an emotion type (for example, bullies may have a higher threshold to negative emotions than victims). The decay rate represents how fast the emotions of an emotion type fade out. When the emotion intensity reaches zero (de-

pending on the decay rate), it is removed from the character's emotional state. An emotion is added to the character's emotional state only if the emotion's potential surpasses the defined threshold (thus bullies and victims react differently to the same events in the world even under the same circumstances). Further, if an equivalent emotion already exists already, no emotion is added, but the existing emotion's potential is recalculated using the logarithmic sum of both emotion's potentials. Finally, once the emotional state is appraised, agents need to choose the most adequate action to perform and emotions must have an effect on such actions. In FearNot! they can be conceived of as plans (stored as a library of plans) or programs to achieve such ends, which are put in a state of readiness.

3.2. Evoking empathy: The character's physical aspects

In FearNot! characters are embodied, which means that we can use facial expressions, attitudes, body expressions to convey their emotional states.

So, we designed the characters and the situations for the age groups we are targeting. For each country (UK, Portugal and Germany), we designed different characters given that children in the UK have uniforms and in Portugal and Germany do not.

Figure 3. Three of the characters developed for the FearNot! application (John, the victim, Martinha, the neutral and Luke, the bully)

We also have considered specific situations for both genders (more direct bullying for boys and relational bullying for girls, see Figure 4). Finally, we used very popular characters from a Portuguese children's web portal (Cidade
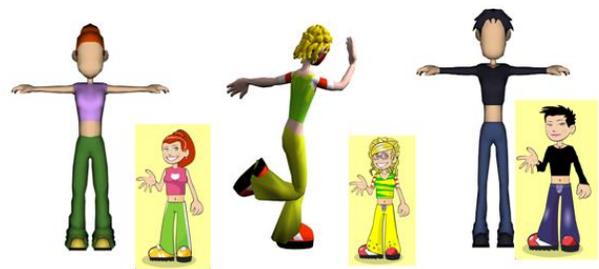

Figure 4. Some characters developed for FearNot! targeting teenager girls

da Malta in http://www.cidadedamalta.pt/), originally in 2D and converted to 3D for the project.

3.3. Evoking empathy: Conversations and Expressions

Further, and as described earlier, empathy can be mediated in an affective way, so the characters must be able to express emotions in facial expressions, voice and body posture. If the user perceives the agent expressing emotions that are adequate to the displayed situation, believability and empathy should increase. In FearNot! we use mainly facial and body expression. A precondition therefore is that the emotional expression can be recognized by the user correctly. Another possible mode of emotional expression that avoids the danger of misinterpretation is language. The agent could inform the user about his emotional state verbally. One should note that the cognitive component of empathy would be realized if the user has the impression that the virtual agent "knows" something about the user's inner state.

In order to clearly convey the character's emotional state we decided to adopt cartoon like characters. In fact, tests carried out with children in associated schools revealed that children preferred the cartoon characters. This also reduces the importance of using complex and resource intensive real-time facial animation and lip-sync. Simple textured faces (see Figures 3 and 5) can be very believable (even more believable than perfectly modelled faces).

As for conversations, we collected from schools several scenarios with typical dialogues and even with common aggressive names uttered between children of the targeting age.
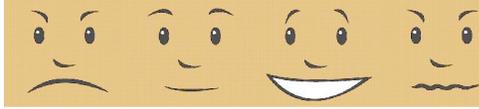
Figure 5. Example of Some Facial Expressions in Characters

3.4. Evoking empathy: The Storyline

Finally, bullying is episodic, where a sequence of similar situations - sometimes apparently innocent on their own - builds into a serious issue that affects the victimized child. Such a build up of situations is essential for the development of empathy. Long-term and abstract planning of all the possible situations would be extremely complex and is avoided by using the characters behaviours to create an emergent narrative.

Thus narrative management in needed to guarantee that the situations lead to the empathic relations we desire. A *stage manager* is therefore used to determine the required characteristics of each episode, drawing on situations that we clearly find in schools. This entity selects appropriate places and characters (according to the knowledge of experts in bullying) that *potentiate* the occurrence of certain events favoring specific authored purposes. Nevertheless, although the situation is externally prepared, the characters autonomously decide their actions, performing their roles *in character*. For example, if we wish to potentiate a direct physical bullying event, we can choose a situation involving the bully and the victim alone in the dressing room. If some aggression is detected, the episode then halts and the system passes to the reflection phase (phase where the child advises the victim) .

3.5. Evoking empathy: The environment

As with the characters we have designed a set of schools (although all are cartoon like) that resemble to different types of schools the children belong. So, for example we have urban and countryside schools as well as country specific schools. For example, Figure 1 shows one character in a urban Portuguese school, and 6 shows one of the designed classrooms.

4. Evaluation and Results

The main focus of this evaluation was to consider the different perspectives and empathic reactions of adult and child populations with the system. The main questions we were seeking to answer were: Are there differences in the views, opinions and attitudes of children and adults? And,

Figure 6. One of the characters in a classroom

if there are differences in the empathic reactions to the system and do these have any important design implications for empathic embodied characters?

4.1. Experimental Design

Using one limited version featuring a single bullying episode of FearNot! already released and evaluated with several types of users we have conducted a set of experiments in three different countries: UK, Portugal and Germany. All the main aspects of the architecture were already in place and the characters built follow the requirements presented. Children were shown the trailer of the FearNot! which depicts one physical bullying episode developed by experts in bullying research in conjunction with teachers and pupils. All characters and animations, places and objects were transposed to 3D by the team of designers according to the principles just described. The dialogues were obtained through the recording of real voices. The physical bullying episode contains 3 characters, Luke the bully, John the victim and Martinha the narrator. The trailer begins with an introduction to the main characters, Luke and John and subsequently shows Luke knocking John's pencil case off the table and then kicking him to the floor. John then asks the user what he should do to try and stop Luke bullying him and arrives at 3 possible choices: 1) Ignore Luke, 2) Fight back, 3) Tell someone that he trusts such as his teacher or parents. Developmental constraints of the application did not allow us to include the dialogue phase in the first trailer developed. Nonetheless, the importance of the dialogue phase for the overall success of the application required us to include it in the demonstrator (as briefly stated).

A questionnaire applicable for children and adults was designed in order to evaluate aspects of FearNot, the VICTEC bullying demonstrator. The questionnaire was di-

vided into 7 main sections and was predominantly measured according to a 5 point Likert scale. Table 1 illustrates the main sections of the questionnaire and the nature of the questions within each section

Section	Nature of question
1	**Preferences for cartoon or realistic characters**
2	**Characters attributes** - voice believability - likeableness - conversational content (believable to unbelievable) - conversation interest (interesting or boring) - realism of characters (true to life to false)
3	**Character Movement** - movement believability (believable to unbelievable) - realism to movement (realistic to unrealistic) - smoothness of movement (smooth or jerky)
4	**Appearance of the school environment**
5	**Bullying Storyline** - storyline believability (believable to - unbelievable) - storyline lenght
6	**Character preference** (character likes most and character liked least)
7	**Empathy towards characters** Feeling sorry for characters (and if yes which character) Feeling angry towards the characters (and if yes which character)

Two hundred and twenty five questionaires were done, out of which 128 by children from schools in England and Portugal. The remaining were done by adults (teachers and experts). These are some of the results (more on these results can be found in [3]) that show partially the significance of the proximity factor.

4.2. School Environment

Significant differences were revealed between child, expert and teacher views of the appearance of the school environment in the trailer. Post hoc tests showed that these significant differences were between the child and expert views and between the child and teacher views for the attractiveness of the school environment, indicating that the children viewed the school environment more positively than experts and teachers. Furthermore, there were also significant differences between child, expert and teacher views in relation to the match between the environment and the characters. These significant differences lay between the teacher and the child, where children were significantly more positive towards the match between the school environment and

characters compared to teachers. We found this result quite positive as we wanted children to feel as close as possible with the environment.

4.3. Character Movement

Concerning the character's movement, there were significant differences between the stakeholder groups and views of the believability of character movement. Children thought that the character movement was significantly more believable than teachers, which again is quite positive. Overall, no significant gender differences were revealed for the believability of character movement, however, when age was taken into account, female children found character movement significantly more believable compared to female adults who found the character movement least believable. Again this show that our design was able to inspire more belivability to the right target users. Significant differences emerged for views of the realism of character movement where children thought that the character movement was significantly more realistic compared to teachers and experts. An independent samples T-test revealed significant gender differences for the realism of character movement. Females found character movement significantly more realistic than males. When age was considered, female children found the character movement significantly more realistic compared to male children, male adults and female adults.

4.4. Conversation and Storyline

Significant differences were found in the views of the true-to-lifeness of character conversation, where teachers found the character conversation significantly more false and less true to life compared to children. Given our effort in obtaining real children dialogues and scenarios, this again is a quite positive result. Furthermore, significant differences were found between groups for views of the believability of the storyline where children found the storyline significantly more believable than teachers.

4.5. Affective and Cognitive Empathy

Significant differences were found between children, experts and teachers for affective empathy. Significantly more children (80%) expressed feeling sorry for the characters compared to teachers and experts (70%). Affective empathy was only expressed for Luke and John, and not for Martina. Significant differences were uncovered for age and gender, $(x=15.02, N=213, df=3, p=0.002)$ where significantly more female children (95%) expressed affective empathy compared to male adults (67%).

Significant differences were found between children, experts and teachers for cognitive empathy. Significantly more children (71%) expressed cognitive empathy towards characters compared to experts (47%) and teachers (28%). Significantly more experts expressed anger towards John (the victim) compared to children and teachers and significantly more teachers expressed anger towards Martina compared to experts and children. Interesting significant age and gender differences emerged, where significantly more female children expressed anger towards the characters compared to adults. This anger was almost exclusively directed at Luke (90%), the bully , which again is a very positive result because it shows that FearNot! can evoke emotions to children of the age that we are targeting.

5. Final Discussion

In this paper we have provided a discussion on some of the features needed to build characters that are able to establish an empathic relation with users. One of the issues here described is what we call the proximity factor that tells us that, in order for a synthetic character to evoke affective and cognitive empathy, users must feel close to the character. Further, we argue that this is achieved by designing the whole environment and situations in a way that users feel some degree of familiarity and closeness with the characters, environment and situations.

To illustrate these issues we have presented a system FearNot! that has been developed to address bullying problems in schools using empathic synthetic characters. We have described some design decisions of FearNot! and discussed the results attained with the trailer, in particular the aspects associated with the proximity of the characters with the user.

6. Acknowledgements

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