TOWARDS MULTIMODAL PLAYER ADAPTIVITY IN A SERIOUS GAME FOR FAIR RESOURCE DISTRIBUTION

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ABSTRACT

We present an initial demonstrator towards the creation of an adaptive serious game for teaching conflict resolution. The overall aim is the development of a game which detects and models player in-game behaviours and cognitive processes and, based on these, automatically generates content that drives the player towards personalized conflict resolution scenarios.

***Index Terms*—** Serious Games Technology, Procedural Content Generation, Player Modelling, Facial Features Video Tracking.

1. THE GAME DEMONSTRATOR

We developed a single-player game [1] composed of 10 levels during which the player finds herself in an environment populated by resources and non-player characters (NPCs) of two types: red and blue. The NPCs have a property called *happiness* which decreases constantly over time. The aim of the player is to keep all the NPCs happy by distributing resources to them. The learning goal we set is to maximise the level of player's fairness towards both red and blue NPCs. Feedback (i.e. emoticons) is provided to the player based on the strategy adopted at the end of each level [1]. A Player Modelling component (PM) tracks the player behaviours and, based on such information, a Procedural Content Generation component (PCG) constructs levels in real-time which would lead the player toward the predefined learning outcome.

The PM module is composed of two sub-modules: a behavioural (BPM) and a cognitive sub-module (CPM). The BPM is based on the way the player actions affect the average happiness of the NPCs (fairness of resource distribution). The CPM sub-module is based on estimated levels of attention retrieved from a tracking system, based on a plain webcamera, which estimates the player's head pose, eye gaze directionality, and qualitative measurement of movements back and forth [2]. The need for modelling attention is intuitive: the more the player is immersed in the game, the higher the chance to reach her learning goal. The two PM sub-modules are constructed as two separate multilayer neural networks. The input features are the content data (NPC happinesses, remaining time, game field size, etc.) and the training procedure (backpropagation) occurs at the end of each level.

The PCG generates the level and presents it to the player as soon as the player finishes the previous one. A genetic algorithm encodes a population of candidate levels and evolves them by means of crossover and mutation. The level chosen for gameplay (i.e. the fittest) is the one with maximum expected attention values and an expected fairness of distribution higher than of the player during last previous level.

The final version of our serious game is meant to be played by children of 10 - 12 years of age. The game would then turn into a multiplayer one and the conflict scenarios [3] would then be closely related with, but not confined to, resource management. As a result, our current mini-game is providing insightful information not only regarding the technology we might use and how, but also help with tacking the issue of conflict strategy modelling on a smaller scale: once the game will become multiplayer the notion of fairness would be transformed into collaboration.

[1] A video demonstration is available at: http://www.youtube.com/watch?v=4EYvawpCC88

2. REFERENCES

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