Spectator Games:
A New Entertainment Modality
For Networked Multiplayer Games

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Networked multiplayer games are becoming tremendously popular. At any given moment on the Microsoft Game Zone (http://zone.msn.com), there are thousands of people playing Asheron's Call or Age of Empires. Traditional board and card games are also increasingly being played online and will continue to gain in popularity. While networked games are certainly fun for active players, there is potentially a much larger audience: spectators. In most traditional games, such as football, the number of spectators far exceeds the number of players. The key idea presented in this paper is to tap this potential by making online games engaging and entertaining to non-players watching these games.

The experience for spectators can be made much richer by employing techniques often used in sports broadcasting, such as a commentator providing analysis and background stories, slow motion and instance replay. For 3D games, cinematic camera movements and shot cuts be much more visually interesting than the first-person views often provided to the players. There is the potential to significantly increase the "eyeballs" on sites such as Microsoft Game Zone. Spectators can be more easily targeted for advertising. Finally, supporting the spectator experience will help drive sales of the games themselves as casual viewers take the next step to become players.

Watching others play networked games has the potential to become a vital component to an overall entertainment/media strategy. The authors of this document have already developed significant technologies needed to support the online game spectator. We propose that new resources be devoted now to carry these technologies into practice.

INTRODUCTION

People play games and watch TV primarily for entertainment. There have been many attempts at making TV more interactive, but there have been few attempts to go in the other direction – making interactive games attractive for passive viewing. We can draw an analogy from the sports industry to see why this is important: Television helped fuel the popularity of the sports stars as well as the sport they engage in. Watching sports on TV, rather than participating in them, became an entertainment form itself – complete with its star system and fan base. Likewise, watching networked games has the potential to become a new entertainment form.

As inexpensive internet-enabled game consoles, such as Sony PlayStation 2, Microsoft's X-Box, and Nintendo GameCube, flood the market, more people will flock to participate

networked multiplayer games. Unlike trying to master a new game, watching skilled people play requires little initial commitment and is a great way to get a gentle introduction into the often-complex games that are currently being played. With more engaging experience, more people may be willing to watch a new game. Sales of the games themselves will be driven up as casual viewers take the next step to become players. With enough audience, there will be plenty of opportunities for advertisement, merchandizing, and cross promotion. If the experience is entertaining enough, some people may even consider buying a console mainly for watching games.

USER EXPERIENCE

Our key focus is to make watching networked games a much richer and more enjoyable experience than simply seeing what the active players see.

- **Cinematography:** An active player's viewpoint must allow him to control the actions effectively. And the game designer often restricted a player's viewpoint intentionally to block him from accessing certain information. The viewpoints for spectators have no such restrictions, thus can tell a more complete story. In a war simulation game, first person views for the ground troop would be required for individual success but the spectators can take a strategic view from the hilltop to see the larger picture of what is going on in the game. Furthermore, techniques used in broadcasting or moviemaking could be applied to make it more visually interesting. For example, a game of Quake for spectators can look like an Arnold Schwarzenegger movie when cinematic camera movements and shot cuts are used.
- **Commentator:** A human commentator, or a computer-simulated commentator agent, can provide analysis and background stories in a game broadcast. This is especially useful for new players attempting to learn a new game.
- **Audience Awareness:** Perhaps equally important is the notion of audience awareness for games. If the size of the audience is visible to other audience members, viewers might be attracted to places where there are a large number of people viewing. Players might be able to receive feedback about the number of people observing them. For example, crowds showing up around an arena to indicate the size of an audience, or cheering or booing can be transmitted to everybody else. This could create a virtuous feedback cycle where people come to play games because there is a large audience observing them.
- **Rich Spectator Activities:** Although spectators aren't actually playing the game, they do not necessarily need to be passive. In addition to the abilities to pause or instantly replay the action, they have the opportunity to kibitz or chat amongst each other, or as appropriate, to the players themselves. In board and card games, kibitzers have many options when viewing games or tournaments. They can see a single player's cards or all of the people's cards, they can discuss among themselves, and they can see how many people are watching. Some games might be designed to incorporate audience feedback like "Who wants to be a Millionaire" or "Big Brother".
- **Stars and Fans:** Almost everything that has emerged to build a system of stars and fans in conventional sporting, such as player/team standings and statistics,

tournament updates, newsletters, background and bio information, etc., can be incorporated into the spectator model.

If the broadcast is offline as opposed to live, additional post-production is possible:

- **Better Animation and Rendering:** Better animation and more detailed rendering, which require too much computational power in real-time processing, may be added in the post-production phase.
- **Editing:** For long running games, time-compression and editing techniques can be used to produce more action-packed highlights.

To better illustrate the idea, some example usage scenarios are given below:

1. Like in real life, a group of friends in the online world can go out together to an online gaming destination. A few of them can play while the others watch, cheer, and make comments.
2. A spectator can browse the web pages of a game network and see a number of screens much like a TV director in a control room. He can look at action from a number of games to see which is the most exciting or the most popular and learn how it plays.
3. A game network can sponsor a national tournament and broadcast the event. Millions of people can log on to watch a few star gamers perform. Professional commentators can be hired to provide analysis, and advertisements can be inserted as in live TV broadcast of sport events. Some real life games have already been broadcast on the web: e.g. the chess game between Kasparov and Deep Blue and Major League Baseball games. Pure networked games can conceivably be as interesting to watch.
4. Avid game players may like to record their gaming experience. Some automatic or semi-automatic tools can then help them to produce highlight footages so their achievements can be archived and publicized.
5. For long running games in persistent virtual worlds, players and spectators could get a visual or textual summary to fill them in on what has happened since the last time they logged on.

RELEVANT TECHNOLOGIES

Streaming animation and rendering

There are a variety of methods by which spectators can view the game. At one extreme, video can be shown in a standard streaming format such as Windows Media Video Format or over broadcast television. At the other end, a special spectator-enabled game binary, which includes all the logic and graphical elements, might receive streamed events that signify the state changes as play progresses.

With the latter setup, the network bandwidth is kept to a minimum, but getting the game binaries to spectators might be problematic. The users who are already playing the games have the binaries, but first-time users need to get the binaries by either

downloading them from the network or receiving free promotional CD-ROMs through the mail.

There also exist intermediate methods that use formats for streaming 2D or 3D animation. General-purpose client software that renders these formats should be widely distributed. This method again allows the network bandwidth to be considerably less than purely streaming video. Furthermore, in this setup, along with streaming video, a powerful server can pre-render some graphics and broadcast the results to the spectator's device. Such a presentation can potentially have much higher quality animation and rendering than when rendering everything on players' devices.

Production tools

The simplest case of enabling spectators is to use the same view for both the players and spectators. For simple 2D games like Pac Man and most board and card games, this approach usually suffices and minimal production is required. These are the games that got enabled for spectators first. In Microsoft Game Zone, users are allowed to watch others playing board and card games in Kibitz mode. There are hundreds of users logged on at any given moment to kibitz others' games.

The most interesting and challenging problem lies in 3D games. In virtual 3D environments, production is in fact the task of camera control and editing similar to the task that film directors, cinematographers, and editors face. The tools for positioning and controlling the camera, selecting the camera for transmission, and post-production editing are not yet available, but will be conceptually similar to the tools for real life footage.

Automatic camera control

Events like the broadcast of a national game tournament might justify hiring human producers and commentators because of the huge audience size. Production of games with smaller audiences or of lesser importance should be done automatically to reduce the cost. Because the complete game state and object geometries are readily available, analysis can be done to position and control the cameras. Cinematic rules can also be codified to simulate human directors and cinematographers.

There were some attempts in the game industry to automate camera control for either players or spectators. In Virtual Fighters for Sony PlayStation, 1-2 seconds of instant replay in dramatic camera angles is presented after each knock out. The resulting sequence is brief, but very impressive. In Zelda: Ocarina of Time for Nintendo Ultra 64, there are some pre-scripted camera movements and cuts while the user's control is suspended briefly. These usually happen when the character enters a door and some introduction to the new location is necessary. Several games attempt to automatically position the camera in an optimal position as people play the game (these include the Lara Croft Tomb Raider games and Super Mario World). One of the big drawbacks of this style of camera control is that moving the camera often interferes with a player's controlling the onscreen character since suddenly moving the joystick to the left no longer means the same thing once the camera position has changed, for example. This is a large problem in using camera control during active participation in a game. In the

computer game Quake, users can become spectators and control the camera angle interactively or attach the camera to some active player' viewpoint. This approach often requires tedious control of low-level camera parameters.

The authors of this document also developed significant technologies in this area. Steven Drucker, in his doctoral thesis [Drucker94], outlined some research issues in automatic camera management in virtual environments. Drucker created the concept of camera module, where the knowledge of how to set up the optimal camera positions is stored. He demonstrated a camera path planning application for virtual museums and a camera control console for virtual football games using a set of camera modules. Li-wei He et al., in the SIGGRAPH 96 paper Virtual Cinematographer [He96], demonstrated a real-time camera controller in the context of a "virtual party", in which the actors can walk, look around, converse, get a drink, and so on. Each user runs his own virtual cinematographer, which conveys the events at the party from the point of view of that user's actor, or "protagonist." The hierarchical state machines used in He's paper capture film idioms and might be applicable to networked multiplayer games, but it is not certain that it will scale up to the complexity of real games, such as Quake or Asheron's Call. Further research and development are needed to define a reliable and flexible architecture for 3D camera control.

Commentator agents

Like in broadcast sports, a human commentator can provide insightful analysis and interesting background stories to the broadcast of networked games. On the other hand, a computer simulated commentator agent has the advantage of low cost and the ability to personalize to each spectator. Artificial intelligence and user interface techniques need to be incorporated to develop such agents. Microsoft 3D Baseball has a commentator agent that says appropriate one-liners by stringing together pre-recorded phrases commonly used by baseball commentators. Spectators of other games would also benefit from such agent.

Software architecture

The game engine has to expose its state and object geometry to allow logging, analysis and rendering from different camera angles. Many questions exist: How to achieve a clean separation between the game engine and the camera control system? What is the best API? What communications are necessary between the game engine and the camera control system? How do we obtain and encode the cinematic rules, since the people possessing this knowledge are usually not programmers?

If an appropriate architecture can be developed to allow any game that supports a certain API to be plugged into a Spectator Server, then sites like the Microsoft Game Zone could be greatly enlivened. Besides seeing how many people are playing, you would immediately be able to see how many people are observing.

Relevant work from existing games

As previously mentioned, there are many relevant examples from existing games. If we can take the best of these examples and provide a convenient way of incorporating them into new games that are made, then we can promote a general trend towards more spectator viewing of computer games. To list some of the relevant examples:

- Automatic camera control in SuperMario World, Zelda, and Virtual Fighter.
- Ability to record and playback games in Quake, Unreal Tournament and Age of Empires
- Third party mods to Half-Life and Quake that allow ghosts or other spectators in the game
- Sites like Gamespy and Zone which show how many people are currently playing games
- Kibitzing on bridge or go sites like (www.bridgeplaze.com, www.zone.msn.com , www.usgo.org)
- Sites devoted to Asheron's Call and Everquest which talk about quests, clans, etc.

CONCLUSION

Networked multiplayer games are becoming an increasingly popular form of entertainment. While networked games are certainly fun for active players, there is potentially a much larger audience: spectators. We can tap this potential by making online games engaging and entertaining to spectators watching these games.

Enabling games for spectators is a multi-faceted effort. Several key technologies must be developed: a reliable and flexible architecture for manually assisted and automatic 3D camera control; an API that allows for modular spectator components; a server and transport system for rendering and viewing spectator games; a system that shows how many people are viewing the games. The game developers also need to be evangelized so they will make the effort to expose the interface to spectators.

A recent Forrester report "Pervasive Gaming" predicted that the video games industry, the television broadcasting industry and the film industry would all move closer together to merge into a $26 billion dollar industry in the next 10 years [Forrester00]. Developing spectator gaming and establishing a platform and architecture that makes new spectator games possible could help propel Microsoft to the forefront of this highly competitive industry.

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