



WebMD Spa Sweepstakes & Health Newsletters

Enter Our Daily DVD Giveaway
And Win a Spa Vacation for Two!

Daily DVD Giveaway

Issue 3.12 - Dec 1995

The Toy Story Story

Page 1 of 6
[previous](#) | [start](#) | [next](#)
Printing? Use [this version](#)

How John Lasseter came to make the first 100-percent computer-generated theatrical motion picture.

By Burr Snider

Quiet, everybody. Lights, please. We're rolling.

Toy Story: sequence 8, shot 28B, frames 1 through 50.

We're in the screening room of an exotic little San Francisco Bay area production company called Pixar Animation Studios, watching the dailies of a major work-in-progress, director John Lasseter presiding. And not to get too hyperbolic here, but we're witnessing history being made before our very eyes. You've heard of Debbie Does Dallas? Call this Disney Does Digital.

Two years ago, less than a half-dozen feature films employed the use of computer graphics; this year maybe a half-dozen won't use any sort of digital enhancements. If Hollywood has suddenly embraced the computer as a significant (and cost-effective) illusion-making tool, then Disney's Toy Story is arguably the most ambitious computer-generated undertaking yet.

How ambitious? Even in the most spectacular exemplars of digitally created cinematic imagery to date - Terminator 2, Apollo 13, Casper, to name a few - the computer illusions make up but a fraction of the running time (ranging from a total of 6 minutes in Jurassic Park to 40 minutes in Casper). The difference with Toy Story is that everything is virtual. Each one of the movie's 1,560 shots was created on Silicon Graphics and Sun workstations by artists working from some 400 computer-generated mathematical models and backgrounds. The shots were then edited using Avid editing systems and painstakingly rendered by powerful Pixar-developed RenderMan software. (That software consumed 300 Mbytes per frame, provided by 117 Sun SPARC 20s. Four years in the making, the 77-minute film required 800,000 machine-hours just to produce a final cut.)

As they like to say around Pixar's Point Richmond studios, Toy Story was shot entirely on location - in cyberspace.

Never given to understatement, Steve Jobs, Pixar's founder and owner, confidently predicts the film will give birth to a whole new era of filmmaking, possibly even supplanting traditional 2-D cel animation entirely.

"We take an average of three hours to draw a single frame on the fastest computer money can buy," says Jobs, the famed Silicon Valley boy whose day gig, of course, is running NeXT Computer Inc., the Redwood City outfit he founded after his spectacular flameout at Apple. "It's not just that the pictures look cool," explains Jobs. "The characters really come to life, which is at the heart of what animation is all about."

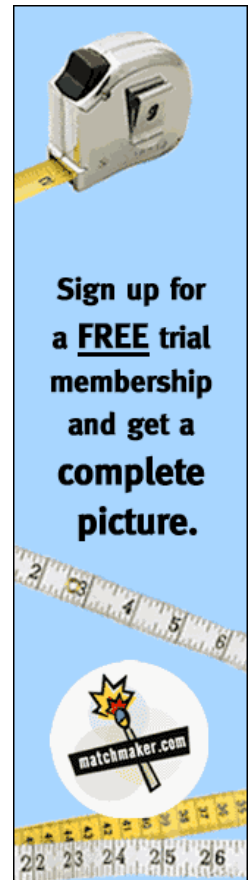
For Jobs, who negotiated Pixar's deal with Disney and played a hands-on role as Toy Story's executive producer, the new tools are revolutionary. "I had the same experience when we shipped the first laser printer at Apple. You looked at it and thought, There's an awesome amount of technology in this box, but you don't need to know that to enjoy its output. There are more PhDs working on this film than any other in movie history, and yet you don't need to know a thing about technology to love it."

Here in the Pixar screening room, the only thing on the collective minds of John Lasseter and his team is jiggering and polishing the brief clip on screen to eek out the maximum slapstick yuks. The shot shows one of the film's major characters, a rag-doll cowboy named Woody (the voice of Tom Hanks), flat footedly taking a flying poker-chip square on the chops. Over and over the scene loops, undergoing excruciating nit-picking by the assembled crew.


Should the chip perhaps be bigger? Smaller? Should it come in at a higher angle? How about two chips? "Maybe the chip should get caught in his mouth," someone suggests facetiously. "Sort of a Ubangi plate-lip thing." Hoots and jeers erupt as a rain of paper balls is showered on the miscreant.

The old saying in the trade is that doing animation is like watching grass grow, and here, too, in the futuristic realm of the virtual studio, the labor is endlessly exacting. "Where you spend time in this medium is during the last 10 percent of the project," says Lasseter. "In computer animation, it's so easy to make things move, but it's the minute detail work at the end that makes it look so real."

Key to the entire process is a Pixar-developed program called Menv (Modeling Environment). Nine years in the making, Menv is an animation tool used to create 3-D computer models of characters with built-in articulation controls; these controls enable the animator to isolate specific frames of a desired motion - the hinging of an



Sign up for a **FREE** trial membership and get a complete picture.



matchmaker.com

elbow, say, or the movement of lips to match dialog – and then leave it to the computer to interpolate the whole sequence of animation. This not only obviates the tedious process of frame-by-frame animation, but achieves an almost preternatural fluency of motion.

.

Get Back to **WORK**Location: Keyword:

Issue 3.12 - Dec 1995

The Toy Story Story (continued)Page 4 of 6
[previous](#) | [start](#) | [next](#)
Printing? Use [this version](#)

As Lasseter's reputation grew, the Disney brain trust began to take note. Already, Disney and Pixar had worked together in the development of CAPS (Computer Assisted Production System), a cost-saving program for digitally coloring hand-drawn animation, and the collaboration had worked. The system was first used to make *The Rescuers Down Under* in 1989, and later to much greater effect on *Beauty and the Beast*; it has been used on every Disney animated feature since. Katzenberg and Peter Schneider (head of Disney animation) now began offering Lasseter ever more enticing deals, including an opportunity to direct big projects to lure him back to the Mouseworks.

SEE ALSOArchive Category:
[Film & Special Effects](#)

"When we did CAPS with them, Disney realized they had something special," says Catmull. "We performed on time and on budget, and gave them more than they bargained for. We were aware they were trying to steal John away from us, but John knew we had something important going on here. I remember him saying, 'I can go to Disney and be a director, or I can stay here and make history.'"

Disney kept upping the ante until finally, in 1990, Lasseter proposed another option. "I said, 'Since we have this relationship, why don't you let Pixar do some animation for you?'" Lasseter remembers. But Disney refused. "They said, 'Nope, nope, all Disney feature animation will be done at Disney.' So we let it drop. Then time passed and we got a call saying we're interested in hearing some ideas from you."

Still enamored with the Tin Toy notion of playthings that come to life, Lasseter and his writers hammered out a treatment concerning a tin soldier trying to make its way home after being lost by a child at a highway rest stop.

"This ended up being pretty far down the evolutionary chain from what we finally pitched to Disney," says writer Andrew Stanton. "As the months went by, we decided there should be two main characters and they should be opposites – Woody, the old cowboy, and Buzz Lightyear (voiced by Tim Allen), the flashy, new space ranger toy with all the gizmos – and they would fight over who would be the favorite. Then the two would get lost and have to learn to work together to get back home. It evolved into a classic buddy picture, and it pretty much stayed that way from then on."

Disney bought the concept, reserving the right to exert strict story supervision and, in 1991, Pixar went to work on *Toy Story*. "They essentially made a commitment to the film before we had all the software ready to do it with," says Catmull.

"It was nuts when you think about it, but we knew we could do it."

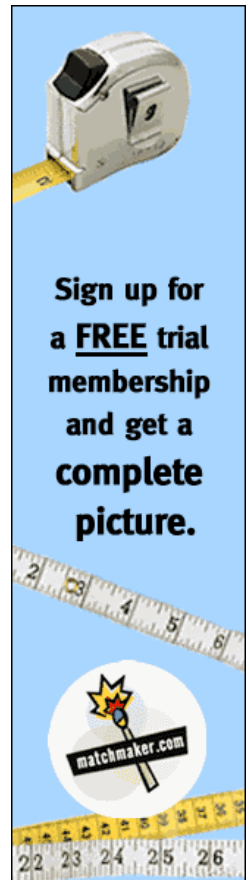
The Disney people say they had no qualms about going ahead, despite inexperience. "My feeling about John is he's a true pioneer; I'd work with him on any project, any time, anywhere," says Tom Schumacher, Disney's senior vice president for animated features. "In the words of the immortal Don Hahn [producer of *The Lion King*], Pixar has the ability to be 'small and naughty,' to be fleet of foot. Even though they hadn't made a feature for us before, all the channels were open."

With the story reasonably locked down, Lasseter's first step was formulating what the movie's visual feel would be. For this crucial task, Pixar hired art director Ralph Eggleston, whose animation credits included *Fern Gully*, the *Last Rain Forest*.

"When I came here, I told John right off that I hated computers," says Eggleston. "So, I had to make a decision early on as to whether I was going to learn more about computers or just art direct. It's actually not any easier or cheaper or faster with computers; you just trade one set of problems for another. I decided to art direct and let them worry about the rest."

The result was a singular visual style that shifts radically in crucial moments of the film. For the playroom where the toys live, Eggleston's artists created sketches of a warm and cozy ambience – lots of sunlight and pastels and no dark shadows. But when Buzz is pushed out a window and begins an adventure with Woody, the two enter a foreboding city of night, and the film becomes dark and cold. Eventually, they end up in the room of Sid, the weird kid next door, who builds macabre mutant toys and has a mean dog named Scud. Sid has barbed wire around his bed, and his belongings are dirty and tattered. The mood here is tense and edgy, the visual milieu menacing, and every kid watching will be glad to get back to the snugness of the playroom for the film's finale.

From the early sketches, a storyboard was drawn delineating each of the movie's shots. These pencil images were then transferred onto video storyreels using an Avid Media Composer. Since this was long before the actors had recorded their parts, scratch dialog was provided for each character's voice by the animators themselves.



Sign up for
a **FREE** trial
membership
and get a
complete
picture.

WebMD
Spa
Sweepstakes
& Health Newsletters



Plus Free DVDs & Asics Running Shoes
Win a Deluxe Spa Vacation

Canyon Ranch Resort

Go

Issue 3.12 - Dec 1995

The Toy Story Story (continued)

Page 2 of 6
[previous](#) | [start](#) | [next](#)
Printing? Use [this version](#)

"What this system gives us is the ability to perform these last little tweaks to get the look we want," Lasseter says. "In 2-D cel animation, you also have this ability, but it's much more difficult. If you want to slow down an arm movement 15 percent, you have to go back and erase all the animation and redraw it. Here we just move a key frame, and it's done quickly."

SEE ALSO

Archive Category:
[Film & Special Effects](#)

If Lasseter wants to exaggerate Woody's reaction to being smacked by the chip, say, by having his eyes bulge out, the animator needs only to reset Woody's controls governing this specific motion (Pixar calls them articulation variables, or avars, for short) and let the computers go to work.

Virtually everybody who's seen any part of Toy Story so far raves about its breakthrough techniques, but no one knows how the film will be received once it reaches the world's cineplexes.

Meanwhile, more than 100 people have been pouring heart and soul into the project for more than four years, and now, as they enter the final stages of production, it's nonstop crunch. Given this, you'd imagine the pressure level to be just a little tense around the Pixar studios.

Forget it. If things were any looser, everybody's pants would fall off. As Lasseter puts it, animators are kids who never grew up, and Pixar is the kind of place where people navigate the mazelike hallways on kiddie push scooters, where rainbow displays of penny-candy jars are to be found at every corridor intersection, and where successful shot completions are rewarded with trips to the in-house freebie toy box. (A few weeks hence, when a particularly difficult phase of making the film is accomplished, a calypso band will appear unannounced in the Pixar hallways, and a spontaneous conga line will go dancing deliriously through the offices.)

Here in the screening room, the ambience is so raucously sub-teenoid, you'd think you were sitting around in some kid's bedroom watching a bunch of precocious 9-year-olds try to crack each other up with gross body-part jokes and armpit farts.

"You know what?" somebody says, out of the blue. "I've been thinking that maybe Woody should get a peanut head. Then we could call it Peanut Trouble."

"Oh, yeah, right, total rewrite," comes a derisive reply. "Then we can have a sequel and call it Peanut Envy!"


"Hold it, you guys," says a young woman running the video from her workstation to the Sony projector. "I'm having trouble with my mouse."

"What a coincidence," laughs Lasseter. "I'm in big trouble with Disney, too."


In fact, in the hothouse world of computer animation, Lasseter is not in any trouble at all. On the contrary, it seems, he can do no wrong. Lasseter is already regarded as one of the authentic, trailblazing stars; his short films have consistently turned into landmark events in the evolution of this young craft. In 1984, he produced the very first demonstration of cartoon-style motion with computer-animated characters (in a Lucasfilm short called *The Adventures of André and Wally B.*); and in 1985, he astounded movie audiences with the eye-popping animated stained-glass knight he designed (in conjunction with Industrial Light & Magic) for Steven Spielberg's *Young Sherlock Holmes*. But it was the sensational *Luxo Jr.*, made at Pixar in 1986, that effectively changed the course of the burgeoning industry. A simple story involving cunningly animated desk lamps, the film was the sensation of that year's Siggraph conference and went on to win some 30 filmmaking awards, including a Silver Bear at the Berlin Film Festival, and an Academy Award nomination - the first 3-D computer-animated movie to have been officially lined up for an Oscar.

Yet, while on the verge of becoming a big-time Hollywood golden boy (*Toy Story* is the first of a Pixar/Disney three-picture deal, and the industry rumble on the film is deafening), Lasseter, so far, remains the kind of regular guy, say his co-workers, that you'd love to have babysit your kids. Only you'd probably end up down on the floor crayoning the wall along with him and never make it out of the house. If, as they say, whimsy is coded into the genes of animators, Lasseter was definitely born with it. One look at him sitting in the director's chair his production team fashioned for him - a wheelchair with drink holder, ooga-ooga horn, and gaudy bike streamers coming from the armrests - and you know the man was destined to make cartoons.

In fact, says Lasseter, the lead character of *Toy Story* has its origins in his own childhood. Woody is based on his favorite toy, a pullstring Casper the Ghost talking doll, which the director still keeps in his office. He loves to demonstrate it for visitors. "My parents always knew when I'd fallen asleep because Casper would stop talking," he laughs. "It still talks today, only it's so worn out that I'm the only one who understands what it's saying."



Sign up for
a **FREE** trial
membership
and get a
complete
picture.



WebMD Spa Sweepstakes & Health Newsletters

Enter Our Daily DVD Giveaway
And Win a Spa Vacation for Two!

Canyon Ranch Resort

Issue 3.12 - Dec 1995

The Toy Story Story (continued)

Page 3 of 6
[previous](#) | [start](#) | [next](#)
Printing? Use [this version](#)

Growing up in Whittier, California, Lasseter, now 38, was a precocious artist blessed to have a family that recognized his talents. His mother, a high school art teacher, actually encouraged him, he says, to get up early on Saturdays to watch the cartoons. "It was a gift to have that kind of nurturing. My folks thought doing animation was a noble profession, a wonderful thing to shoot for, and that's pretty rare."

SEE ALSO
Archive Category:
[Film & Special Effects](#)

In high school, the budding artist wrote to the Disney studios of his ambitions and was invited to take a tour of the fabled animation department. In 1975, he attended the California Institute of the Arts in Santa Clarita, just in time to be a part of the school's new character-animation program. There he won the Student Academy Award two years running, and after graduating in 1979, he went straight to work in the Magic Kingdom.

Only he didn't precisely live happily ever after.

"Disney was really sort of dead when I got there," Lasseter recalls with a grimace. "This was before Michael Eisner and Frank Wells and Jeffrey Katzenberg came in, and you got the feeling after a while that Disney animation had reached a certain plateau technically with 101 Dalmatians. People like me and Tim Burton were looked at as rabble-rousers – you know, young upstarts."

Then, in 1981, Lasseter came upon one of the first crude demonstrations of computer animation and something clicked. He saw his future, and it was definitely digital. He convinced the studio to let him make a 30-second test film using hand-drawn character animation within a computer-animated environment; the result, he says, blew him away.

"First of all, the backgrounds were so much more dimensional than you could paint by hand and, beyond that, I saw how this could totally liberate the camera: with painted backgrounds you could only go sideways or pull up or back; with this, you could go in for a shot wherever you wanted and move the camera around in all directions. It was just another world!"

Still, his bosses didn't get it, and Lasseter was told to go back to his pencils and be a good boy.

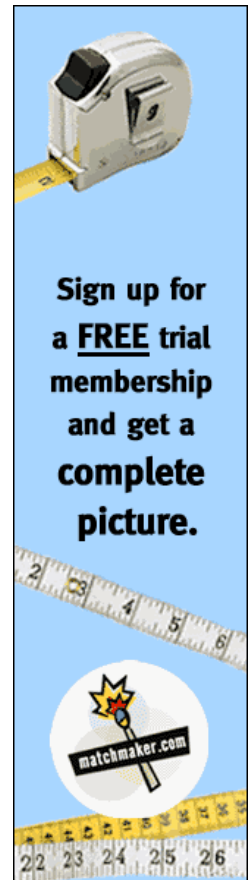
Then, in 1983, a job offer came from Lucasfilm in San Rafael, California, where some brilliant research was going on under Ed Catmull, one of the first-wave innovators of high-tech computer graphics. Lasseter joined the Lucasfilm computer group and quickly found himself immersed in just the kind of intense collaborative ferment he'd longed for at Disney.

"People were doing stuff that no one had done before, just making it up as they went along, and I guess I really blossomed. I'd be inspired to create a character, to use the new stuff all these brilliant PhDs were creating, then they'd get inspired by my character and develop something that would make it even better."

Lasseter had been working at Lucasfilm for three years, when company owner George Lucas decided to divest the computer division and concentrate solely on filmmaking. It was then that Jobs stepped in and bought the division to form Pixar. For the US\$10 million sale price, Jobs got a core group of about 45 talented Lucasfilm people, including Lasseter's cadre of animators and technical virtuosos, as well as the rights to some Lucas technology.

Under Catmull as president, the fledgling company began producing and marketing the Pixar Image Computer, a 3-D graphics system applied in such fields as medical imaging, seismic analysis, and satellite-image interpretation. Pixar's computer scientists, led by technical director Bill Reeves (a key former researcher at Lucasfilm), went to work designing Menv and RenderMan, a revolutionary program that pulls together the complete digital information for a 3-D animated scene – color, shading (surface description and texture, for example), and lighting – and renders it precisely onto each frame with breathtaking chromatic opulence. The process is expensive and time-consuming, but it has enabled the Pixar animators to achieve a look of "heightened reality" never seen on the big screen before.

In its early solo years, Pixar produced several short films that made a splash at Siggraph, and, in 1988, the company hit the jackpot with Tin Toy, winning the Academy Award for Best Animated Short Film. Tin Toy, which provided the first demo platform for RenderMan and Menv, became the seed for Toy Story. Buoyed by repeated successes, the company decided to move into TV-commercial production to establish a name as a high-end animation house. Lasseter's six-person team immersed itself in the learning process of producing against deadlines, and again Pixar raked in awards, winning Clios for its spoofy Listerine spots (featuring, among others, Robin Hood as a mouthwash bottle), and for the goofy dancing Gummi Life Savers.



Sign up for
a **FREE** trial
membership
and get a
complete
picture.

matchmaker.com

WebMD
Spa
Sweepstakes
& Health Newsletters

Win a Deluxe Spa Vacation

Canyon Ranch Resort

Go!

Issue 3.12 - Dec 1995

The Toy Story Story (continued)

Page 5 of 6
[previous](#) | [start](#) | [next](#)
Printing? Use [this version](#)

Now the production process began to resemble the proverbial pig moving through the python. First, the modelers had to create sculptures and 3-D computer models of the entire film's characters and sets. Some of these started life as computer-drawn diagrams created by artists using the language-based Menv software, which employs a technique resembling claymation to produce puppetlike 3-D images. Others, such as the pit bull Skud, were first sculpted out of clay and then digitized with a magic wand called the Polhemus 3 Space Digitizer, which the artist touches to key points on the model to create a 3-D surface description in the computer.

SEE ALSO

Archive Category:
[Film & Special Effects](#)

At this point, articulation controls were coded into each model, enabling the animators to choreograph action and fit mouth and facial movements to the dialog. Scud, for instance, has 43 controls in his mouth alone to allow him to snarl menacingly and show his fangs.

"Since the controls are going to be used by animators who aren't really computer people, we try to give them models that are easy to deal with," says modeler Eben Ostby, who has a degree in architecture.

"I work a lot with the lead animator to find out what he needs to know about a character, how he expects it to behave, how the wrist should bend, or how we should make the face smile or frown. This takes months for each character."

By now, months down the line, the actors in Hollywood had recorded their voice parts, so as the animation phase began, dialog was also being added. "For an 8-second shot, it takes about a week to fit the facial expressions to the soundtrack," says animator Eliot Smyrl. "It's not just getting the mouth to line up, it's getting it to look like that particular character is really emoting it. We'll watch videos of Tom Hanks and Tim Allen recording the dialog, and if I need the character to make an 'e' sound on frame 9, I can plug it in. We work closely off the attitudes of the actors for cues."

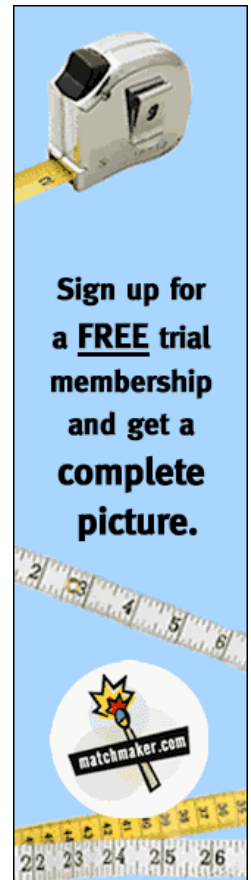
Next, the rough animation shots went onto storyreels to replace the sketched storyboards, and, for the first time, Lasseter could begin to see what his movie looked like. "It's hard enough to write a good story, much less with all the constraints of a new medium, but now we could see what our tools could and couldn't do," he says. "We made a conscious decision, for instance, to stylize the humans rather than try to reproduce real people, since doing things like hair and skin are so difficult. At Disney, they'd always said the biggest challenge was to animate the prince."

Once the storyreels were in place, the shading began. Working on Sony color-correct monitors and using Amazon and Adobe Photoshop, layers of paintings were composited with computer images to achieve the desired effects. Specifically for this process, Pixar developed Unwrap, a software program that enables complex 3-D surfaces to be flattened out for painting, much like a Mercator projection map. With this feature, an artist can unwrap a character's face onto a flat plane, paint in features such as pores or freckles, and then rewrap the finished look back on the model.

"When stuff comes out of the computer, it looks kind of boring," says Robin Cooper, a background painter who came to Pixar from the set department of the San Francisco Opera. "My job, basically, is to put in the detail that'll make it more interesting. I'll do things like distress a bookshelf to make it look like wood, put dirt and scuffs on a floorboard, make surfaces look wet or bumpy, shiny or flat. As a team, we do all the little details to make the surfaces look right."

The next phase was lighting, perhaps the most arduous process of all. So far, during the working cut, ambient lighting had been supplied by a single overhead source; now the film would be computer-lit in much the same manner employed on live-action movie sets.

"We use the traditional movie nomenclature – key lights, fill lights, kickers, bounce lights, and so on – moving the lights around just as we would on a set to see how the colors will react to them. The chief difference here," says Toy Story producer Ralph Guggenheim, "is that it's all done inside the computer. Contrary to live action, we can control the lights and shadows independently of each other. The bane of all cinematographers' work is that if you have, say, 20 lights, you'll have 20 shadows, but the beautiful thing about synthetic imagery is that you have only the shadows you want."



Sign up for
a **FREE** trial
membership
and get a
complete
picture.

matchmaker.com



WebMD Spa Sweepstakes & Health Newsletters

Enter Our Daily DVD Giveaway
And Win a Spa Vacation for Two!

Daily DVD Giveaway

Issue 3.12 - Dec 1995

The Toy Story Story (continued)Page 6 of 6
[previous](#) | [start](#) | [next](#)
Printing? Use [this version](#)

With all the elements assembled, the film was ready to go to the "render farm," where Pixar's bank of 300 Sun processors would render the movie into its final form. After the processor was fed massive amounts of digital information to determine the animation, shading, and lighting, RenderMan software stirred the mix slowly (taking anywhere from 2 to 15 hours per frame) in a huge, simmering computational soup. The finished images were then transferred to the Avid editing system for Lasseter and his team to digitally cut and paste into the final version of Toy Story, which was then used to create the final 35-mm cut.

SEE ALSO
Archive Category:
[Film & Special Effects](#)

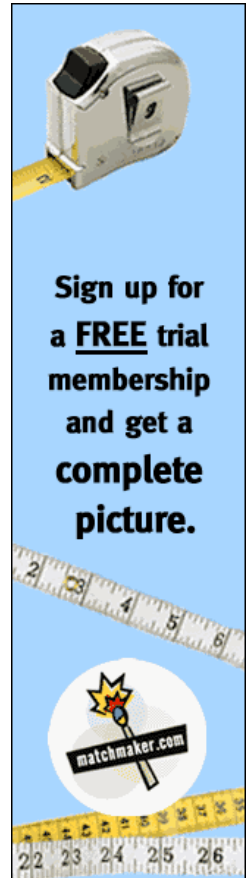
Steve Jobs is so obsessed with Toy Story he can barely stay in his seat when talking about it. In the fall, Pixar announced a plan to go public, and it goes without saying that a big hit with Toy Story would go a long way to restoring Jobs's somewhat tarnished image as a major entrepreneurial visionary. But beyond that lies the possibility of becoming a latter-day Hollywood mogul in the style of, say, Irving Thalberg, the Hollywood wonderboy who glamorized MGM in the '30s. Pixar is tied to Disney for two more films following Toy Story - in fact, work has already begun on the second. But after that, who knows? Everybody involved is exceedingly close-mouthed about the cost-sharing and profit distribution in the Disney deal, though Guggenheim concedes that Pixar will score a percentage of the copious merchandising revenues expected from the Toy Story characters. If Toy Story performs anywhere near the Pocahontas range, Jobs will no doubt be able to write his own Tinseltown ticket.

"I think our deal with Disney is the second-best deal in Hollywood - right behind Spielberg's old deal - and we're looking forward to making dozens of films with them," Jobs says. "We might just have one of these famous 20-year partnerships where we just do phenomenal work and bring out the best in each other. And if not, well, we'll be seen by others as a very desirable partner to work with."

But, as Jobs knows well, Pixar isn't exactly the only pretty face in town. Even in the fey cosmos of animation, the competition is ferocious.

"We saw the Pixar presentation at Siggraph, and yes, it was pretty impressive," says Bob Hoffman, a spokesperson for Digital Domain, the Venice-based production company that created the computer graphics for Apollo 13. "But the Casper presentation was pretty impressive, too, and it turned out to be a poor movie. As far as we're concerned, we'll put Apollo 13 up there with any movie made this year. As far as a full computer-graphics film is concerned, well, they're first in that narrow category. If that's the point, then it would appear they're ahead."

As for Lasseter, he will tell you that making Toy Story has been the dream of his life and that he can't wait to do more. "When we were working on this film, what kept pushing us was that we were doing something that's never been done," the director says. "With these tools of computer animation, you can make things look so real that people believe whatever you've created really exists." As an animator at the helm of his first feature film, perched in his customized director's chair, Lasseter is right where he wants to be. "Even back when I was a kid watching the Saturday morning shows on TV, I remember thinking, Cartoons, that's the job for me!" he says passionately. "It just seemed like the neatest way to tell a story."

[<< Page 5](#)

Sign up for
a **FREE** trial
membership
and get a
complete
picture.

matchmaker.com