Creating an Authentic Aural Experience in the Digital Songlines Game Engine: Part of a Contextualised Cultural Heritage Knowledge Toolkit

Craig Gibbons, Theodor G. Wyeld, Brett Leavy, and James Hills

Abstract. Digital Songlines is an Australasian CRC for Interaction Design (ACID) project that is developing protocols, methodologies and toolkits to facilitate the collection, education and sharing of indigenous cultural heritage knowledge. The project explores the areas of effective recording, content management and virtual reality delivery capabilities that are culturally sensitive and involve the indigenous custodians, leaders and communities in remote areas of the Australian `outback'. It investigates how players in a serious gaming sense can experience Indigenous virtual heritage in a high fidelity fashion with culturally appropriate interface tools. This paper describes a 3D ambient audio quilt designed and implemented specifically for the Digital Songlines software, which is built using the Torque Game Engine. The audio quilt developed provides dynamic ambient fauna and flora sound effects to represent the varying audio environment of the landscape. This provides an authentic contextualised interesting aural experience that can be different each time a location is entered. This paper reports on completed and ongoing research in this area.

1 Introduction

The Australasian CRC for Interaction Design (ACID) is a collaborative research organisation formed with a number of universities and industry partners. The Virtual Heritage program is a research program under the auspices of the ACID organisation. The digital Songlines project within the Virtual Heritage program is developing protocols, methodologies and toolkits to facilitate the collection, education and sharing of indigenous cultural heritage knowledge across Australian communities, cultural institutions and commercial businesses [2, 3, 9].

The project objectives are to protect, preserve and promote Australian Indigenous culture, its practices, myths and legends, expanding and re-vitalizing a culture through the visualization of its most prized asset – the land. The project has developed the Digital Songlines software with a virtual landscape encapsulating cultural information, oral histories and mythological stories, based upon the eternal sense of land and

spirituality understood by the Aboriginal people of Australia, where feeling, knowing and touching the country, kin and spirit can be experienced. Research to-date has focused on investigating how virtual worlds can capture the spirituality, culture and heritage of Indigenous people and impart these in an empathic way so that non-indigenous people throughout the world can understand the significance and cultural heritage of these areas.

Part of the emphasis on providing a simulated contextually accurate experience of indigenous knowledge is the need for an authentic aural experience within the virtual environment. This paper reports on a 3D ambient audio environment designed and implemented in the Torque Game Engine used in the Digital Songlines software. The audio environment attempts to simulate a dynamic aural environment that might be experienced in an Australian 'outback' landscape.

2 The Limitations of Current Ambient Audio Technology

Ambient audio in most current game engines is represented by either a location based looping soundtrack or by placing static 3D audio emitters around specific nodes of interactivity [1, 4, 5, 6, 13]. The design of a looping soundtrack needs to be careful considered so it appears as "dynamic" or randomised.sound, and not a loop [7, 8, 10, 11, 12]. For example, when moving through different terrains the user should notice a change in ambient sound levels; a wooded area should sound more alive with wildlife than a sparse terrain. Careful placement of 3D audio objects can significantly enhance the users experience with aural characteristic unique to each area (see figure 1).

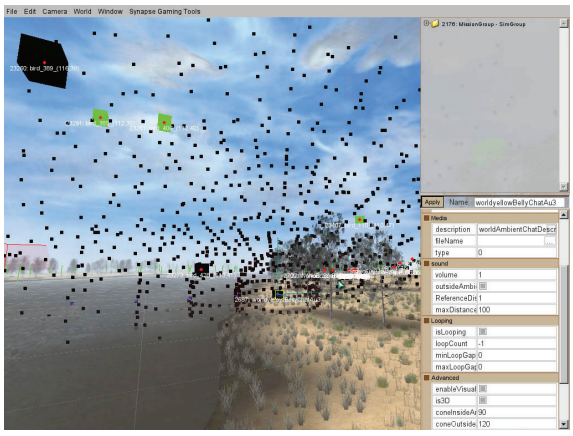

Fig. 1. 3D audio emitter in the Digital Songlines Torque Game Engine environment

3 Collecting Appropriate Audio Assets

By providing the user with multi-sensory awareness information – visual, aural, and tactile (interactive) – a believable landscape simulation experience can be achieved. With the importance of the audio aspect of this virtual landscape experience in

mind, the ACID Indigenous Communities project team embarked upon the collection of a variety of authentic audio 'assets' to be used to aurally contextualise a culturally and place-specific 3D virtual environment. A number of locations were identified as suitable. The location reported here is in the remote north-east of Australia. In August of 2005, a field research trip was undertaken to western Carnarvon Gorge in Central Queensland, Australia. The purpose of this trip was to capture the visual and aural environment for incorporation into the Digital Songlines software environment.

3.1 Reflections on the Remote Site Visit: Carnarvon Gorge

As Carnarvon Gorge is a remote area it presented a different aural experience to the urban environment commonly experienced. Most notable was how astoundingly quiet the area is. Such was the extent of this void of sound that quiet sounds, normally obscured through aural masking and filtering, were much more audible. The sound of footsteps on the terrain type being traversed – grasses, leaves, or rocks – could be clearly differentiated with distinct audio differences. These footsteps were capable of dominating the listeners' audio environment during quiet periods of the day, and could be heard from some distance.

Due to the relative quietness, the acoustic horizon appeared to be much closer than in urban settings. Distant sounds could be heard with greater clarity and definition. For example, the human voice, under certain conditions, could be understood at distances of approximately half a kilometre.

This notion of a closer aural horizon is due to the acoustic properties of the aurally thinner air space in rural environments as there are significantly less audio sources within the listeners' personal sound field. This reduction in aural density results in distant sounds appearing much closer to the listener, although a perception of distance is still available through the subsequent density of reverberation of the audio source. This raises the question, "how to capture and represent this aural sensation in the Digital Songlines environment?"

4 Capturing an Authentic Aural Experience

It became apparent, after reviewing the aural landscape and many audio recordings and notes of the Carnarvon Gorge area, that a better audio mechanism was needed than the current looping ambient systems supported by most game engines in order to dynamically represent the aural landscape. We noted how dynamic the aural soundscape changed through different times of the day. Also that, upon returning to an area, even at the same time of day over a number of days, the soundscape seemed to have changed in a number of subtle, yet noticeable, ways – as birds moved, crickets started or stopped, and so on. With this in mind, a new method was developed utilising the existing Digital Songlines Engine (DSE) technology to create this dynamism.

4.1 Implementing a 3D Ambient Audio System in the DSE: Phase 1

To attempt to capture the aural sensations recorded at Carnarvon Gorge a system for dividing the virtual world space into a series of cells was used. This allowed specific actions to be performed in relation to an avatar's movement through the various cells.

The system developed uses a "checkerboard" quilt design methodology with cells monitoring an avatar's movement throughout the virtual landscape. Upon entering, each cell adjusts the surrounding cells' audio arrangements – both density and 3D location within constrained random variables. Audio files are randomly selected from a sound bank and used to aurally populate the surrounding cells. The type of audio assets used to populate surrounding cells is dependant on the time of day and any additional required parameters (see figure 2).

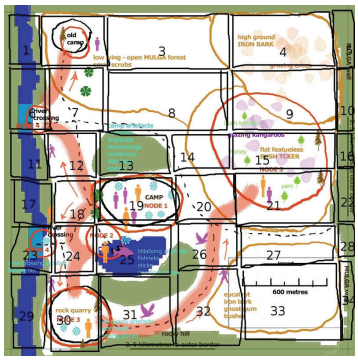

Fig. 2. Checkerboard quilt layout of region-specific audio cells

The first iteration of this system was evaluated within the project team. Not surprisingly, it proved to be better than what was previously used within the DSE (the looping ambient schema). However, once 3D models and characters were added to the scene, the overhead was too great, resulting in poor performance for both sound and graphical components. Also, difficulty with other animated models within the world, such as birds and non-player characters (such as a human or animal bot in the world that runs on AI and not controlled by a user) through the system triggering these squares. A solution needed to be found that would address these issues.

4.2 Implementing a 3D Ambient Audio System in the DSE: Phase 2

With the problem of the unacceptably high overhead caused by the first iteration of this system and the triggering action of other objects in the scene, a revised system was developed which leveraged the capacity of the DSE's bitMap code functionality. BitMap codes are usually used for the population of vegetation, specifically grasses, within the DSE world. For example, a bitMap code is used to analyse a prepared .png overlay on the map to determine what type of grass and level of density is needed to populate a specific region.

We used this semi-random assignment feature of the bitMap code using audio assets in place of models and textures. By implementing the bitMap code for audio, within a controlled radius of the client machine avatar, the ambient audio quilt could be "generated" in real time from a similarly pre-prepared .png overlay. No actual sound generation was taking effect, as every sound was sourced from the prepared sound bank. What was being generated was an algorithmically generated density, placed in a 3-axes coordinated system with a high level control achieved.

For example, we could place a group of frogs around a water source. We could control the density of sounds, yet the computer dealt with where to place the objects, which sound file to use (from the given sound bank), and randomly constrain their placement within the x y z axes.

The use of the bitMap code functionality reduced the overall overhead and made the DSE navigable again. With this implementation, the ambient audio system can be used for dealing with populations of large and small birds, crickets and frogs on the map, among other collections.

Moving around the map gives one the illusion of different aural soundscapes. When returning to a region, the density and placement of subsequent audio emitters may have changed due to the random nature of the algorithmic system, generating the desired different aural soundscapes.

The system is extendable to handle any additional audio materials, with unique density and placement logic for the algorithms to process and deal with. Combined with looping area effects (such as wind), DSE's Ambient Audio Quilt provides a more accurate aural representation of the landscape than existed under the standard TGE technology.

5 Conclusion

The latest iteration of the audio quilt provides for an authentic aural experience in the DSE. This forms a critical part of a highly contextualised cultural heritage knowledge toolkit. The importance of contextualising the stories gathered from the community elders is paramount in addressing the sensitivity of their telling. A key tenet of the project is to protect, preserve and promote Australian Indigenous culture, its practices, myths and legends, expanding and re-vitalizing its culture through visualization in a 3D virtual environment. As such, the audio quilt project helps contextualise the virtual landscape with an authentic soundscape where feeling, knowing, touching, and hearing the country, kin and spirit can be experienced.

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