Database and Narratological Representation of Australian Aboriginal Knowledge as Information Visualisation using a Game Engine.

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Abstract

Current database technologies do not support contextualised representations of multi-dimensional narratives. This paper outlines a new approach to this problem using a multi-dimensional database served in a 3D game environment. Preliminary results indicate it is a particularly efficient method for the types of contextualised narratives used by Australian Aboriginal peoples to tell their stories about their traditional landscapes and knowledge practices. We discuss the development of a tool that complements rather than supplants direct experience of these traditional knowledge practices.

Keywords: Aboriginal Knowledge Domain, Narrative as Metadata, Torque Game Engine as Information Interface.

1. Introduction

In response to requests by Australian Aboriginal elders and communities to preserve and communicate their culture for current and future generations, the process of gathering and documenting Aboriginal knowledge has accelerated in recent times. This has also been due to the increased capability of digital environments to store and manipulate large amounts of information in various accessible formats. Most recently it has been found that some formats are more suited to representing the Australian Aboriginal oral cultural tradition (such as audio, video, graphics) than others. However, one of the most important issues which has arisen and continues to influence the design of these digital tools is that of representation of the environmentally contextualised narratological nature of Aboriginal knowledge traditions.

Current database storage mechanisms don't appear to support the sorts of narratological knowledge practices used by Aboriginal knowledge traditions. What is needed is a multi-dimensional non-linear, database visualization schema that better supports real time narratives spatially contextualized.

As such, this paper critiques how Aboriginal knowledge practices have been, until recently, represented in digital media and then suggests some prerequisite characteristics of such media if they are to support traditional knowledge traditions. Finally, a digital environment – Digital Songlines – that promises to fulfill many of these prerequisites is examined in more detail.

2. Background

Aboriginal knowledge is a contentious area of study. This is because Aboriginal knowledge exists as a self-contained knowledge tradition, radically separate ontologically and epistemologically from Eurocentric knowledge traditions. Its purpose is to reify culture and identity [12]. However, current technologies for the representation of this knowledge tend to embody assumptions that are based on a Eurocentric scientific knowledge tradition. This allows Aboriginal knowledge to be objectified and commodified for use in a wide range of 'scientific' fields. This raises questions about the validity of current methods of study. A critical principle to be addressed is that Aboriginal knowledge is embedded and deeply associated with their land. This includes the relationships that people have developed with that land or 'country' over time. This

knowledge is primarily situated in "kinship, language and humour" [8, p4]; not objects, artifacts, or recordings as such.

To understand the nature of the holistic Australian Aboriginal knowledge practice and how it relies on a reciprocal relationship with the environment, or its spatial context, we can refer to a Western abstract spatial concept: Descartes arbitrary three-axial spatial coordinate system.

While space is a difficult concept to define, we give it coordinates when we try to describe what space is – up, down, left, right, near, far and so on. In the Cartesian coordinate system we apply three arbitrary axes – x, y, and z – to locate objects in space. But, we do not ordinarily think of the space in which we live as having three axes. It is only when we abstract spatial coordinates out of this space that we apply the arbitrary axes to make sense of it. If we can accept the Cartesian spatial concept as an abstract, arbitrary mapping of space for representational purposes, then it is possible to imagine other spatial realities too. For example, a space which is brought into existence through the meaning making traditional knowledge practices of Australian Aboriginal peoples who see their existence as having a reciprocal meaning with the environment in which they find themselves.

Hence, it is clear, there are vital differences in Western (or in the specific context of the Australian experience - Eurocentric) and Aboriginal knowledge traditions and practices. For example, Western traditions emphasize the differences between what exists and how we represent it in a variety of symbolic systems. By contrast Aboriginal knowledge traditions emphasize the unity of symbol and object – of what exists and how we represent it. In Aboriginal knowledge traditions, language, ceremony, singing, dancing and other representational forms can influence events and cause real world events to happen. Objects and phenomena can be 'sung' or 'talked' into and out of existence. These processes of the amalgamation of representation and reality have been going on since the Dreamtime (in Australian Aboriginal terms, the time of creation of all things) and continues to this day.

3. The Problem with Current Database Technologies for Narrative Representation

The difficulty with current systems is that they are founded on the same philosophical methodologies that underpin Descartes axioms. For example, in a relational database there are linear relationships between he objects contained and their metadata. This can be mapped out in an arbitrary coordinate system. Like the Cartesian system, this mapping relies on differentiation of object from its symbolic abstraction or semiotic reference. In this system the object and its representation can be completely unrelated other than the relationships that we agree to give them. In a sense, the Aboriginal knowledge practice is the obverse of this. With no written language, any representation of an object is considered as real as the object itself [3]. This means that the consequences for an object and its representation are similar. For example, a sketch of an Australian Aboriginal person is thought to be part of, rather than merely a representation of, that person.

For Aboriginal knowledge to be visualized in a Western database manner it needs to undergo two processes. Firstly, it must be objectified and secondly, organized into relational categories. Due to its non-representational nature, however, Aboriginal knowledge lacks an easily accessed metadata system that would make it amenable to these two processes.

In effect, Aboriginal knowledge objects are embedded in a multi-dimensional narrative of story, song, dance, art and ceremony. This narrative embeds any knowledge 'object' in a matrix of relationships that is both temporal and spatial. Because the narrative is not a representation but is as 'real' (in a spiritual and metaphysical sense) as any object which it refers to, there is no explicit metadata available to distinguish categories of objects; the metadata is contained implicitly in the narrative and resists representation in a conventional relational database schema.

To-date the organizing and categorizing of Aboriginal knowledge has followed two main types of database application. Firstly, complex relational schemas that have proven to be largely unworkable in terms of access and metadata. Secondly, the ontologically flat database with a simple schema of one or few fields that more accurately reflects the non-representational nature of Aboriginal knowledge. However, in this solution it is too difficulty to query the data [3, 15].

Both these methods use narrative as the 'glue' or metadata to establish relationships in the database schema. However, due to the non-representational nature of Aboriginal knowledge narrative, categorization of knowledge objects is extremely difficult. The expression of Aboriginal knowledge narrative that is multi-dimensional and non-representational is the landscape itself. Thus there is no duality or contradiction between data and narrative in Aboriginal knowledge as both are embedded in and defined by the landscape.

Various authors have posited that storytelling or narrative has a vital role to play in information visualization [16, 6, 14]. and that the nuances and uncertainties of both forms can effectively complement each other. In Aboriginal knowledge, the landscape is both the visualization of knowledge and the narratives of knowledge.

Therefore, any attempt to present the complexity of Aboriginal knowledge and practices in a digital environment needs to provide a visualization of the landscape that is capable of embedding a wide range of knowledge objects. In effect the visualization of landscape, if effective, provides the schema (types of objects and relationships between them) of a complex database of Aboriginal knowledge. There still remains the problem of accessing the data in all the many locations in the landscape. The most effective visualization for this is to allow the user to 'be in the landscape' in a virtual sense. A much less complex parallel in Western knowledge tradition would be allowing a user to walk through a virtual library and access books from the shelves. The virtual Aboriginal knowledge landscape provides a more complex relationship as it not only provides the 'books' or knowledge objects but the narratives which describe how they came to be there and the human actions necessary to ensure that they continue to exist.

4. A New Approach to Narrative Representation.

Referring to the characteristics of Aboriginal knowledge practices in Christie [4], any supportive representation of Aboriginal knowledge needs to enable the user to become involved in an extended collaborative, performative narrative which pursues a purposeful journey through a sentient (responsive) landscape, exploring and reaffirming relationships with significant people and the land. However, the current state of representation of Aboriginal knowledge seems to be split into either data based tools or narrative based tools – collecting and telling. For all intents and purposes, in Western thought, the dichotomy between database and narrative presents a large obstacle. As Manovich [10, p12] states, the "database and narrative are natural enemies. Competing for the same territory of human culture, each claims an exclusive right to make meaning out of the world".

Hence, any digital tool based exclusively on one or the other is presenting at best only half of the knowledge practice tradition. On the one hand, database tools struggle with the dual agendas of metadata and the selection of knowledge categories. On the other hand, purely narrative tools, such as digital storybooks, struggle with the linearity, lack of multi-dimensionality and simplification of the digital publishing formats. Both these types of tools also lack the essential capacity for the user to 'perform knowledge' (to actively participate in knowledge construction), rather than merely access and manipulate what is given.

Although the database is increasingly the pre-eminent symbolic form of information resource in a digital society [10], the enduring power of narrative has become recognized in recent times as adding meaning to the information. For example, in the work of Brown [1] he addresses the differences between logical argument and narrative which explains the power of narrative in the corporate world to reveal the various roles of narrative as sequential events, explanations of cause and effect and also as metadata. We can see the value of this approach in Huggins' [8, p4] assertions that Aboriginal narratives are cultural institutions of collective memory which are "held in 'lived' experience"; that these narrative structures are not easily understood by conventional approaches to history and, "the only way the Indigenous narrative memory can be properly understood is through the paradigms of Indigenous people." Hence, narrative forms a powerful ally as metadata in any knowledge data collection.

5. Capturing Specific Narratological Contexts in a 3D Game Engine

In an attempt to address the need to combine narrative and knowledge artefact as a database of information which emulates Australian aboriginal cultural understanding, the Digital Songlines project was formed in 2003. It uses a computer game engine to immerse participants in a narratological landscape similar to that espoused by its indigenous contributors.

The Digital Songlines environment attempts to match important characteristics of Aboriginal knowledge in the way it is able to amalgamate the power of database and narrative. It presents a visualization of a landscape which has elements of sentience or responsiveness. To visualize this sentience the data objects are embedded in an interconnected network of multi-layered pathways or Songlines (pathways of Aboriginal knowledge practice). This network of data is made accessible by a matrix of interactive narrative which acts as a metadata structure for the data objects. In effect, the narrative and the situation in a landscape provide meaning, purpose and ownership to the data objects in an intuitive and

complex manner which is extremely difficult for a conventional database to emulate.

The "essential task (of the game design) is to envision a dramatic *storyworld,* not a *storyline*" [8, p56]. The storyworld is made powerful by the designer's control which "is exercised through the *rules* of the gameworld rather than the *events* of the gameworld" [2, p52]. Frasca [5] elicites a corresponding typology of the requirements of powerful game design, which relies on 3 ideological levels. The first and weakest level deals with representation and events, the second and more powerful level deals with the manipulation rules or what the player can do in the game, whilst the final and most powerful level is that of goal rules or what the player must do to 'win' or, in the case of Digital Songlines, what they must do to reveal knowledge contained in the sentient landscape. Manovich [10] states that having multiple trajectories between data objects does not necessarily constitute a rich narrative and that, "the author also has to control the semantics of the elements and the logic of their connection so that the resulting object will meet the criteria of narrative." He quotes Meikie Bal [in 10, p1] as to the criteria of narrative, "it should contain both an actor and a narrator; it also should contain three distinct levels consisting of the text, the story, and the fabula; and its 'contents' should be "a series of connected events caused or experienced by actors."

6. Testing of Multi-Dimensional Narrative Representation in a 3D Game Engine

A highly resolved proof-of-concept prototype Digital Songlines application has been developed. It includes arrays of 3D objects used to recreate a landscape populated by indigenous flora and fauna. These assets have been imported into the game style application based on the Torque Game Engine. The active features include sound, animations, weather and daylight simulation. An established mechanism to import digital terrain models existed and it was modified for importing satellite based geo-spatial data, or data that is prepared for use in GIS software, for accurately mapping the cultural heritage landscape including ancient rock art [4].

The terrain data in vector or raster based formats is layered with spatial attributes that identifies where the features are located in geographic space as relevant to Aboriginal cultural heritage. The geo-spatial data includes various files that make up a cultural metafile set with vector data representing trade routes (Songlines), a table containing the artefacts belonging

to significant places and their location, and data including the indigenous names for sites, watercourses, hunting grounds, scar trees and other significant places. These are positioned correctly in the 3D world using GPS coordinates. In addition, native vegetation specific to the area was included in the 3D world. Flora and fauna were surveyed and photographed on-site and modelled for inclusion in the environment [9].

While the primary use of the tool has been in the area of cultural history, a wide range of potential educational installations have been identified including: museums, science centres, cultural centres, interpretive centres, community consultation, local councils, forestry, water resources, development organisations, schools, mining, safety training, media and data fusion capabilities [9].

What the Digital Songlines project provides is a vehicle for the unfolding of real-time narratives involving Elders and the ancestral spirits of the landscape. These narratives consist of the network of Songlines that traverse the country and reinforce Aboriginal knowledge practices. At any one location in the landscape the user may be able to access information from any number of Songlines, which offer different perspectives on what exists in that place, who can be in that place, what activities can be done in that place, how that place came to be, what needs to be done to maintain that place, the ownership of that place, and many other deep and subtle nuances of Aboriginal knowledge (see figure 1).

In terms of contemporary Aboriginal knowledge, we have developed some animated sequences from an Aboriginal dreamtime story that is included as part of the world in a transparent manner. Developing the art works for the animations and some 3D objects with cultural significance requires regular consultation with indigenous artists and representatives from the country to ensure they are portrayed correctly (see figure 2).

Many issues have arisen from the creation of these virtual spaces of some 400 square kms and its reliance on the computational capacity of real-time hardware and visualization technologies. Some are difficult to resolve in a suitable way to communicate the presence required within the virtual space. Such as, how to convey immersive narratologies like: while in place, indigenous knowing pauses at each rock, knows the cycles of the winds, can track underground water, find food and medicine, and uses of the land to speak its stories and keep its history. The kind of knowledge represented and the 'field' in which it is held by local indigenous peoples is often deep, subtle and most intimate (Langloh-Parker, 1953).

Figure 1 Example of Aboriginal knowledge in practice – woman weaving a fishing net.

To address this the Digital Songlines project uses a 'tiered' model where 'layers' of content are created, accessed, and linked back to the virtual model of the physical place. With such a model, we are able to conceive of the (virtual) land as an interface through which the more traditional dynamics of software creation can be accessed. This layered model allows us also to participate in indigenous knowing and 'being-with', at the most basic level, as the tool is used.

The content can be layered to support narratives (such as land ownership issues, spiritual knowledge, historical and oral stories) and as a community content development and archiving tool (re-populate the virtual spaces with indigenous content). These can be used in entertainment, display, community consultation and education, such as museums, cultural centre displays, as an indigenous language walk, or bush tucker (traditional food) walk, or oral history lesson. These are all developed with the notion of land-as-interface where the (virtual) land is layered with information and practices that arise from that very landscape.

Figure 2. Screen image of animated fish with representative contemporary Indigenous art work.

Although anchored by a database, the Digital Songlines delivery tool is in the form of an immersive narrative. In this sense, we have not only partially ameliorated the 'flat database versus dynamic narrative' problem faced by most Aboriginal knowledge digital tools but we have done it in a manner that also supports the cultural form Aboriginal knowledge takes – *narrative in practice*. As such it blurs the non-Aboriginal dichotic distinction between subject and object at the level of the interface itself.

7. Preliminary Results

The Digital Songlines project has been enthusiastically received by numerous Aboriginal communities, groups, schools and museums. These groups have grasped the opportunity to gather information relating to their particular area of 'country' using a range of digital media. This is leading to the up-skilling of many community members in digital media. It is also providing a cultural focus for the sharing of knowledge practices between generations. Early, informal evaluation groups of Aboriginal adults and children have responded enthusiastically both to the Songlines concept and also to the visual interface and interactive activities that are possible within the Songlines environment.

More formal evaluation of the Songlines environment and user interactions will take place during 2006. Investigations into cultural aspects of cognition, information visualisation, pedagogical application and sociological aspects are planned. These studies will use a variety of ethnographic and phenomenographic methodologies. They have the potential to yield rich data about the nature of representation of Aboriginal knowledge, the pedagogical implications for Aboriginal learners, and the participatory design process for the construction of accurate local landscapes and cultural activities.

8. Conclusion

In its review of the Digital Songlines project, this paper has explored some key questions around the nature of Aboriginal knowledge, issues surrounding appropriate representation of this knowledge and the way specific features of the Songlines environment appear to be addressing these key issues. We argued that environments should be responsive to the need for a database that reflects not only the content of knowledge but the forms of its communication in knowledge practices. We have argued that the key mechanisms for this aspect of representation of

Aboriginal knowledge practice in the Songlines project lie in the combination of a user experience that is collaborative and performative with a sentient responsive landscape and a multi-layered narrative.

9. Acknowledgements

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