Intercultural-role Plays for e-Learning using Emotive Agents

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Abstract: This paper presents joint work between an Australian team developing role-based games for experiential learning of Aboriginal culture, and a Portuguese research department developing interactive modules to create believable agent reactions in virtual environments. The game incorporates recorded stories in an online system to teach culture. Teaching scenarios group the narratives along a learning path, but their presentation in the game requires an emergent narrative to provide the flow through agents that reacts to the players' actions and enacts significant aspect of the culture. We present here the existing agent modules and how they will be used in this project and the challenges in extending the work to this new domain.

1 INTRODUCTION

When confronted with cultures with widely different priorities and forms, we are often quite unaware of the effect these rules can have on relations between individuals and groups. In this project we are aiming to teach a historical perspective of the Aboriginal culture of Australia that has been largely subsumed and denied within the mainstream culture. However the culture continues to exist and individuals continue to practise the rituals, adhere to the values or norms and learn from childhood how to read the symbols of the culture (Hofsted, 1991).

The teaching process to be used is highly experiential and will incorporate role-playing within a game that will be built from stories provided by Aboriginal people. The focus of the teaching is an example amalgamated from the Aboriginal kinship systems of Australia.

The kinship system provides a series of rules that are important within the highly mobile cultures for maintaining genetic health and communal responsibilities, but also forms the basis of a highly complex process of knowledge sharing and learning. This lends itself to the process of developing an emergent, self-generated narrative from community stories (Spaniol et al., 2008) by using an agent-modelling system to provide realistic agents within a culture that is different to that of the player (Nazir et al, 2008); (Endrass et al., 2011) and to support learner modelling (Aylett et al, 2005).

Simple scenarios are created for the teaching framework, and then presented in a game format that varies with the player's interactions and the interaction of the agents on the screen through the agent modelling.

2 LEARNING SYSTEM

The learning system is a Unity game with animated characters presenting video narratives from Aboriginal people. The system is to be used at University as part of the assessable coursework, to enable students and staff to engage with the culture and be immersed in the relations between agents.

First the Aboriginal contributors are shown the video information on the kinship that will also be shown to the game players. This introduction material explains the kinship system, using a simple group format based on sixteen types of group members, derived from eight generational divisions and two marriageable divisions. Each of the sixteen members of the group has specific relation and level of responsibility to each other member.

Then the authors are asked to contribute stories of their experience of the various aspects of kinship. These stories are recorded and presented in the game as audio, or usually video, recordings.

The authors are then asked to tag their stories. These include the subject theme of the story (eg Education, Law, Social Work), the relevant theme

from the introductory material, the kinship role to be given to their character, and the type of content (whether it be about living in Aboriginal culture, living between cultures or the effect of denial of culture) plus any suggested questions to raise after the story is viewed. At present we allocate them an s simple agent that presents their story in the game.

We have developed prototype games that provide a simple environment for users to navigate a collection of narratives by Aboriginal people discussing issues relating to the introductory material. The aim of this extension work is to provide parameters that the authors can select for their character that will guide agent interaction in the system and provide a representation of cultural relations to the user. Hence we will add an interface to select some of the agent modelling parameters discussed below.

To develop this into a learning system we are using scenarios that are based on future experiences our graduates may have with Aboriginal clients and employers, as when running a health service or conducting land claims. The scenarios are simple learning paths that provide an introduction to set the scene, a goal for the student to complete and then certain challenges along the way. The example used in this paper is:

The student is going to work as a teacher at a school in western Sydney with a high aboriginal population. They are assigned a kinship role within the local community. They will be then shown the kinship role of each agent as they move through the game. They can work out their relation to that person and act accordingly or ignore these rules.

The stories that will be available to hear will therefore be selected on the basis of the main theme being Education, and a selection of different kinship relations to the user.

Some of the challenges are presented here under the kinship theme they relate to:

Totem: The player will be invited on a hunting trip to collect/catch their own totem. Another elder person of the same totem will be nearby whom they should ask for permission to hunt.

Skin Name: The player should speak to people of the appropriate skin or the stories that are offered will become more discouraging and illustrate Aboriginal distrust of the education system.

Communication: A non-Aboriginal character will prevent the player from teaching the material they wish to teach. They should call a community meeting to discuss this or they can confront the other character alone.

Language: The school library will contain only simple books even though it caters to high school students. The player may not notice this or ask the community why this is. They can then be told stories on the user of pidgin in teaching Aboriginal people, government control of education, and so on.

The scenario forms a series of thematic spaces or rooms the player will go through. At the end of each room they can be asked questions, or any narrative can conclude with questions. The aim of using the agent modelling is to reduce scripting of the scenarios and increase the automated interaction between player and agents, as well as between agents in the game. This will also enable a player to play the game twice and have a different experience, or be able to talk with their peers and retell different stories.

3 AGENT MODELS

The initial agent models used are generic characters available in Unity, but these will be adapted to the culture of the contributors by using some characteristic mannerisms and patterns of behaviour, including:
- Frequent hand signalling related to sign language
- Avoidance of direct eye contact
- Subtle rather than overt use of emotions

The level to which these aspects will be portrayed will be selected by the author so as to reflect the nature of their story. For instance authors may wish to present a cultural denial story with a more direct facial approach as this represents honest of the story in the mainstream culture. By adopting behavioural aspects to the culture of the player we can change the users perception to match the learning needs of that story (Endrass et al., 2011). However as mentioned above, the actual conveying of story is usually done by video so the stance and tone during the story is set directly by the author.

The agent modelling will manage the pre-narrative and post-narrative actions of the in-game agents, such as selecting who approaches the player, who avoids them and what feedback is selected when the player has finished listening to a story or exits a theme in the scenario. It will also manage the score of the player and the reaction of the agents to this score, which will be effectively a measure of the community trust. This idea is expanded further in the next section. Here we look at how the different cultural aspects will be handled by different parts of the system.

3.1 Agent Appraisal Modelling

The timing and level of the reaction of the agents to the player, and interactions in the game between agents will need to be developed using agent modelling to create a flow to the scene. For instance if the player is losing many points, the authors with cultural denial stories will be selected for the scene.

The software component that drives character behaviour will be based on FAtiMA (Dias et al, 2011) an agent architecture that uses the OCC appraisal theory (Ortony et al, 1988) which defines the concept of emotion as bipolar or valenced reactions to an event. The emotion is generated from a subjective evaluation according to the agents' goals, standards and beliefs.

The advantage of using the OCC-model for modelling emotions is that it provides a formal description of many independent affective outcomes The OCC model is used to provide a relative emotional state based on individual events, actions, and symbols:

Rituals: Aboriginal society is rich in rituals that provide guidance for evaluating the consequences of an event.

Values: Aboriginal knowledge system provides clear values about environmental care and respect for others, which guide the evaluation of the actions of others.

Symbols: Aboriginal symbolism will be used only in the use of sign language and modelling mentioned above which define what is appealing or not.

3.2 Agent Deliberative Modelling

The deliberative layer of FAtiMA uses the perceived event to activate predefined goals, and the agent will then select between competing alternative goals. Here the cultural goal selection process calculates the cultural utility for active goals.

We use rituals as corresponding to a predefined sequence of actions that should be performed once the context of the ritual is reached. This is implemented in the architecture by creating a special type of goal that includes a predefined plan, and with the parameters that compose a ritual.

When a ritual is initialised, the planner creates an initial plan with the steps required and can alter the plan to achieve the goal of the ritual.

3.3 Agent Reactive Modelling

The following dimensions of cultural difference between the agents and the player, and between agents are used to represent different cultural approaches. A survey reported in Reece et al (2010) provided the initial modelling, however this study was for a specific culture of Northern Queensland.

Power Distance Index PDI: In Aboriginal cultures people tend to regard others as equals while retaining some formal status. In mainstream Australian society respect for more experienced members of society has been lost.

Individualism IDV: Aboriginal cultures are high in collectivism, with individuals integrated into groups with reciprocal responsibilities. In mainstream Australia, people stress the importance of personal achievements and individual rights.

Masculinity MAS: Aboriginal cultures can be matrilineal or patrilineal, while the patrilineal cultures have respect for the co-existing women's society within their own culture. Therefore relationships and quality of life are more important within the cultures. Mainstream Australia is a very masculine culture so favours assertiveness, ambition, efficiency, competition, and materialism.

Uncertainty Avoidance Index UAI: This dimension indicates to what extent people prefer structured over unstructured situations. In mainstream Australia, people have as few rules as possible, and unfamiliar risks and ambiguous situations cause less discomfort. In Aboriginal cultures, people tend to have strict laws and rules and also various safety measures to avoid the novel.

Long-Term Orientation LTO: Indicates to what extent the future has more importance than the past or present. Australian Aboriginal culture are viewed as oriented towards present benefits, but their traditions are highly adaptable to the changing climate and conditions, while still fulfilling reciprocal social obligations. The mainstream culture focus on progress and change but have a short term orientation.

3.4 Combining the Modelling

A similar application developed to enable history students to learn from a past culture (Bogdanovych et al., 2009) uses cultural norms of behaviour characterised through the notion of cultural institutions, as the carriers or knowledge. In this previous example the culture was based around the technology and environment of the society, and the cultural institutions consisted of (amongst other aspects) roles, relationships between roles, flow between roles and norms of behaviour for roles.

However this project modelled explicit cultural aspects that have to be individually coded. Work

with agent models such as FAtiMA deal with implicit cultural aspects that can have an explicit but subtler reactive effect on character behaviour, and also handle the interaction between the different cultural dimensions and social norms.

4 AGENT MODEL DESIGN

For these reason we are investigating the use of FAtiMA architecture for modelling this culture, and we will use the following three modules:

Cultural Component: Implements cultural-dependent behaviour of agents through the use of rituals, symbols and cultural values, relating to the above dimensions. This component determines a Praiseworthiness appraisal variable based on cultural values and the impact actions have on the motivational states of the agents. For instance, the more collectivistic the agent's culture is, the more praiseworthy is an action that positively affects the need of others in the group to the detriment of the agent's own needs. This would implement the Aboriginal system of knowledge sharing that links to the totem groups and prevents the holder of a totem from eating their totem while providing knowledge to others how to hunt the animal.

Social Behaviour: Provides modification of decision making in implementing cultural rules depending on the social importance of the agents and rules of interaction that are denoted by the kinship relationship.

Theory of Mind Component: This creates a model of the internal states of other agents. This component determines the desirability of an event for others by simulating their own appraisal processes.

Also the Reactive and Deliberative Components are used by these components.

4.1 Modelling Aboriginal Culture

The features of social relationships that lend themselves to automated scripting, and hence simply development of the games, are:

Story selection by tagging:

▪ Kinship relations that dictate the generational status and rituals of interaction between characters. This will also help randomise the stories that agents wish to share with the player. Since the player's tag is randomly assigned, and the main knowledge sharers will be their parents and grandparents, mostly stories with these tags will be shared in a session.

▪ Knowledge sharing processes where knowledge is shared with the learning in increasing order of complexity, within a theme. Hence an author's video may be divided into introduction and fuller version as well as author being able to tag their stories as being further examples of another story in the repository. Also the communication needs will effect story sharing in that it is important for those of specific totems to share.

▪ Agents will know which other stories are relevant to either their story or the player's tag, so can advise on who to talk to next through the text interface

▪ Using stories from different uploads to the repository so the knowledge is continually updated, but old stories retain relevance.

▪ Select different narrative styles for each player to hear to help the learning process for different learning styles. The narrative style will be tagged on each narrative.

Movement of Agents in game scene:

▪ Agents will approach the user if they have a story to share and will move away if they do not wish to share. This desire be assessed using the above rules (PDI).

▪ If the player focuses on stories from only a few people, others will distrust them but will meet together on screen away from the player, reinforcing collective knowledge sharing (IDV).

▪ Agents will not always be there to give an expanded story, the player will be told they have gone on business. If the player waits for them then they will get bonus information to help them in the scenario (LTO).

▪ Agents will tend to move in groups based on their sex, but each role in a scenario will be taken alternatively by different sexes (MAS)

▪ Agents will tend to avoid the player at first them become more used to their presence as they are seen to learn more stories (UAI).

Generation of Feedback to learner using text:

▪ The initial scenario will be scripted, with introduction material and pointers along the way to guide the player

▪ In addition to telling the stories, agents will have the option to add text based comments or questions. Authors may add a question to be displayed at the end of their narrative

▪ The user can select certain actions in the community, such as group meetings or hunting trips. The number of agents that respond will depend in the level of trust they have in the community.

Community Trust as the assessment parameter:

- The level of trust of a player within the community will be an influential factor in agent interactions with the player. This will be assessed from the number of stories heard, who from, and the time the player has been in the game (hanging around the community)
- Trust will also be evaluated from the player's response to certain scenario situations, that is, the player's score so far.
- When trust is lost within the game, the user will have options to regain trust through a process where they are required to hear the stories of how their actions, and the actions of those before them, have affected people's lives.

4.2 Modelling Process

The agent modelling is based on the FAtiMA model (see Figure 1) and relates to the components shown as follows:
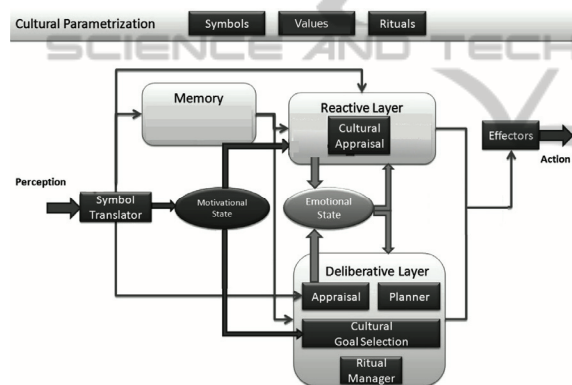

Figure 1: Adapted from the full FAtiMA Architecture presented in Mascarenhas et al. 2010.

The scenario will set up the overlying rules and assessment point system, specifying the scene and what is a good or bad goal in the game.

The rules relating to rituals as goals for the agents will be updated by the ability to complete a ritual given the state of the world and the other agents, and players, responses.

The rules of interaction of characters with each other will be based on a group of parameters relating to the above five cultural aspects with strong preference for the Aboriginal viewpoint.

The agent's mood is evaluated using the OCC theory of emotions as a method of appraising events or situations for aspects such as Desirability and Praiseworthiness that are handled by the cultural reactive appraisal layer.

To express the mood evaluated by FAtiMA, individual animations will be selected for the agent's character by the author. This will specify the limits of the expressiveness of that character, such as how much the character expresses happiness or sadness. Indigenous users will evaluate the modelling of their agent's parameters.

5 INITIAL SCENARIO

The first scenario being run in FAtiMA describes the protocol of hunting. In the scenario the user has been asked by an agent to join a hunting expedition.

They will learn social protocols from the agents if they follow the correct protocols as given to them. These relate to four components:

Totem: they may not be involved in a hunt of their own totem.

Skin name: They should not speak directly to their grandparent (two skin level up) without introduction.

Communication: They should not confront people directly for request but first engage in conversation.

Language: They should not assume that agents can speak or understand English, but include them still in their communication through other means.

We use a scenario that specifies the agents and their parameters relating to the four components above; the cultural rules that the user is to extract from their experience; the actions agents and the user can take in the scenario, and the single goal to join the hunting group. The emotional thresholds are set once across all agents.

The user can then step through a selection of options as to how they deal with the problem, and receive the response that is appropriate to the cultural rules plus feedback from the mood of the agents, or they can ask for assistance and watch the agents step through the same process with the user as observer.

5.1 Modelling Issues

The existing modelling system calculates the user's Social Importance within the culture. This provides an additive value of the user's actions within the culture, and forms a transparent marking scheme. However issues that arise in the existing system when modelling such a different culture include:
- Cyclical nature of Aboriginal relationships
- Lack of good-evil dichotomy to guide heuristic evaluation of actions
- Tracking the complex requirements of obligation and responsibility.

6 CHALLENGES

The first challenge we face in this work is the development of a range of cultural 'stereotypes' that are acceptable to the Aboriginal authors using the system as valid representations of their culture or if they feel other aspects are more significant.

The next relates to the creation of rules that reflect the balance between the cultural rituals and the social values and cultural dimensions that moderate the application of these rules. While Aboriginal culture has many rituals, the complexity and subtlety of these has been developed by one of the oldest cultures in the world, so it will be hard to emulate these using computer modelling.

Then we will look at the aspects of culture that are not represented in the existing agent modelling system as listed above. These are also significant for the learner modelling system within the game as the kinship system also relates to the teaching models used for knowledge sharing with the community. For instance the Mood of the agents will reflect their ability to carry out their social obligations, which will depend on the hindrance or compliance by the user.

The final challenge will be to link the different aspects of the system into a connected whole. These are the individual's stories; the game scenario developed by the teacher; the characters in the game with their specific animations; and the agents controlling the characters.

7 CONCLUSIONS

The application of an existing agent cultural modelling system to a very different culture will provide both challenges in design and an opportunity to verify the flexibility of the system. While there are many aspects of Aboriginal culture that are related to other cultures, there are also a lot of different approaches to knowledge sharing which will be relevant when providing a learning environment in which users can immerse in the culture.

We aim to make the learning environment reflect as many aspects of the culture being learnt as possible. We will not be using this adaption to make the player more 'comfortable' (Endrass et al, 2011) as this will not be their own culture they are experiencing, but we will help them to gain a better grasp of the subtle differences that arise from a different value system.

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