

Building an adaptive museum gallery in Second Life

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Abstract

We describe initial work on building a virtual gallery, within Second Life, which can automatically tailor itself to an individual visitor, responding to their abilities, interests, preferences or history of interaction. The description of an object in the virtual world can be personalised to suit the beginner or the expert, varying how it is said—via the choice of language (such as English or Greek), the words, or the complexity of sentences—as well as what is said—by taking into account what else has been seen or described already. The guide delivering the descriptions can remain disembodied, or be embodied as a robotic avatar.

Keywords: multi-user virtual environments, second life, personalization, museums, natural language generation.

1. INTRODUCTION

Second Life is a massive multi-user on-line environment; “a 3D virtual world where users can socialize, connect and create using voice and text chat” (<http://www.secondlife.com>). It is therefore not surprising that both real-world museums, and private individual ‘residents’ and groups, are building on earlier work on 3D virtual galleries, and exploring the possibilities offered by Second Life, and other virtual environments that provide similar facilities (Calef, Vilbrandt, Vilbrandt, Goodwin and Goodwin, 2002; di Blas, Gobbo and Paolini, 2005; Rothfarb and Doherty, 2007; Urban, Marty and Twidale, 2007; Wieneke, Nützel and Arnold, 2007). In web museums, visitors have become accustomed to clicking on images displayed in their browser, to retrieve pre-written textual descriptions of cultural heritage objects (Sumption, 2006). It seems straightforward to adapt this to Second Life and allow a visitor (represented by an avatar) to click on an object to read a ‘notecard’ attached to it (Rothfarb and Doherty, 2007).

Such environments may have significant motivational advantages over more conventional internet-based media (Urban et al., 2007). But we see a specific additional opportunity. The virtues of Second Life can be combined with those found in our earlier work on personalisation of the museum experience. In particular, user-tailored information can be delivered either through dynamic labels on objects, or through embodied conversational agents—avatars representing virtual museum curators. In this paper, we record some of our first attempts to season Second Life with a hint of personalization. But first, we provide some detail on the ingredients.

2. MUSEUMS IN SECOND LIFE

Urban et al. (2007) survey museum developments in Second Life, gathering evidence from more than 150 sites, and draw attention to a number of emerging trends. They emphasise that, although museums tend to be understandably concerned about the accurate representation of their artefacts, “The social nature of Second Life is a critical component of understanding what it is and how it can, and should, be used.” This confirms the view of di Blas et al. (2005), who previously pointed out that “the strong point of shared 3D environments is not realism but rather virtual presence (i.e. 'I am engaged in an activity with someone else'), to which realism or high quality graphics are not relevant issues.”

Urban et al. cite a number of features which help distinguish the new museums into groups. Regarding scale, they note that (because avatars can fly) artefacts can float in mid air or be attached high up walls, and be much larger than is possible in physical buildings. Setting is linked to this: some sites (like the Second Louvre, <http://slurl.com/secondlife/Tompson/153/96/100/>) do emulate specific physical buildings and interior decoration, but there is no necessity to display virtual objects ‘under cover’. They also note that, unless a museum builds its galleries on its own private island, there may be problems with the neighbours and the tone of the neighbourhood. Considering persistence, they note that the changeable nature of not just exhibitions but of museum buildings can disorient repeat visitors, but can be managed by distinguishing permanent from temporary galleries. On media richness, they note that while video streaming into Second Life allows for mixed realities, the possibility of using ‘holodecks’ within the environment is now being explored. Regarding visitor engagement, they note the importance of scheduled special events to draw visitors in at the same time, so that they can enjoy opportunities for social interaction. Commenting on the variety of intended purposes—ranging from artefact display to environment simulation to historical recreations—they note that there can be specific difficulties associated with the use of non-player characters to add realism. Clearly, a balance must be struck; while the Second Louvre “does not provide much, if any, descriptive information about the artifacts on display,” at the other extreme, the Computer History Museum (<http://slurl.com/secondlife/InfoIslandII/225/51/23/>) “features a slightly aggressive and somewhat insistent robot docent”.

Rothfarb and Doherty (2007) observe that in the real world, a large amount of interpretive information accompanying an exhibit might satisfy one visitor but drive another away, while in the virtual environment, there are potential solutions to this problem: “you can create rich textures adjacent to or on exhibit objects that contain visual or textual information, or you can attach notecard objects.” Wieneke et al. (2007) note the success of the International Spaceflight Museum in Second Life (<http://www.slinspaceflightmuseum.org>), and observe that its design “often cites and mimics real world museum features, like descriptive texts and even simulated audio guides.” Notecard objects fit this mould, but we would go further, and urge the use of personalised, dynamically generated notecards, dynamic audio or even non-player avatars. Ellis, Patten and Evans (2005) explore a variety of more or less social museum media, and point to the continuing need to “target personalised offerings at specific users.” In the more traditional web case, Aroyo et al. (2007) have recently explored personalization through the use of recommender systems. So long as they can avoid excessive aggression or insistence, avatars could be useful not just because they personalise the experience, but also because—returning to di Blas (2005) and Urban et al. (2007)—Second Life is about social interaction, and avatars can improve the social presence of the absent information providers, who created the exhibit.

Our adaptive gallery is designed in the first instance to address the problems presented by the need to cater for diverse individual visitors; we will shortly relate its specific features to those uncovered by Urban et al. (2007). The 3D gallery we are piloting in Second Life was initially developed in the project Xenios (<http://www.ics.forth.gr/xenios>) and is now being enhanced within the Indigo project (<http://www.ics.forth.gr/indigo>). Although Xenios was mostly concerned with real-world robotic guides, its Second Life gallery was used to demonstrate that some of the project's technology is also applicable to virtual 3D museums.

The current Indigo project is directed at human-robot interaction in the real-world. As with Xenios, a robot is designed to act as a guide to places within the Hellenic Cosmos (<http://www.hellenic-cosmos.gr>) cultural centre of the Foundation of the Hellenic World (FHW), now providing multi-lingual and multi-modal information about objects associated with the agora of ancient Athens. Compared with its immediate predecessors, the key aspect of Indigo is that it should support less restricted dialogues between people and a physical robot, using speech, gesture and facial expressions. But the human-robot dialogue techniques developed for the physical world would very naturally lend themselves to being used by a 'robotic' (machine controlled, non-player) avatar in a virtual environment like Second Life. Thus, we now sketch some details of the technology enabling the adaptive gallery under construction on the Virtual University of Edinburgh's Second Life archipelago.

3. THE TECHNOLOGY BEHIND THE GALLERY

3.1 PERSONALIZATION

Our current gallery is based around two natural language generation systems: Methodius (Isard, 2007), developed at the University of Edinburgh; and NaturalOWL (Galanis and Androutsopoulos, 2007; Androutsopoulos and Galanis, 2008), developed at the Athens University of Economics and Business. NaturalOWL provides native support for Semantic Web standards (Antoniou and van Harmelen, 2004), such as OWL (<http://www.w3.org/TR/owl-features/>) and RDF (<http://www.w3.org/RDF/>); see also Ghiselli et al. (2005) and Ossenbruggen et al. (2007). In the Xenios project, NaturalOWL was embedded in a real-world mobile robotic guide, to generate spoken Greek and English descriptions of points of interest from an underlying OWL ontology in the premises FHW. Methodius was designed to be both robust and scalable up to millions of objects, and was used to demonstrate a test domain at the Royal Commission for the Ancient and Historical Monuments of Scotland (RCAHMS, <http://www.rcahms.gov.uk>). There are significant differences in the focus and implementation of these two generation systems, but discussions of these lie outside the focus of this paper. We will therefore focus on their shared common heritage and underlying architecture, to give a background to the use of natural language generation in virtual museums.

The gallery's personalization mechanisms are rather different from those underlying recommender systems. The basic idea is to create a new text for each user, each time they view an object, by taking account not only of their preferences, but also the context in which they arrive at a specific object. The core of the personalization is natural language generation system, a form of artificial intelligence which allows data (captured here from collections information management systems and from interviews with curators) to be presented in more user-friendly language.

3.2 NATURAL LANGUAGE GENERATION

There are four main stages in natural language generation: content selection, text planning, microplanning, and surface realization. In the first stage, the system consults a model of the user (and in our case, a set of educational priorities), and a representation of the interaction history, in order to select a subset of the information stored in its knowledge base. In the next stage, this information is placed in a specific order, taking into account the entities and relationships mentioned in each piece of information. Then, again consulting the interaction history, the system's microplanner specifies the verbs and noun phrases, and how they are to be 'aggregated' together, so that more than one idea can be expressed in a given sentence. Finally, the surface realizer converts these specifications into actual text (or a specification which can be converted to speech by a speech synthesizer).

This means that the system can adapt its descriptions of museum objects to take into account what has been described before, thereby avoiding redundancy and enabling comparisons to be drawn between objects the visitor has already seen. It can also highlight ways in which an object resembles or differs from the majority of similar items in a collection.

3.3 PREVIOUS GENERATION SYSTEMS

Two previous systems form the basis of our current natural language generation technologies. ILEX was developed at the University of Edinburgh, in collaboration with the National Museums of Scotland (Hitzeman, Mellish and Oberlander, 1997; Oberlander, Mellish, O'Donnell and Knott, 1997; O'Donnell, Mellish, Oberlander and Knott, 2001). There were two main versions: a web-based virtual gallery; and a phone-based system for physical gallery visitors. It was followed by the M-PIRO system (Isard, Oberlander, Androutsopoulos and Matheson, 2003; Androutsopoulos, Oberlander and Karkaletsis, 2007). This added support for Greek and Italian, along with improved authoring support, and with more sophisticated user modeling. Teams in Edinburgh, Athens, Trento and London (<http://www.ltg.ed.ac.uk/mpiro>) worked with FHW to provide written and spoken descriptions of ancient Greek artefacts, displayed both in a web-gallery and in FHW's 3D virtual reality centre.

4. AN ADAPTIVE GALLERY IN SECOND LIFE

4.1 VUE: THE VIRTUAL UNIVERSITY OF EDINBURGH

The VUE group is "a virtual educational and research institute bringing together all those interested in the use of virtual worlds for teaching, research and outreach related to the University of Edinburgh" (<http://vue.ed.ac.uk/>). It is independent of Second Life, in that its virtual presences are not confined to it. Nonetheless, Second Life currently provides a focal point for researchers from Schools such as Education, Architecture, and Informatics. The VUE archipelago houses meetings, tutorials, entertainment, artworks, temporary constructions, and various kinds of academic research, including our gallery (<http://slurl.com/secondlife/Vue/205/53/30>), which is currently available only to visitors participating in experiments.

4.2 THE ADAPTIVE GALLERY

Referring back to the features isolated by Urban et al. (2007), our current adaptive gallery is conventional as to space and setting, being relatively small and located on a University's

own island. It is relatively permanent, and does not currently mix realities for a richer media experience—unless we consider the avatar itself to be a ‘medium’. As yet, we have not mounted any scheduled events; this is because the continuous presence of a software-controlled interpreter, in the shape of a non-human robot, means that a visitor will always confront another social presence in the space. How social it is, of course, depends both on its appearance, and on whether we can provide a smooth experience for users, avoiding excessively insistent behaviour for instance; and this has yet to be demonstrated.

4.3 A SAMPLE VISIT

To give a flavour of a visitor’s experience in the prototype gallery, we here provide a sequence of screenshots taken within Second Life. In each case, part of the text which the user sees is visible in the image, and the full text is given below it.

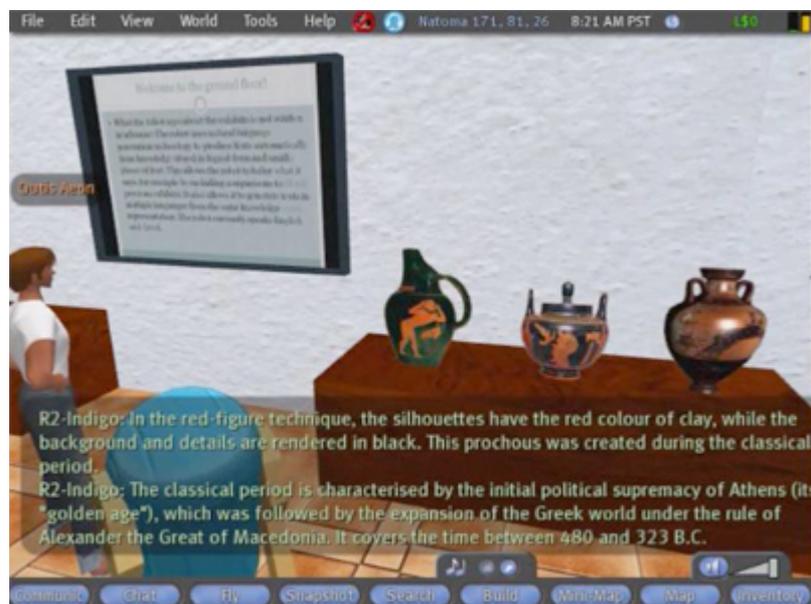


Fig 1: Gallery visitor views a prochous

The avatar says:

This is a prochous. A prochous is a vessel that was used to pour liquids. It has one handle, a large body, and a nib-like neck. This particular prochous was created during the classical period. The classical period is characterised by the initial political supremacy of Athens (its “golden age”), which was followed by the expansion of the Greek world under the rule of Alexander the Great of Macedonia. It covers the time between 480 and 323 B.C. This prochous dates from the second quarter of the 5th century B.C. It depicts a Greek hunting a Persian. Currently it is exhibited in the Museum für Kunst in Hamburg.



Fig 2: Gallery visitor views a tetradrachm

The avatar says:

This is a tetradrachm. Like the prochous that you saw earlier, it was created during the classical period. It originates from Attica and it dates from between 440 and 420 B.C. It is made of silver and today it is exhibited in the Numismatic Museum of Athens.



Fig 3: Gallery visitor views a drachma

The avatar says:

This is a drachma, created during the classical period. Like the tetradrachm that you saw earlier, which is also on my left, this drachma originates from Attica and it is made of silver. It dates from circa the 5th century B.C. It has an image of Athena crowned with a branch of olive, her tree, on its obverse. On its reverse, there is a picture of the goddess' owl. A drachma was enough for a "metic" (that is, a foreigner who stayed in Athens) to pay the

“metic tax” each month. Currently this drachma is exhibited in the Agora Museum of Athens.



Fig 4: Gallery visitor views a stater

The avatar says:

This is a stater, a kind of coin. It was created during the Hellenistic period. The Hellenistic period is the chaotic period from the death of Alexander the Great and the subsequent dissolution of his empire to the victory of the Romans over the Greeks at the Battle of Actium, comprising a truly international range of artistic trends. The Hellenistic period covers the time between 323 and 31 B.C. This stater originates from the Aetolian League and it dates from between 220 and 189 B.C. While all the previous coins that you saw are made of silver, it is made of gold.

As can be seen, the system never repeats information which it has already expressed. The first time that the classical period is mentioned, in the description of the prochous (figure 1), extended information about the period is provided. When the user then moves on to the tetradrachm (figure 2), which was also created during the classical period, no information about the period is repeated.

The drachma (figure 3) has several similar attributes to the tetradrachm (figure 2), and these are highlighted in the third text. In the fourth text (figure 4), we learn that the stater is made of a different material from both the previous coins. The system also has some spatial awareness, and is able to refer to objects in terms of their position, demonstrated in the third text (figure 3), where the tetradrachm is now to the left of the avatar.

5. CONCLUSIONS

We noted earlier that avatars can compensate socially for the absent information providers, who created the exhibit. But even if well-designed, such avatars simply deliver personalised information to an individual visitor, so they run a risk already observed in the real world. There, Sumption (2006) points out that developers of wireless handheld guides

must “look for solutions that avoid the often socially isolating consequences of so many current electronic guides.” This strikes us as a challenge relevant to the virtual as well as the physical museum guide, and we hope to address it as part of our programme of work.

There are not yet any user evaluations for our virtual gallery, since it is still under development. However, studies of several of the previous systems mentioned above have shown that users both prefer and learn more from systems which use personalization than from those which do not (Cox, O’Donnell and Oberlander, 1999; Karasimos and Isard, 2004; Marge, 2007).

It is planned that the current gallery will be extended to allow the National Museums of Scotland to pilot new real-world gallery designs, and we intend to carry out evaluations of users interacting with more-or-less human-like avatars. In particular, we aim to exploit an evaluation technique piloted by Dalzel-Job, Nichol and Oberlander (2008): tracking the gaze of a human user as they explore an environment within Second Life, and interact with the avatars within it.

We also plan to extend our technology to support natural language generation from ontologies compliant with the CIDOC CRM standard (<http://cidoc.ics.forth.gr/>), which is now also available in OWL.

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