Virtual Globe Games for Geographic Learning

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ABSTRACT

Virtual, online maps and globes allow for volunteered geographic information to capitalize on users as sensors and generate unprecedented access to information resources and services. These new "Web 2.0" applications will probably dominate development and use of virtual globes and maps in the near future. We present an experimental platform that integrates an existing virtual globe interface with added functionality as follows; an interactive layer on top of the existing map that support real time creation and manipulation of spatial interaction objects. These objects, together with the existing information delivered through the virtual globe, form a game board that can be used for educational purposes.

Keywords: Author Guide, Article, Camera-Ready Format and Paper Specifications.

1. INTRODUCTION

Geographic literacy is alarmingly low in the U.S. as witnessed by a recent report suggesting that "…young people in the United States – the most recent graduates of our educational system – are unprepared for an increasingly global future" [1]. Geography is also the only 'core academic subject' identified within the No Child Left Behind act that lacks funding as well as any specified implementing programs. This is a major concern in an increasingly interconnected and information rich world, where spatial thinking is a crucial skill for science, workplace and everyday life activities. So it is both evidence and a paradox that the use of online virtual globes and maps is exploding and geography is emerging as a key means for organizing web data.

We see an opportunity to address the literacy problem through the strengths of emerging technologies and a recent but rich literature on game-based learning [2]. As an example, James Paul Gee [3] present 36 principles of learning that he argues are currently built into good video games and how these potentially can be used for targeting specific learning goals. This paper reports on work to develop a user interface that combine the popularity of many computer based online games with rich information on the state of the world delivered through virtual globe browsers. The *Virtual Globe Games* (VGG) concept will then be presented as a learning tool, not only from a perspective of students as consumers of content, but also discussed from the perspective of having students as producers of content.

2. VIRTUAL GLOBES

Several revolutionary map and image based geographic data access platforms have emerged during the last 5 years. For example, in 2005 Google, Microsoft and Yahoo! all released free online mapping sites that went far beyond what previous web map interfaces such as MapQuest had provided. Most importantly, these new websites provide open Application Programming Interfaces (APIs) that allowed users to build customized mapping applications that could be embedded as part of their own website. They also increasingly offer support for user contributed data such as photographs, points of interest, and even live feeds from news organization such as the New York Times. These developments have been a key driver behind what is now termed the Geospatial Web [4], in which online communities can access and share geographic information

Continuing these developments, Virtual globes are Internet-based applications that display a 3D model of the earth. On top of the globe model they can drape images taken from any vantage point, such as satellite images, air photos, and even images taken from the ground. In addition, any type of information that you can find on the Internet can be displayed as part of the globe model. A highly interactive interface allow users to select what to display, spin the globe around and zoom in and out between a full overview of the globe down to detailed views of your own neighborhood. There is built in support for adding your own 3D models and even 3D rendering of the entire environment.

The easy access, rich content, and a fascinating ability to 'fly' around to anywhere in the world have made virtual globes enormously popular, and they are currently used for anything from professional applications through leisure activities. The Google Earth browser was quick to provide users with a possibility to add their own information in this rich geographic context, free for anyone to see. With the growing popularity of virtual globes, users have realized that most information has a spatial location; photographs, video clips, articles, weather, travel information. In this evolving and growing "wiki-cartography" there are now also themed collections ranging from Americas favorite architecture, through the refugee crisis in Darfur, near real time tracking of California wildfires, to spatial annotations of books. The wiki approach implies a community effort that contributes to make virtual globes a tremendously rich environment for exploring information on human activities and the physical environment through a bottom-up and grass-roots geographic perspective. Some well known solutions are Google Earth, Microsoft's Bing Maps 3D, ESRI's ArcGis Explorer, and NASA's Worldwind.

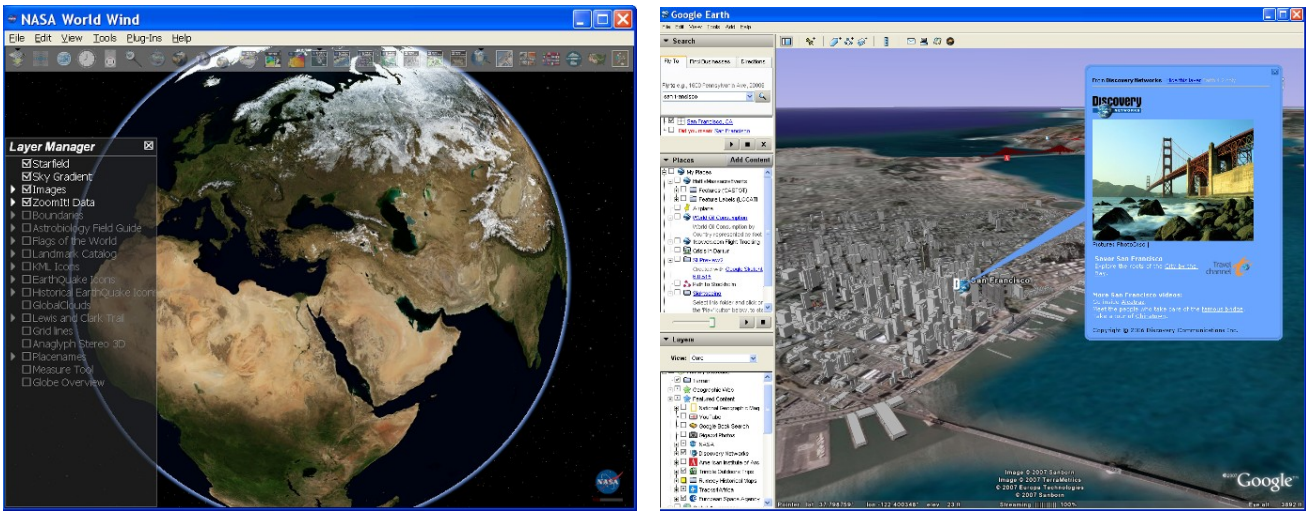

Figure 1. The NASA Worldwind (left) and Google Earth (right) applications.

While many now see these online mapping platforms as the ultimate solution of bringing the power of GIS to the people, much of the functionality in terms of user interaction, social networking, and collaboration offered by Web 2.0 remains to be exploited. In addition, the traditional hallmarks of GIS to model and simulate geographic phenomena have yet to find its place in this new environment.

3. THE VIRTUAL GLOBE GAMES INTERFACE

We take the above mentioned developments one step further and leverage the current use of virtual globes and geographical web resources from a simple "search, find, and display" tool to an educational quest that requires observation, inquiry, and analysis in order to promote geographical literacy and global awareness. The Virtual Globe Games interface transforms an existing online virtual globe into a "game board" and implements interactive web functionality and content as a source for challenges and answers on geographically related issues. More specifically, we have developed several games that add an interactive layer on top of an existing online map interface adding support for multi-user interaction and manipulation of "scenario objects". These objects can be game pieces on the map, dice, playing cards, and even functionality such as user chats or searches for other information over the web. This allows for construction and execution of game-like scenarios, through which users can immerse in, explore, investigate and learn about our world.

Pilot applications

A few experimental pilot applications have been developed. One was built to develop support for multiple user interaction around a live map and to run the application users only need an Internet browser with a free Google Earth web plugin http://earth.google.earth. The interface was constructed and rendered using lightweight HTML, and user interaction is handled through asynchronous JavaScript and XML. Furthermore, leveraging Google search API, users are given the ability to search web information during the game play and when KML results are returned, they can be dynamically loaded onto/off from the globe interface as the user desires. There is also a chat interface to enable communication between players since they can play the game over the Internet and be located anywhere in the World.

In a second prototype (see Figure 2) we developed a geographic board game, similar to the popular RISK game that we envision can be used as part of instruction and homework assignments in an introductory, undergraduate Geography class. In contrast to a standard board game, the information that feeds into the game mechanics are not set to pre-defined fact bases, but can be accessed from live information resources through the web. In our RISK-style example we use online information on e.g. country GDP and population to inform game mechanics such as evaluation of player resources for movement and actions. The game also reads real time information on weather conditions from NOAA web services, and that information is used to affect the game mechanics. For example, if there is a major snowstorm or heavy rain in one state, troop movements are limited across that state. On the other hand, pleasant weather allows for troop movements across longer distances. Since weather information will change from day to day, or sometimes during the course of the day, the game will never be quite the same. It is similar to what traditional board games would do through a random deal of weather cards or something, but with the capabilities of online information we can tap into realistic data and actually learn a bit about the area. Along those lines it easy to envision that the developed platform, together with online geographic information resources can potentially support other application areas such as public policy scenarios and planning.

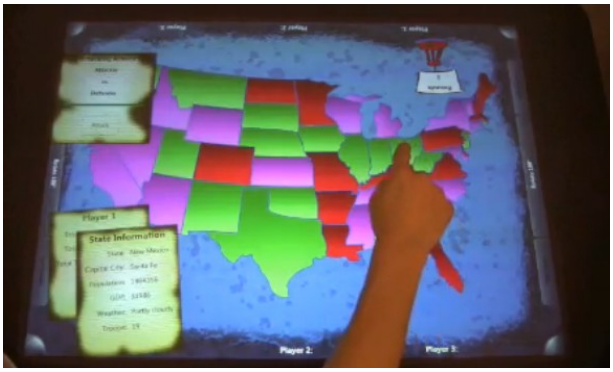

Figure 2. The second prototype "Calculation" developed for the Microsoft Surface table.

4. DISCUSSION AND FUTURE WORK

In this paper we have presented a novel idea to use existing online map interfaces as game platforms in order to develop engaging learning activities around geographically situated scenarios. In future work we will continue to integrate components of online social networking so that we get closer to a geographically based conversation around a task. Through this we can start looking into even more realistic scenarios in which we also seek support for social and environmental models. In this work we see a tremendous opportunity to investigate how a richer support for user interaction and simulation of real world processes such as water models, economic transactions, and market negotiations can be integrated with a GIS interface. We argue that the objective of such collaborations is not necessarily towards a specific conclusion, but for identifying, modifying, and recreating goals based on continuous alignment to user/citizen needs and work towards local community goals.

5. REFERENCES

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