Developing Serious Games With The APEX Framework

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Abstract
APEX was developed as a framework for the prototyping of ubiquitous computing (ubicomp) environments. In this paper we explore its role as a platform for developing serious games. In particular we describe the Asthma game which is aimed at raising awareness of Asthma triggers among children. The game is designed to stimulate a healthier life-style for children with ashma.

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Serious games, Ashma, virtual worlds

ACM Classification Keywords
I.3.7 [Three-Dimensional Graphics and Realism]: Virtual reality.; K.8.0 [Personal Computing]: Games.

General Terms
Human Factors, Design

Introduction
Serious games encourage playing in order to learn rather than merely to entertain. Games can be used to instruct and to inform as well as to provide pleasure. This paper explores the use of a framework for the prototyping of ubicomp environments as a means of the rapid development of serious games. In particular the game that addresses the problems that children with asthma face is

used as an example. The status of the project and lessons learnt are presented.

The APEX platform

APEX (rApid Prototyping for user EXperience) [4] was originally developed for the rapid prototyping of ubiquitous computing environments. The tool enables simulation and analysis of an environment in the early phases of its development. The APEX platform consists of several components that support multiple layers of development using different levels of abstraction. The four main components are: 1) a behavioural component, responsible for managing the behaviour of the prototype, which is based on CPN Tools that use Coloured Petri Nets (CPN) [3] models to describe the virtual environment's behaviour in response to user action and context change; 2) a virtual environment component, responsible for managing the physical appearance and layout of the prototype, that is based on a virtual environment simulator (OpenSimulator[1]); 3) a physical component, responsible for supporting connections to external physical devices, such as smart phones and sensors; 4) a communication/execution component, responsible for the data exchange among all components and for the execution of the simulation.

Each layer supports a specific type of evaluation: analysis of the behavioural model (in the modelling layer); observation of environment and users' behaviour within the virtual world (in the simulation layer); observation of real objects connected to the virtual world, and user reaction to them (in the physical layer).

The paper proposes the use of APEX for the rapid development of serious games inside virtual environments' simulations (cf. [2]). The aim of the proposed game is to improve health education of child asthma sufferers thereby improving quality of life.

Asthma

Asthma [1] is a chronic inflammatory disease of the respiratory tract characterized by variable and recurring symptoms, reversible airflow obstruction, and bronchospasm.

Asthma attacks have numerous causes, among which the most common are allergen intake during feeding or medication and inhalation of certain substances when breathing, such as pollen, smoke, animal dander, or dust. Many of the substances that cause asthma attacks are directly related to the existence of abundant mites. These substances are very often in our homes. There are several procedures that prevent the domestic causes of asthma attacks, but these procedures are not always carried out in practice because because of a lack of awareness of causes. Parents and mainly children need support to identify what triggers asthma, and to take appropriate action. Government and non-government organizations have developed home environment checklists (cf. [5]) but these lists are not the most appropriate way of encouraging children to learn them.

The Game

The game described in this paper aims to present players with the basic procedures that are required to avoid asthma attacks at home. Playing the game entails connecting, using an appropriate viewer, to the server hosting the virtual environment. By using an immersive environment, players are better able to relate situations in the game to their daily life.

[1] Opensimulator: http://opensimulator.org/

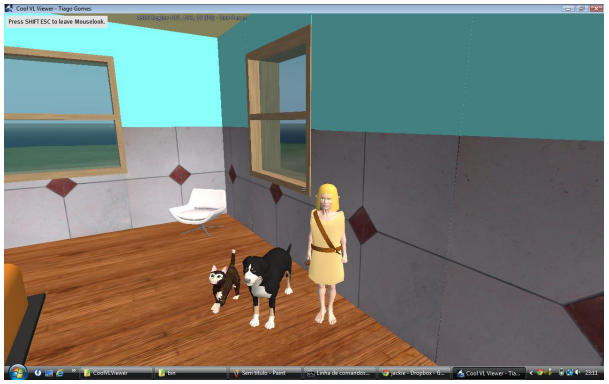

Figure 1: Pets in a bedroom

The model of a house was developed and enriched with objects from online libraries (using Google 3D Warehouse[2]). Locations in the house were related to some of the main causes of asthma attacks (see Figure 1). Next to each one of the triggers a character is placed that functions as a facilitator of learning. These characters take care of questions associated with the asthma triggers next to them. Each question has four statements associated with the asthma trigger. Of these statements, only one or two can be correct and the player must identify them. The statements in each question explain how to proceed when faced with the relevant trigger to avoid ashma attacks. For each correct answer the player gets a word. At the end of the game the words will complete a sentence about asthma. In this way the player is encouraged to correctly answer all questions. After answering all questions, the player is notified that the game has ended and how many of the answers given were wrong.

The specification of the game's logic is achieved by a combination of LSL (Linden Scripting Language) scripts directly in the environment, and CPN models in the behavioural component. We have experimented with different approaches to describing the behaviour, placing more or less control logic in the CPN models. The game is easily configurable, so new asthma triggers and corresponding questions can be inserted into the environment using the viewer.

[2]http://sketchup.google.com/3dwarehouse/

User Study

To assess the ability of the virtual environment as an aid to learning, as well as the acceptability of the game, a usability study was carried out. The target audience in this experiment were young people aged between 9 and 10 years, attending the fourth year of primary school. Since all the children were in possession of a personal computer with enough features and capabilities to run the game, their machines were used.

The procedure began with the preparation of all the machines to play the game. *Cool viewer* was installed and configured. The instructions were then given so that all users could use the platform without problems. Then, all users had at least 30 minutes to try to complete the asthma game. After this period, each of the players completed a 3-point Likert scale questionnaire describing their experience of using the game. The data collected helped to better understand the shortcomings of this first version of the game, and to determine what possible improvements could be implemented to increase educational value as well as to improve gameplay.

While the reaction to the game was positive (e.g. 12 out of 18 players found the game easy to play, and none difficult), it was found that some of the props used in the virtual environment, as well as the public availability of configuration options in the virtual server environment

used, contributed to some confusion in terms of the purpose of the game: 1) It was found that one of the main factors of distraction was that the water surrounding the game environment could be entered and the bottom of the sea explored for some distance. 2) The fact the players could fly was also a major distracting factor. 3) Another aspect which decreased the focus of the game was the ability to create new objects in the virtual world, as well as changing or removing existing ones. 4) The chat feature was another OpenSimulator feature which contributed to the lack of focus during the experiment.

A reason that may explain the confusion is that while some users stated that they had experience with computer games none of them had previously experimented with Opensimulator. Several Opensimulator features where new to them and their novelty would explain why these features distracted them.

Game redesign

In order to better focus users on the goals of the game, thereby improving learning about prevention of asthma, a second version of the game was developed. To avoid the first problem identified above, a barrier was placed between land and water, to restrict the area of the game. However users still had the possibility of entering the water area by activating the flight mode to overcome obstacles. Hence, the flight mode was disabled. A significant number of players lost time changing the environment. To avoid these distractions, the functionalities of editing the environment were blocked. Despite chat being found a distracting factor, this feature could not be disabled as it is used during the game to count the correctness of the responses for each player.

Players from the first user study continued to use the game of their own volition after the first use. This provided an opportunity to record all accesses made subsequently by the users. This type of information may prove useful for future analyses of platform use.

Conclusions and future work

At this stage we are preparing a second study with the new version of the game. So far we have learnt that while virtual environments proved engaging, there is a need to restrict what avatars can do to promote a focus on the objectives of the game. We also believe that the novelty of certain features had impact in distracting the players from the goals of the game. A new study with users with Opensimulator experience will hopefully validate this assumption. In addition, due to desire by users to return to the game outside the experiment, positive results and facility for creating new games, the APEX platform seems a promising approach for the rapid development of serious games and to support behaviour change and wellbeing.

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