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Digital Footprints – A tool for generating heat maps and capturing data from FPS games

Alastair Hebson[1)], Thomas Welsh[2)] and David C. Moffat[2)]

Abstract. This demo paper introduces the *Digital Footprints* software tool which can analyse data from the FPS game Unreal Tournament 3 and generate heat maps based on game data.

Digital Footprint s is a software tool with a number of potential uses. It interoperates data gathered from an FPS game session and formats that data as a heat map. This map can provide insight into player behavior, the actions and behavior of AI controlled bots and the structure and navigation of the game environment. In this way, *Digital Footprints* has applications in game design, testing, difficulty and team balancing and analysis of player behavior.

Digital Footprints is designed to work with the third version of the *Unreal Engine* which is the technology behind *Unreal Tournament 3*. The tool is coded in C# and requires the .net architecture to run.

Digital Footprints shows a plan view of the level that the players inhabits and thus provides an overview of where all players are and what they are doing. Queries can be made which will return the locations of specific, defined events in the game. For example, a query to show where certain weapons were used could be made. If a weapon was used twice at specific locations on the map, the result would look something like figure 1 below.

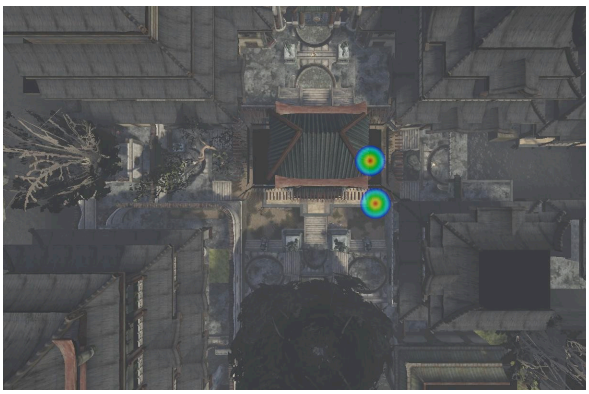

Figure 1. Plan view of game environment

A number of steps are involved to prepare *Digital Footprints* to display this kind of data. The image of the plan view of the map must first be captured. To do this, *Unreal Tournament 3* is run and when the game begins a mutator that we have created is loaded. This mutator sets the game camera to a fixed position and viewpoint and takes a screenshot of the level. A mutator is a small modification of a game which can be created by anyone with knowledge of UScrpit; *Unreal Tournament's* scripting language. Once the image has been captured with the help of the mutator it is saved to a specified file and the game can be stopped. By capturing the image in this way, *Digital Footprints* is able to work with any map available for the game.

Once this has been done, the player begins a game and uses another, different mutator to gather data in the game session. This mutator simply gathers data from the events of the game and outputs them to a log file. The log file is a tabulated, time stamped set of figures describing every event taking place during the game session. Once this log file has been generated the main executable can be run and the user will be able to generate heat maps based on the data captured from their game session.

Once the main *Digital Footprints* program is run the image of the game level is loaded and over this heat maps are drawn. At this point the user can select the data to be included in the heat map.

One of the most simple heat maps the user might generate would be one which shows the navigation of a player throughout the course of a game session. *Digital Footprints* would highlight areas of a displayed map based on the amount of time spent in that area by the players (figure 2). This heat map allows the user of the tool to determine the busiest parts of the map and the areas where either bot or human players fail to explore. A simpler version of this type of heat map was used in the development of *Halo 3*. In that case, the heat maps showed only human player navigation through a level and were used to balance the difficulty and play test the single player campaign.

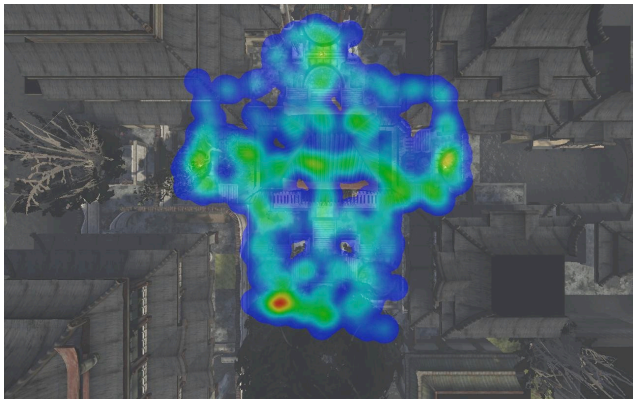

Figure 2. Heat map showing player navigation

The heat maps generated by this program offer unique opportunities for many areas of game research. The heat maps are simple to generate and can offer clear representations of the events of the game which can be easily understood. The uses for such rich and accessible data are limited only by the imaginations of the researchers who use this tool.

1) Rockstar North, 1 Greenside Row, Edinburgh
2) Glasgow Caledonian University