Editor: Frank Nack
Center for Mathematics and Computer Science (CWI)

Play the Game

Frank Nack
CWI

Whenever I visit my godchildren we play a lot. When they were younger, we had fun with traditional games, such as cards and board games, or outdoor activities, like flying a kite. Now that they have computers and game consoles, we go for electronic entertainment, such as real-time strategy, action, or role-based games. Besides the fun, I'm always fascinated with how easily these children (who range from 9 to 13) cope with the technology and user interfaces. For them, digital entertainment is a fact of life, not some futuristic dream. Moreover, their experiences with entertainment technology shape their expectations for digital media-based technology.

The game paradigm

Games are interactive multimedia. From the beginning, their major design paradigm was plug and play. Think back to a game like Atari's Pong (1972), where each player could use a handheld dial to control a graphical ping-pong paddle on a TV screen. The installation was easy, and the interface was clear and sharp without illogical menus or difficult procedures. Since then, several technical innovations have emerged.

Laser-disc games

These games were based on laser-disc technology, mainly appearing in arcades. They used—for the first time—visually eye-catching animations and let players control human-like characters in a 3D environment. Some examples include The Cliff Hanger by Stern Electronics (1983) and Dragon's Liar by Rick Dyer, Don Bluth, and Cinematronics.

PC games

These games freed users from the arcades and used the increasing power of home computers for even more stunning audio-visual 3D environments and faster interaction—for example, action games like Doom by id Software (1993), or puzzle-solving adventure games like Cyan's Myst (1993) and Riven (1997).

Moreover, the PC offered interactive simulations. An early example was Maxis' Sim City (1989), which allowed players to create their own cities from scratch, converting an untouched landscape into a metropolis over many hours.

Two current versions of real-time strategy games are the simulation of artificial life in Creatures III by Mindscape Entertainment (1998) and Ensemble Studio's Age of Kings (1999), which spans a thousand years, from the fall of Rome through the Middle Ages, in which players lead one of 13 civilizations into development based on combat and economic strategies. Some of these games can also be played online.

Console games

The game-console industry aimed to provide intuitive and cheap technology where playing doesn't require particular skills other than coping with the game. In particular, consumers shouldn't rely on PCs.

The development of console technology was driven by the need to provide game developers with a powerful platform and game enthusiasts with extraordinary experience. Today's games operate on tiny supercomputers with outstanding graphics processing (such as Sony's PlayStation 2, the next-generation Nintendo's Dolphin, and Microsoft's X-Box).

In addition, new consoles let users play movies (DVD), support A/V output (such as standard TV, LCD flat-panel displays, and high-definition TV), and provide Internet functionality, such as email, online gaming, and so on.

Multiplayer games

This technology emerged when players discovered they could beat the machine and wanted the challenge of playing with fellow gamers. (For more on this, see "Games People Play Online" in the October-December 2000 issue, pp. 18-20.) In the beginning, local area network-based multiplayer games allowed the sharing experience among a

1070-986X/01/$10.00 © 2001 IEEE

small group of friends, but with improved Internet technology, we see new game environments where thousands of potential players can participate (such as the Game Gathering LAN party in Duisburg, Germany, which had 1,600 participants in 1999).

The challenge for this type of game environment is not so much the hardware of the local machine, but the quality of the connection and the ability of the game designer to implement the plot in a cyberspace way. Examples for action games include Sierra Studio's Half-Life (1998), id Software's Quake III Arena (1999), and Epic Games' Unreal Tournament (1999). Because these are high-speed games, network delays reduce the fun factor. Thus, most games calculate the movement of playmates already on the client side in advance to bridge possible interruptions.

Real-time strategy games, however, confront a player with different problems. First, you have to visit a chat room to form a team, which might take some time. Second, during the game all clients must be synchronized. As a result, one bad connection can slow down the game for everybody. Third, if the server is out of time, a pause is required until all clients are synchronized again. Finally, if a player leaves the game it depends on the game design if the server might step in or if the other players have to compensate for the loss. Examples of such games include Westwood's Command and Conquer and Ensemble Studio's Age of Kings—both allowing solo games—and true online game environments such as Mankind from Cryo, Ultima Online from Origin, and Asheron's Call from Microsoft. In each of these environments, hundred thousands of players meet daily.

If you look at the economic side of gaming, you can understand why the gaming industry drives digital entertainment. Datamonitor (http://www.datamonitor.com/productdetail.asp?id=DMTC0704&ref=News%20Story) estimates that the PC and console software sales in the US and Europe amounted to $10.9 billion in 2000. In another Datamonitor forecast on online gaming, the company stated that in 1999 8.4 million players worldwide played PC games online and that figure should reach 28 million by 2004. The forecast also points out that in 2004 we'll see an additional 48 million players using a console. This figure seems correct because Sony alone sold more than 70 million of its PlayStation 1 (without Internet access) consoles worldwide and it seems that PlayStation 2 (with Internet access) will become a similar success story. Although, that might depend on the Nintendo's forthcoming Dolphin (spring 2001) and Microsoft's X-Box (fall 2001), which promises near-photorealistic graphics and lifelike animation (http://www.microsoft.com/presspass/features/2000/05-10bachqa.asp). Thus, the game industry has shown tremendous performance in producing cutting-edge hardware and software technology. As researchers, we should closely watch what's happening in the field of games in particular and digital entertainment in general.

The same problems?

Without avoiding computational complexity, game producers have developed easy, reliable, and cheap technology. The computer performance of Sony's PlayStation 2 was assessed by the Japanese government as powerful enough to require export restrictions. If Microsoft's X-Box provides the strived for improvements (such as a 733-MHz Intel P3, a 300-MHz Nvidia custom chip graphics processor, memory bandwidth of 6.4 Gbytes per second, polygon performance of 300 million polygons per second, and sustained polygon performance of 150 million polygons per second), we'll be able to buy a supercomputer for around $300.

Such technology will open the door to 3D computer graphics that really provide the illusion of continuity in space and time (see films such as *Stuart Little* or *Hollow Man* and you'll get the idea). However, digital cel animation and 3D computer graphics animation require new tools that can model detailed representations without becoming hopelessly complex (think about physical modeling, motion capture, image-based rendering, and so on) and should do so with a simple click.

I'm sure that our research community could come up with the necessary algorithms. However, could they be easily integrated into such environments, and will they be adaptable enough to fulfill artists' needs? (See http://www.lucentcache.com/workshop.html for more information on the needs of digital artists.) Or put the question the other way. Can the feature-extraction and manipulation algorithms or the presentation techniques discussed in the multimedia literature cope with such challenges provided by games?

In terms of software, problems exist beyond the mere polygon-oriented approach. Realism pays but interactive games require more if you wish to capture a sound market share. So far, the gaming industry has covered this desire with improved visual effects in first-character point-of-view-driven action games and through puzzle-solving story environments of vast computer worlds. Until now

Web Resources

Here's a list of game-related sites that might be interesting to you.

Laser-disc games

http://www.dragons-lair-project.com/games/

PC games

http://simcity.ea.com/us/guide/
http://www.riven.com/home.html
http://www.idsoftware.com/
http://www.microsoft.com/games/
http://creatures.mindscape.com/

Console games

http://www.xbox.com/xbox/flash/home.asp
http://www.scea.com/playstation.asp
http://dreamcast.ign.com/
http://www.nintendo.com/home/index.html

Multiplayer games

http://www.sierrastudios.com/games/half-life/
http://www.idsoftware.com/
http://www.epicgames.com/
http://westwood.ea.com/html/index_f4.html
http://www.microsoft.com/games/
http://www.cryo-networks.com/uk/cryonetworks.htm
http://www.uo.com/

this model worked, but today's game developers want more for players than simply becoming actors in virtual worlds. They'd like to create worlds where players decide how the plot moves along. Some of the Internet-based multiplayer games provide us with a glimpse of what to expect in the future.

However, developing such environments will require database networks, which provide rich multimedia plot elements and decision algorithms for generating unique content. Furthermore, we might need convincing synthetic actors or animator-actors, a field which in itself is full of difficult tasks (see http://characters.www.media.mit.edu/groups/characters/, http://imk.gmd.de/index_research.html, and http://dfki.de/).

Moreover, development environments for game developers and artists are required for authoring a particular production, such as an interactive game. This includes support for artists to make the best out of diverse platforms (and thus free them from the dependent relationship with one game machine).

Current development tools merely work with closed, static environments and are restricted to particular game engines. Competition in the gaming and multimedia authoring industries will force manufacturers to provide satisfactory development environments. Yet, I wonder whether our research on the creation, manipulation, representation, and retrieval of media material is helpful or if our work focuses on completely different targets than the gaming industry? Even if our goals differ, I think it would still be worthwhile to observe the game activities for improving our research methods, say for example on individualized browsing and visualization of large multimedia-based information spaces.

The hot trend in games today is convergence. The goal is to morph all sorts of digital entertainment into one big stream of bits, allowing content and distribution to converge (such as the traditional consumer-oriented gaming console). All next-generation game machines will provide Internet services, video streaming, DVD palyers, and so on that might result in new types of games that respond to all sorts of information such as news, email, telephone calls, and so on. However, I question whether the console manufacturers and software designers can retain the reliability required by mass production if they introduce additional complexity. Also, will users really want all this added functionality, which increases the potential for system errors? The answers to these questions will eventually be reflected in our work, and hopefully we can contribute to it—either through research or by supporting standardization activities.

What about the consumers?

Don't get me wrong. I don't rack my brains with all these questions while playing with my godchildren. I just wonder why the advances in games and digital entertainment are or seem to be swifter than in multimedia research. I don't think it's just because of the competitive economic environment where products thrive with successes and die with flops. Rather, it seems to me that the underlying question behind the development effort is different. In digital entertainment, the customer is king. Developers constantly assess who their customers are and whether their products meet consumers' needs. Multimedia researchers, however, seem to focus on how to solve a particular problem and ignore the real-world applicability part of the equation. Perhaps we should play computer games more often and put ourselves in the consumers' seat to find out what is happening out there. **MM**

Contact Media Impact editor Frank Nack at CWI, Kruislaan 413, PO Box 94079, 1090 GB Amsterdam, The Netherlands, email Frank.Nack@cwi.nl.