unexceptional.net

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ABSTRACT

This paper describes the pervasive game unexceptional.net. Unexceptional.net is a unique pervasive game that is story-driven where the story evolves through multiple media channels interacting with the player. The game interacts with the user on a cellphone and a PC, and the game provides unique gaming experience by introducing gameplay elements through comics, web hacks, Blogs, a 3D client, a transaction visualizer, a phone client and an applet client. The paper describes the process of building this game through integrating various open source software and running multiple student projects. Further, the paper reveals challenges in building multi channel pervasive games and identifies how this was solved in the unexceptional.net project. The contribution of this paper is the description of a novel pervasive game and the experiences from designing and implementing this game.

Categories and Subject Descriptors
K.3.2 [**Computer science education**], K.8.0 [**Games**], and D.2.11 [**Software Architecture**].

General Terms
Documentation, Design, Experimentation, Human Factors, and Languages.

Keywords
Software architecture, Game Development, Pervasive Gaming, Game Concept.

1. INTRODUCTION
Research within pervasive gaming has had a growing interest the last years and the development of mobile and context-aware computing opens for new opportunities in this domain. Traditional computer games are attractive for people as they draw them into an interactive imaginative world through sound and graphics [1]. Good computer games immerse the player through fantasy, providing the appropriate challenge, and stimulating the player's curiosity by hinting to the player that something will be reviled if the player succeed to the next level [2]. Games are now becoming more important as a social arena and in games like World of Warcraft the social aspect plays a major role [3]. Pervasive gaming tries remove the boundaries that games are only played on your computer or game console and does not relate to the real world. In pervasive gaming, the games can be played in various settings, on multiple devices, and interaction with real physical things and people. Pervasive games can also be classified into their own genre of games like *smart toys* – electronic toys with sensors that include game mechanics, *affective*

gaming – games that influence and/or are influenced by emotions, *augmented tabletop games* – mix traditional tabletop games with computer games, *location-aware games* – games where the gameplay is affected by the players physical location, and *augmented reality games* – games that uses augmented reality to allow gameplay that mixes real (physical) and virtual objects [4].

In this paper we describe the project unexceptional.net, conceived and directed by Professor Robert Nideffer at Department of Studio Art and Informatics, University of California, Irvine, over a 3.5-year period between Fall 2002 and Spring 2006. Unexceptional.net can be classified both as an affective game and a location-aware game according to the taxonomy presented above. The uniqueness of this game can be characterized in that it is story-driven, and that the story evolves for the player through multiple ways of interaction. This paper describes the concept of the game, architectural considerations, and experiences form implementing the game.

The rest of the paper is organized as follows. Section 2 describes an overview of the game. Section 3 describes experiences from designing and implementing the game. Section 4 describes related work, and Section 5 concludes the paper.

2. GAME OVERVIEW
Unexceptional.net is a mystical realist journey catalyzed by a series of interconnected events related to sexual infidelity, political conspiracy, and spiritual transformation. The project draws on the traditions of comics, graphic novels and computer games in order to create an environment that crosses boundaries between pop culture, fine art, and social critique. It also blurs the borders between "real" space and "virtual" space. The game has been developed as a net-centric, multimodal, pervasive action adventure RPG accessible via GPS enabled phones, the Internet, and a 3D game client.

In the game you get to play a supporting role to the main character, Guy who has discovered that his long-time partner is having an affair. This discovery launches him upon a series of quests that you participate in, in effort to gain insight into the nature of his partner's relationship. The main gateway to the game is through a Web portal designed by Guy, where he keeps a Blog documenting his daily trials and tribulations. He links to his comics, Web-hacks, and games from the Blog. Guy also provides running commentary on issues as his dramatic experience unfolds. Guy's life is utterly out of control, and you attempt to help him regain a sense of stability.

For better or worse, Guy's the kind of friend you like to have because he gives you and your other friends something to talk about. But unlike cults of personality built up around "live" celebrities where people must fantasize a personal connection to the star, Guy actually can reach people on a personal level. Moreover, he can do so on a non-human scale, because there's nothing to prevent him from carrying on thousands of intimate relationships at once, since for all practical purposes he's nothing but a highly scripted, automated and dynamically updated interactive database.

2.1 High Level Goals
There were a number of ideas motivating the development of the unexceptional.net project. These included an interest in linking a range of seemingly disparate devices and technologies together as part of a unified/shared game space; developing compelling content to demonstrate the power and potential of such linkage in a fun and playful way; and allowing players to not only become immersed in the environments created for them, but to participate in various ways to modify and/or extend that content based on their own interest and experience. Toward these interests, key objectives of the project included:

1) using unexceptional.net as a testbed for deploying custom designed and freely distributed software that takes advantage of everyday communication technologies such as Blogging, email, 3D gaming, and mobile telephony in order to enable anywhere anytime access to heterogeneous game worlds;

2) implementing the game infrastructure in such a way that it can either be easily modified or used as a template for alternative content development and deployment;

3) facilitating ease of content creation through provision of a Web-based "World-Building Toolkit";

4) sharing the results in the public domain through Internet distribution, formal exhibition in fine art contexts, professional conferences and events, and publication; and exploring novel forms of single-player and multi-player interaction.

2.2 Architectural Description

Figure 1 presents an architectural overview of the game and its components, which are rather extensive. All were either modified versions of existing open-source or freeware software, or our own custom solutions. They included:

- Greymatter[5], a Perl/CGI based flat-file open-source blogging software modified to dynamically load Guy's blog posts based on the player's game state;

- a 64 table MySQL[6]/PHP database for storing real-time game transactions including quest status and in-game item exchanges;

- a variety of web-based quests, and accompanying comic 'hacks' where comic panels were overlaid using DHTML on top of parsed and reconstructed web pages that players went to as part of quest completion requirements;

- a multi-modal location-aware phone game played in several different ways: (a) as a screen-based game using the number pad as a controller to navigate in-game guy's "physical body" from quest starting point to quest destination point; (b) by toggling to guy's "astral-body" mode which gets navigated in relation to the external game player's physical movement from a quest starting point to a quest destination point mapped in real-world space; (c) in "talk-mode" which interfaces an open source version of Asterisk's pbx telephony software integrated with CMU's Sphinx text-to-speech, speech-to-text software [7] to enable automated call routing to player's based on their physical location;

- a Java-based applet simulator allowing players without GPS enabled phones to play the game via the project's web portal;

- a custom Java-based server to broadcast connection and location data to all active players so that information regarding which clients players were using to connect to the game was available, as well as their current game status;

- a 3D location-aware client using the Torque game engine [8] that essentially mirrored version (a) of the phone game making available 3D renderings of the game environment that also were keyed to player lat/lon location;

- a framework for shipping game world data to the cellphone and the 3D client from the central server based on the player's current region, enabling the phone game and Torque engine graphics to mirror the look and feel of real-world locations (i.e., if a player is over desert the game clients load desert terrain, if playing in a city, the clients show an urban environment, if played in coastal zone, coastal data is displayed, and so on);

- a pixel-based world map lookup table that allowed creation of "metaregions" (those regions defined as existing outside of the actual quest regions) so that the players have an approximate representation of the world no matter where they may be playing from;
- integration of the Googlemap API [9] to allow real-time tracking and display of all connected players, as well as summary game-state information, and ability to view prior quest paths stored in the database;
- PHP based modding utilities allowing customization of virtually all game assets in real-time through simple form-based submissions and/or data uploads;
- a Flash-based database transaction visualizer allowing dynamic viewing of other players' in-game status, including the ability to view players by quest status, geographic location, or needed items.
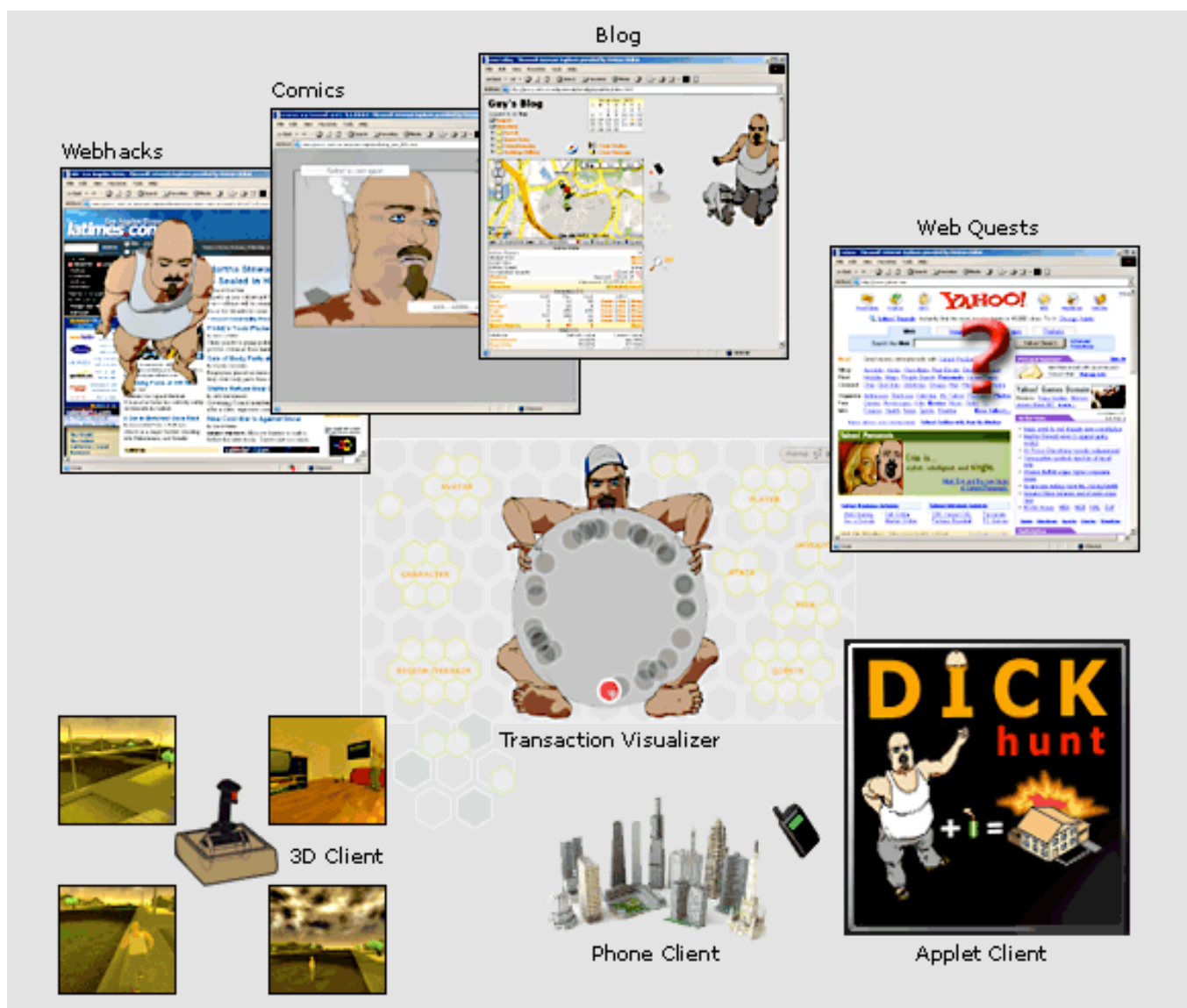

Figure 1 An Architectural Overview of unexceptional.net

2.3 The Narrative

To attain enlightenment Guy must be accompanied on a series of quests to find special objects that will help open all seven of his major "Chakras," the energetic centers of the body according to Buddhist doctrine.

The overall narrative arc entails:

1) an introduction to Guy as the crass, angry, resentful, cynical and curmudgeonly fellow that he is by nature;

2) the catapulting of Guy into a period of crisis linked to discovery of his cheating partner Betty and her love for Dick in the midst of terrorism, war, and homeland insecurity;

3) exposure to Betty and Dick's disturbingly co-opted Eastern mysticism, deployed as a means for experimenting with mind and body control techniques that use Guy as an unsuspecting guinea pig; and

4) Guy's neurotic compulsion to achieve enlightenment… whatever that may mean.

2.4 Example Scenarios

Greta, A PC user ends up at Guy's Web portal on her PC, reads a bit about his project, and decides to create an account in order to become a registered player. Account creation requires a player name, a valid email address, a mobile phone number, and a password. Upon registration she gets sent an email from Guy, and is forwarded to his Blog, which contains a single post providing context for the game about to unfold. The post also gives her the first quest, and provides a link for downloading Guy's recently released mobile phone game, "Dick Hunt" (see screenshot of the game in Figure 2). She activates the quest, and then downloads, installs, and launches the phone game.

When Greta starts the phone application, the entire game world – terrains, structures, characters, statistics, inventory, quest – gets built for her based on her geographic location. The game can now continue endlessly in every direction for Greta, due to an algorithmically generated grid-based game layout. Moreover, each grid has a simple coordinate that's stored in memory, which allows for identical path and object placement on return. The game also sends Greta's physical location information to the game server, allowing her to be tracked by other players in real-time. If Greta decides to play without a GPS enabled phone, or to simply use the Applet version of the game in Guy's online portal, she can still advance by:

1) exchanging inventory items with non-player characters in the applet;

2) offering to sell goods to a shopkeeper accessible through the Blog; or

3) participating in an online trading network, also accessible through Guy's Blog, that allows her to post offers for goods to other players who are alerted via email as well as upon Blog login.

Figure 2 "Dick Hunt" phone game played in Guy's "physical body" mode

After several minutes Greta enters a pre-defined "hotspot" that causes an automated call to be placed from Guy's help-bot to Greta. Greta's phone rings, interrupting the visual interface to Dick Hunt. She answers, and can now continue her quest in voice-only mode. Guy's bot tells her she's in the vicinity of a spot where Betty was rumored to have spent time with Dick, and goes on to lists all the objects available for her to interact with, along with the actions that she can use to manipulate each object. Greta successfully "gets" some of the available objects, which get added to her inventory. She then unsuccessfully attempts to "use" one or two of them. Greta continues walking and talking, as her voice commands are interpreted on the fly by the text to speech and speech to text system. Along the way, she enters a region where another player is active. At this point Guy's bot tells her that she may attempt to steal items from the inventory of the unsuspecting player. Greta does so, but unfortunately is unsuccessful, and instead has something stolen from her! The phone constantly updates the inventory and statistics kept in the database of both parties. Greta quits out of voice-mode and resumes playing the visual version of the Dick Hunt phone game. When she finally navigates both the in-game avatar as well as her physical body to the destination waypoint, she happily watches as a special key object descends from the heavens to be placed in her inventory.

Later Greta arrives back home and logs into Guy's Blog from her PC. She now sees her updated game-state information as well as a visual mapping of her movement in space and time. She also has a Blog-based link to a Web-page associated with the key object that contains a key-code that will allow her to gain access to critical game related information. Once accessed, her initial quest is completed, her stats are updated, and a new Blog post and quest are made available. Next time she thinks she may even want to try the 3D client (see screenshots in Figure 3). But for now, she's had enough of Guy and his chaotic world (see http://unexceptional.arts.uci.edu/).

Figure 3 Torque Game Client 3D Region Samples

3. EXPERIENCES

In late Fall of 2002, Robert Nideffer started exploring ways to combine an interest in comics and graphic novels, computer games and the Web as a delivery platform for episodic content. The process began by playing around with a commercial 3D modeling software, Poser, to begin mocking up character designs. He developed a main character, "Guy", to serve as a proxy for exploring a range of issues related to interpersonal relationships, spirituality, and corporate and political interconnections related to developments in science funding and nanotechnology. From there he began to create and then narrate fairly conventional comic panels, that were laid out via DHTML, and clicked through as a series of layers that would be shown/hidden as users accessed them from a single Web-page.

At this early stage part of the interest was to investigate new forms of comic design and delivery. At the same time Robert had the idea of trying to use a newly released game development environment written by Ambrosia Software for the Apple platform called "Coldstone" [10] as another type of delivery platform. The idea was to create a top-down scrolling game, where the player moved Guy across the "pages" of the graphic novel/comic, revealing the comic narrative while playing an embedded game. Sadly, Coldstone development efforts stopped, and the engine was too unreliable to continue working with.

Shortly after, Robert visited the offices of Electronic Arts in Northern California to meet with Neal Young, one of EA's main game producers who had been responsible for directing a project called "Majestic" [11], an episodic, net-centric, conspiracy styled game that took advantage of a variety of everyday communication devices – Web, email, instant messaging, phones and FAX machines – in order to deliver game content. Majestic had the plug pulled on it for a variety of reasons after the World Trade Center bombings on 9/11. Robert's not so hidden agenda was to get EA to allow him access to the

engine behind Majestic to the university for creative experimentation. Needless to say, that did not happen. Neal did indicate however, that the core engine technology behind the game, what they had termed the "experience server," was not actually that complex – it was all the third-party deals that had to be struck to pull it off that made it so expensive (reportedly some $10 million). The outcome of that meeting was that Robert decided to independently pursue development of a similar framework for tying together heterogeneous devices as part of a shared game space, using free, part-time student labor at the university in the context of an art department, with no initial funding.

In 2003, Robert pitched the idea for "unexceptional.net" – a game environment that would be net-centric and have a range of modes through which the player could interact with it in real-time – to students in a course taught regularly in the school if information and computer sciences at UC Irvine called "Project in Software System Design." That course required students to form teams of 3-4, bid on projects they found interesting, and create plans with the project "sponsor" (in this case Robert) for what they would achieve by then end of the term. The team's grade depended upon their success at achieving those goals. Three teams were interested in unexceptional.net. Normally only one team would be chosen per project, but given the complexity of the project and student interest, the instructor allowed two teams to begin working on it.

Over a two-year period, Robert worked with four teams of students from three different instances of that course. In addition, other students would hear about the project and become interested in getting involved. Thus, over a fairly extended period of time, different configurations of undergraduates, almost exclusively from the computer science department, worked on various pieces including early location-aware phone prototyping, database setup, PHP/MySQL integration, 3D Torque game engine scripting, 3D modeling for Torque, Asterisk PBX telephony and CMU's Sphinx integration for the talk version of the phone game.

This two-year phase was quite difficult, as teams would come and go. Some were talented and productive, others were not. There was little or no robust documentation or version control system in place. Thus Robert would have to walk new student collaborators through prior work, and figure out what to retain, and what to trash. In most cases, starting over from scratch became easier than retention; however it often took long periods of struggling to retain before coming to that realization.

Eventually, four of the undergraduate students (from the more than 20 that were involved at various points), began to play a key role as collaborators – Alex Szeto (a co-author of this paper, who came on board in 2004, and was responsible for the location-aware phone game, and the Java server, and whom Robert still collaborates with), Calvin Lee (who was responsible for much of the PHP/MySQL integration, Greymatter Blogware modification, and Asterisk/Sphinx integration), Dan Repasky (who helped with 3D modeling and scripting for the Torque game client), and Sunny Chu (who played a key role in scripting the Torque client version of the game). Two of those four (Alex and Calvin), Robert was able to hire on as paid part-time researchers in 2005, using money from a concurrent funded project. Once Alex and Calvin became formally involved, development moved forward on a far more consistent basis.

In addition to undergraduate collaborators, Robert worked with several graduate students – Sky Frostenson, Eric Cho, and Eric Kabisch – from the Arts Computation Engineering program that he co-directed. Sky and Eric had experience on prior projects that used the Torque game engine, and thus were in a good position to create the first prototype of the unexceptional.net Torque client. Sky and Eric were both key in mocking up the first characters, buildings, and environment (though neither were in a position to do any of the necessary game scripting). Prior to coming to ACE, Sky and Eric had also

collaborated on a Flash based web game called "Bomb the Suburbs" that served as aesthetic inspiration for the phone game component of unexceptional.net. As a result, Sky also worked closely with Alex and Robert in creating art assets that helped to establish the look and feel for the mobile phone game.

Eric Kabisch had an interest in data visualization and a strong background in Flash programming, and in electronic music. A small amount of funding was secured to support Eric in developing a Flash component that would render all the database activity associated with unexceptional.net in real-time, with accompanying sound. Alf Inge Wang (co-author of this paper) has not contributed to the unexceptional.net project, but as visiting researcher at UCI initiated a process of publicizing results of this project in research papers.

As might be guessed, one of the main development difficulties had to do with managing a diverse group of largely unpaid students with varying levels of commitment over a lengthy implementation cycle lasting more than three years. Much of that time was spent "lost in code" meaning that difficult problems related to software architecture were being worked on across a range of technologies. During that phase, Robert worked on story content, user interface design across the range of devices, graphics for the phone, Web and 3D client, and Web design and implementation. Another main challenge was figuring out what was essential to the project, and what was extraneous. However the biggest issue had to do with the "creeping features" problem. Over the course of the nearly 4 years it was in development, unexceptional.net became so layered and complex that very few players actually had the chance to experience, understand or appreciate the scope and scale of the effort, and what was possible to do within it.

4. RELATED WORK

Although most pervasive games have a unique twist, there are several similarities of such games like the utilization of physical location and use of mobile technology. In this section we will describe some pervasive games described in the literature.

Cheok, Sreekumar, Lei and Thang describe a pervasive capture the flag game (CTF) [12]. The goal of the game is to use mobile devices, PCs and networks to provide an experience where the real-world is mixed with a virtual world. The setting of the game is medieval time where two teams fight as red and blue teams with the goal of capturing the flag at the enemy's castle (virtual castle). A team consists of two types of players: 1) real-world players representing knights that move around in the real world performing various actions; and 2) virtual-world players guides the knights through the real world based on a virtual map that describes various game elements such as castles, flags, bombs, traps, and magic potions. The flag is a physical wooden box holding a Linux-based Bluetooth device with a virtual representation, while the other entities are only virtual entities without any physical representation. The knights use a mobile phone with a GPS while the guides use PCs. All communication between knights and guides is performed as text messages within the game. Compared to the unexceptional.net game, this game draws clear boundaries between the virtual and the real-world through two different player types. In the unexceptional.net game these boundaries are blurred on purpose.

Epidemic Menace is a game where the players become medical experts with the goal of saving mankind that has been threatened by a mutated virus [13]. The setting of the game is that a mad scientist has created a lethal mutation virus, it has spread through out the university campus and infected all humans, and the players should through collaboration defeat this threat within three hours before it spreads outside the campus. Each team has a room equipped with stationary devices that allow players to observe and analyze the virus and to communicate with other team members. The mobile players have to go out to capture and destroy the virus. The mobile players are equipped with a PDA and a GPS

device to track their position (position-belt) and either a mobile augmented reality system or a smart-phone. The mobile players can kill the virus by using a virtual spray they can use if they are close enough. The smart phone can be used to communicate with team game room or to catch the virus in the player's proximity. The game follows a pre-scripted plot. This game is similar to the CTF-game described in previous paragraph, but has also a story. However, the game is not story-driven but focuses on solving one specific problem.

SupaFly is characterized as a community-based virtual soap opera where the players create characters and interact through them [14]. The goal of SupaFly is to make and maintain relationships with other players through sending text-messages using SMS (short-message service). Further, a Web site is provided to let the players manage their characters and track their development in the game. The scores of the players are computed by analyzing how many relations a player have and how much this player has communicating to her/his friends. The goal of the game is to reach the highest level of status in the community to become "Supafly". Every action in the game generates news in the game's online magazine. The game also uses positioning to let the players pick up virtual objects by moving around in the physical world and if players are in the same area. SupaFly uses many of the same elements as unexceptional.net, but is less story-driven and mainly focus on social interaction.

moBIO Threat II Disease Control is a pervasive game similar to Epidemic Menace where two teams are competing to accomplish their own mission trying to prevent the other one from achieving its goals [15]. Terrorists have attacked and kidnapped the biologists at the university's microbiology lab and stole their research. The goal of the game is to play either as terrorists or as a counter-terrorist that must prevent the enemy from achieving a mutilated pathological agent and lunch it using a missile. This can be done by either neutralizing the enemy force or by synthesizing an antidote for the agent being developed. The players use a Tablet PC with built-in loudspeakers, microphone, Bluetooth-card, and WiFi card. The WiFi network is used for communication between the players and the server, while the Bluetooth network is used to manage interaction between players that are physically in the same area. RFID tags are placed on physical objects being a part of the game such as trees and rooms. Location positioning is provided by mapping tagged objects in the physical world with their position.

The Drop [16] is another pervasive game where two teams use cellphones to play a variant of capture the flag where one team hides a virtual "briefcase" and the other team attempts to find it within a specified amount of time. The design of The Drop is based on the assumption that there is a beacon-based location system that can track mobile phones in the playing area. This means that the playing area must not be too large, e.g. a mall.

There are other examples of pervasive games made that we will not cover in detail such as a three-way physical game based on table tennis [17], PAC-LAN [18], Albert in Africa [19], Breakout for two [20], Swordplay [21], and Virtual aquarium and Mona Lisa bookshelf [22].

None of the game in this related work section provides the diversity and the multiple interfaces found in unexceptional.net. Unexceptional.net is also unique in the sense that it is strongly story-driven and that the story is dynamically revealed through a character's Blog.

5. CONCLUSION
In this paper we have described the pervasive game unexceptional.net conceived and directed by Professor Robert Nideffer. The goal when developing this game was to explore ways to combine an interest in comics and graphic novels, computer games and the Web as a delivery platform for episodic content. The game communicate to the player through several channels like comic books, Blogs, Webhacks, Web quests, 3D-client, mobile client, applet client, and a database transaction visualizer (see

Figure 4). The game has built in location-awareness and all the parts of the game are put together through the story about a character name Guy. The game does not ask the player to solve one particular problem or task, but integrate the player in the story through various user interfaces. The game also utilizes interaction over the phone by using text-to-speech and speech-to-text software. The various software components in the game are based mainly on open source software integrated through a database. The unexceptional.net game shows how it is possible to produce pervasive game with a multitude of game-play elements and ways of interacting with the players.
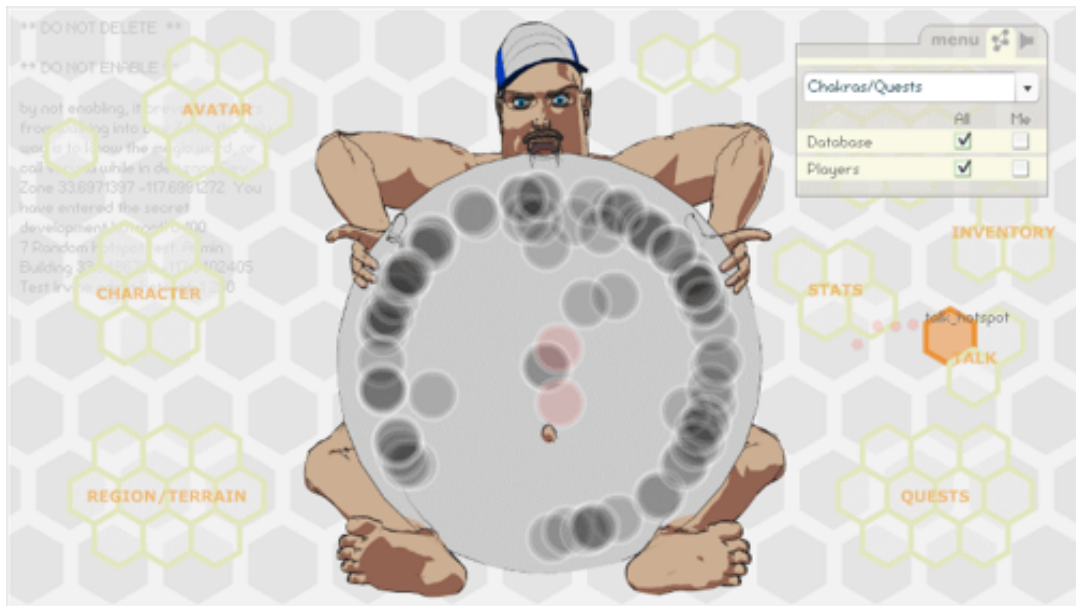

Figure 4 Database Transaction Visualizer

The experience from building the game described in this paper shows that it is hard to build such a game, as it consists of various loosely co-existing and interconnected parts that enable the diversity of gameplay and user interfaces. To develop such games in a university setting is especially difficult, as the project must rely on many short-time student projects where the developers leave after a relative short time. To succeed, it is necessary to have some dedicated developers over a longer period of time that understand the underlying architecture and know how to get the different parts to communicate. One of the main challenges of building a pervasive gaming with multiple interfaces and gameplay elements is to establish an architecture that allows the game to change in any direction (evolve), and at the same time provide robustness and a system that is easy to configure. Diverse pervasive games have to cope with configuration challenges in making various technologies work together. This is always a difficult problem, as new releases of underlying third-party components will cause compability problems for the whole game.

The unexceptional.net game shows that pervasive games can give new and unique game experiences that involve other user interfaces than the ones normally used for gaming. The future will reveal new pervasive games that will take players to new places never seen before and let them experience a game through multiple interfaces and gameplay elements.

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