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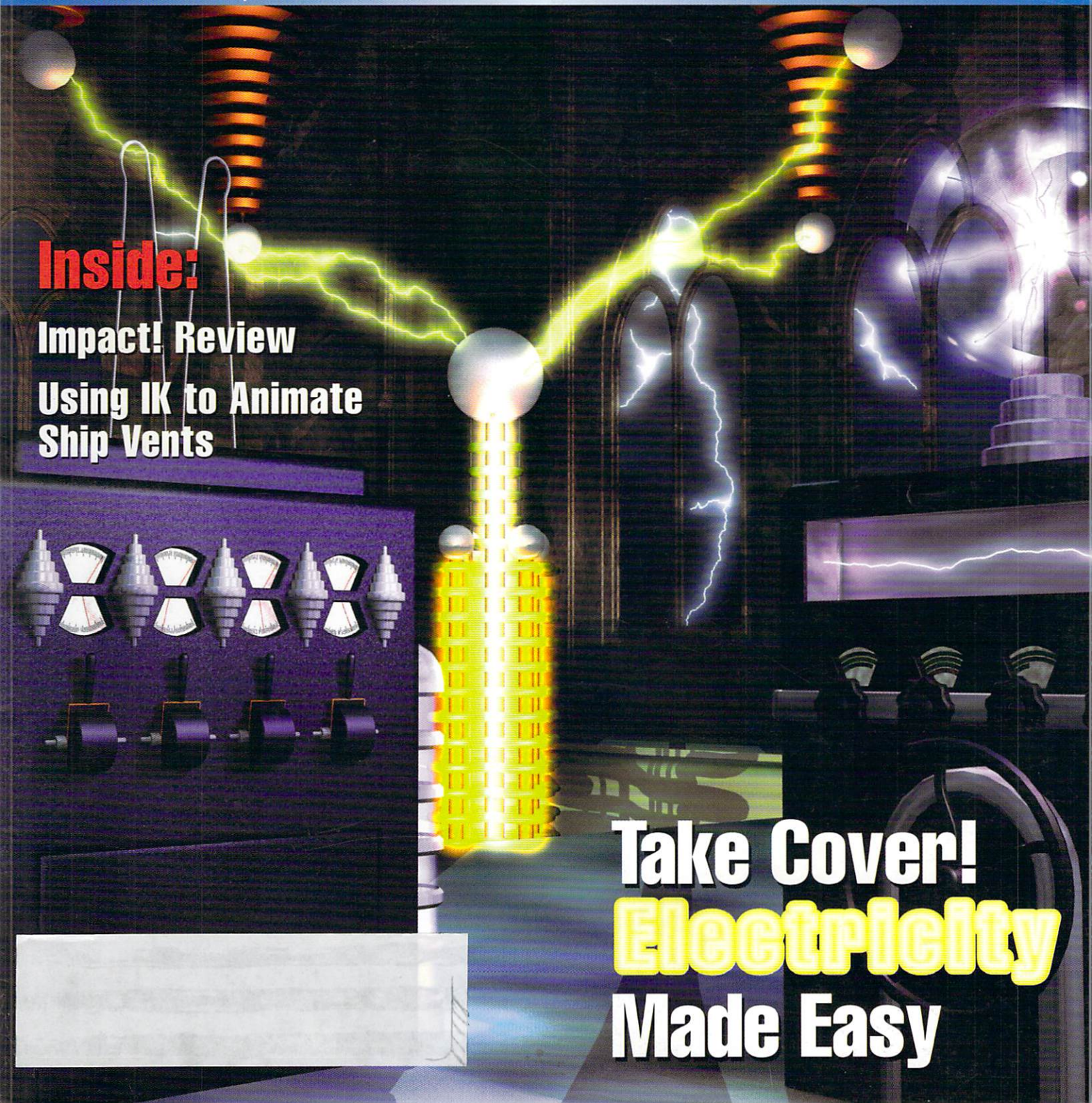

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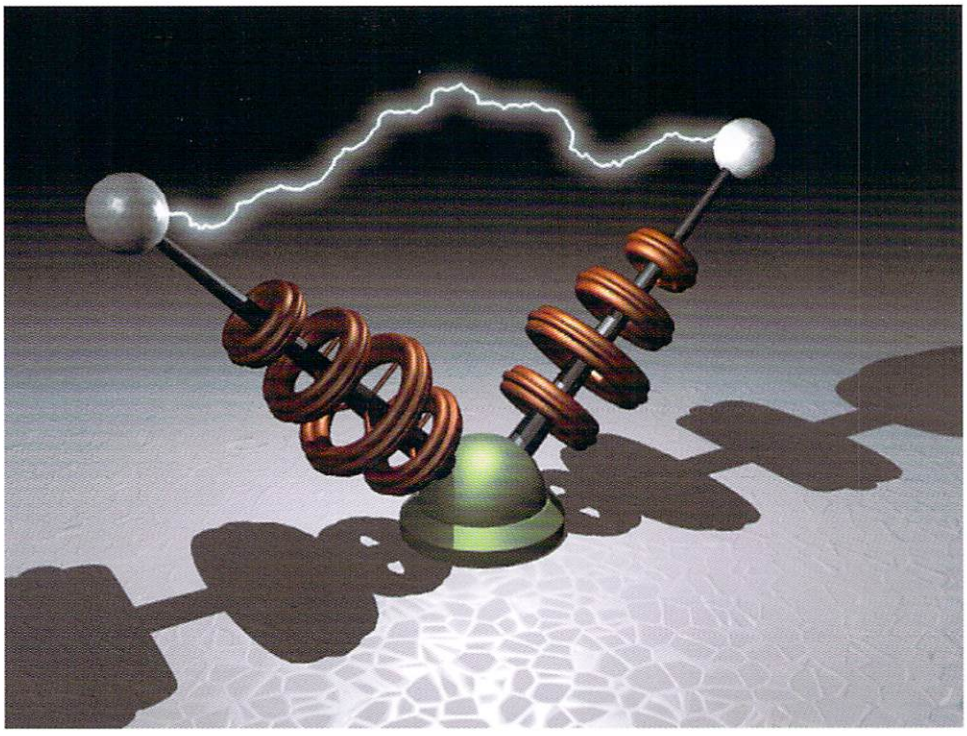
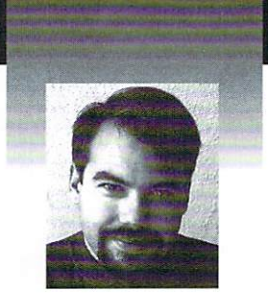


Noah's Arc

Flickering arc effects are just a morph away. See "Zap! A VertiLectric Tutorial," page 12.

Take Cover!

Lightning scenes such as this take only minutes to create. See the Zap! tutorial in this issue.



EDITOR'S MESSAGE

by John Gross

It was at least a year ago that my friend Molly Maguire and I were talking about LightWave animators. Molly had an interesting comment about the nature of many 3D animations she had seen (Molly is also a LightWave animator). She believed that most of the LightWave animations she had seen were done for the sake of making money. In other words, they were animations that were either shown on TV as part of *seaQuest 2032*, *Babylon 5*, *Voyager*, etc., (*Space: Above and Beyond* had not aired yet, although it would be included in this list) or they were animations such as logo treatments, training/instructional videos, games or commercials. But rarely did they seem to be purely artistic endeavors—animation for the sake of animating. We talked about her observation a bit more and I made the point that a lot of LightWave animators *are* in it for the money and perhaps didn't have time to "create" just for the fun of it. But this conversation really made me think for a few days. Then, of course, I promptly forgot about it as I was too busy creating LightWave animations for money.

Now, more than a year later, I reflect back on our conversation and wonder where all of the "purely artistic" LightWave work is. Perhaps it's out there, but it doesn't get the attention it deserves. Or perhaps it's just not out there. But I doubt that. Sure, I've seen some very cool LightWave stuff that was created just for the fun of it, but not nearly as much as I'd like. I've come to realize that, in my LightWave repertoire, I don't have a lot of things that I've done just for fun. I can't remember the last time that I just sat down in Modeler and created something just to build it—for myself, not for a client. I have impressive images that I've created, but they weren't for me; they were for somebody else. I build many objects to test bugs or new features, but those are all just primitive cubes, spheres and simplistic objects—nothing that I would be proud to say "Look at this!" The last time I had some friends over, they wanted me to

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"We provide the most valuable information to people who use technology to create messages with impact."

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This month's cover was created by Bryan James Blevins to show effects that can be created with the VertiLectric plug-in for LightWave 3D 4.0. To receive a working demo, contact Blevins Enterprises, Inc. at http://bei.moscow.com or (208) 885-3805. A VertiLectric demo plug-in for Amiga-, X86- and Alpha-based systems is also included on this month's LIGHTWAVEPRO *disk.*

LightWave Tech

A PC Buying Guide for Amiga Users

by Todd Aubin and Joe Dox

Not too long ago, all we needed to run LightWave was an Amiga, and in some cases, a Toaster. Remember when you first bought your Amiga? Chances are that you didn't think much about the motherboard inside, because, well, it was just an Amiga. It had Agnes, Denise and a few others. The name "Amiga" was directly related to the case, the operating system, the mouse and the motherboard. All in all, life was rather simple then. I think we all can agree that those days are over. LightWave is now on the PC (Intel) platform. It also runs on Alpha, MIPS, SGI and Amiga, but for this article we'll focus on the PC platform. While we are on the subject, we'll use the term Pentium whenever we refer to the PC platform. Pentium has all but become a synonym for the term PC whenever LightWave users gather to kibitz on the subject of the new LightWave platforms.

The Need for Speed

The Pentium line offers many options that provide better performance at a lesser cost when compared to similarly powered non-Pentium systems. The big misconception whenever people discuss system speed is that the processor speed, based in units called MHz, dictates the final potential of the box. This is simply not true!

The speed of a processor is a big factor in rendering/computation performance, but it's not the *only* factor. The definition of speed changes with the technology concerned; if someone owned a race car with a engine that could do a gazillion RPMs, but the transmission was poor, would that transmission not impair the capabilities of the race car? Surely.

Consequently, please keep this in mind when magazines quote benchmarks that machine X ran faster than machine Y. Benchmark information is useful, but you should not form any decision about the faster machine except for acknowledgment that the machine is "in the ballpark" and some others are not. Many benchmarks are an indicator of the general capability of a machine and that's all. They are written so as to be fair to all possible functions. Many benchmarks still include 386 and 486 systems in the published results of the test. In many cases, the only item in common between these other systems and the Pentium is the fact that there is an Intel x86 chip in the case. The basic point here is that benchmarks should not count as much in your final decision unless the benchmark has something to do with the main use of your machine.

Targeting Your System

Keep in mind that you really want to have a LightWave machine—not a database engine, a bar code-processing system, or an office server. Okay, okay. So you say, "But I want to do word processing and use my modem, too. It's the only machine in the house." Rest assured. If you target your purchase towards a system designed around LightWave, the remainder of your computer needs will be supported. In fact, knowing the final intended use of the system is a crucial part of the selection. So when you start the motions of purchasing the system, how do you get the retailer to be sympathetic to your needs?

Knowing the final intended use of the machine is usually difficult to convey to a retailer. No wonder! The perfect retailer would have to understand everyone's line of business. Despite the retailer's ignorance of the LightWave world, it is still possible to communicate your intent without tutoring the retailer.

When it's time to go to the computer store or dealer to make your wishes known, ask for the important things by putting them in writing. Tell the retailer that you will be running Windows NT. And be honest, if you plan on running Windows 3.11 or DOS, networking or Windows 95, state that as well. Many system problems happen not by running Windows NT but when the system owner also uses some other operating system that changes the NT environment.

If you intend to add some other devices to the machine after you bring it home, tell your retailer. If you can, try to arrange to have the device tested with the entire system at the computer store. If the device is commonly supported, such as a SyQuest drive, then the retailer shouldn't object to doing this and shouldn't charge very much for the service. When you receive your system, plan on installing the software as soon as possible. Try it right away. Use a big scene with lots of shadowy objects and rock that baby! Don't start a three-month project, or you may exceed the warranty on some devices, if not the memory of the store owner. Try all the features for a week and back up frequently.

Selecting a Pentium Motherboard

Motherboard selection is a critical part of selecting a new computer animation system because motherboard efficiency is probably the most crucial factor in performance. There are many Pentium motherboard manufacturers that give different benchmark results with the same processor speed. So where do you start? Why not start with what works? Has someone needed to run LightWave on Pentium motherboard and is there a solution? If you know that machine X and machine Y are always mentioned in NT or LightWave benchmarks and/or articles, why would you wish to use brand M? For the sake of a hundred dollars?

A common mistake is made by even experienced LightWave users who possibly could have known better. A Pentium NT system cannot be thought of in the same way as a Mac or an Amiga. One cannot know *absolutely* that what works on one Pentium machine will work on another. Similar to badly behaving software that does not follow BIOS documentation, hardware can behave badly as well. That's why the subject of DOS and Windows 3.11 was mentioned. Most NT system dealers will "tune" a Pentium system to work for NT but may ignore testing it under DOS or windows. This can yield horrible results further down the line. A common mistake is to think that ordering a complete system via mail order is any different than ordering parts and assembling it yourself. If you are new to the non-Amiga world, you should consider working with a local reputable dealer who has sold other LightWave-targeted systems.

With all that in mind, let's look at several sections of the Pentium system and discuss some information that will help the reader avoid problems.

The motherboard should be a known brand and should have a good track record with applications

such as LightWave. It's even better if the motherboard is known to run LightWave properly. Sorry, all motherboards are *not* created alike.

A super plus for a motherboard is if the manufacturer has a World Wide Web page, an on-line BBS server or an ftp site. This is a good source for news, BIOS updates and bugs reports. BIOS updates should always be retrieved from a well-known site, if not a site supported directly by the hardware vendor. Some well-known manufacturers, including Intel, ASUSTEK, Micron, AIR and Systech, are already visible on the Internet, WWW and other on-line resources. Want a quick education? Look over someone's shoulder at work or someone else's workplace when a name brand Pentium has its cover off. Note the motherboard make, the make of installed option boards and, if you can squeeze in close enough, the memory speed and type.

Here's a step by step checklist on what to look for in a motherboard:

1. Motherboard footprint. A small motherboard is both good and bad. It should be small enough so that you don't need the full width of a tower but, at the same time, don't be afraid of a wide motherboard. The usual "AT baby"-sized board is a good selection. It will fit up snugly against all slot openings. A better board will have a slight amount of extra space between slots so boards don't touch. There is no consumer measurable power consumption increase with a larger motherboard, just what you *add* to it. Like a baked potato, it's the "butter" that does the damage.

2. Processor power and clock speed. The current decent, not-really-expensive, processor speed is 100 MHz. The next fastest speed is 133 MHz (the highest CPU speed widely available at this time). What is purchased today may be obsolete tomorrow. But if you do a little research, you will find out that this is a unique time for consumers who wish to shop for a recyclable system. If the P100 is the object of desire today, fine. With a CPU that gets 60ns memory, 15ns cache and the correct clock speed on the motherboard, you have the investment in place for the P133 and (with some current motherboards) the P150!

3. Dual processor vs. single processor. Okay. You have a very nice sports car with a very respectable top speed, but it's not so efficient with fuel. So, what do you have? A car that really performs when it has to, but if you live in the city, you'll lose out. The same deal applies to single vs. dual processors. If you need the top performance speed of the system and you will employ this potential for about 90 percent or more of the time, then you probably want dual processors. But, if you are not going to use that type of speed for the majority of the time, do not get two processors. As in the automobile analogy, the amount of overhead for two processors is not well received when the system is idle. There are too many "what if" in the operating system when two CPUs are installed. LightWave benchmarks have shown that a dual processor may actually run slower in some cases when compared against a slightly faster single-processor systems.

4. Up-to-date firmware. Is the firmware on board version 1.0? Is similar firmware shipping at a much higher version on someone else's motherboard? You may not need the latest and greatest. Although there are many of you who want version 10 "just because there is a version 10, darn it!", you may be okay with version 9. The ability to upgrade or flash the BIOS is a bigger concern. With the flash update option on nearly every Pentium motherboard nowadays, you should settle for nothing less.

5. CPU memory cache and cache type. Make sure that you get 15ns cache chips. Some motherboards are still around; many, in fact, still have 20ns speed cache on board. This is not good if you are planning on using a 100 MHz or higher on that board, no matter what anyone else will tell you. A test in the store is not ample time to prove a crash will occur or not. An example: A major motherboard manufacturer shipped thousands of boards with 20ns cache on board. When it was discovered that the motherboard could not be used with a 100 MHz CPU, the manufacturer sent out letters to all of the distributors informing them of this. Did the distributors send the boards back? No! Why would they? The new boards with 15ns would be more expensive, and anyway, it wasn't crashing in their store when they "tested" it. Stick with 15ns or lower.

And the subject of regular SRAM cache vs. pipeline? Sorry, not in this article. We could prove, with numbers, that pipeline burst SRAM has the best price/performance ratio if only we could get ours hands on some! Pipeline burst SRAM is someday going to come out of the closet and be understood as a pretty nice thing. Right now it is unfortunate that the largest hindrance to this technology is the distributor chain. By design, standard SRAM has very tight access time numbers, which force certain restrictions on the chip makers. Pipeline burst SRAM, in comparison, uses an addressing scheme and data read logic that overcomes the normal chip speed bottleneck.

This technology is like a phone mail system compared to e-mail. In phone mail (SRAM), you get back items one at a time in queue. In e-mail, you see what is available and pick some things over others.

6. Triton vs. Neptune, Intel's latest set of support chips. Once again, the brains at Intel have taken a whole neighborhood of technology and went condominium with it! Suffice to say that the Triton chip set supports technology found in other motherboard chips. At any rate, this technology is relatively new to the PC motherboard scene. Examples of what's in these chips includes bus master IDE, improved IRQ/DRQ/DACK signals that could assist more with audio chips, EDO DRAM and Mode-4 IDE.

7. Memory type and speed. Make sure that you have 60ns RAM on your motherboard. Similar logic as mentioned in the cache memory paragraph applies here. You need 60ns for 100 MHz and 133 MHz. We have personally done this. If your dealer insists on giving you 70ns, get it in writing from where you buy your machine. Speaking of size, 72 pin is the way to go these days.

Above all else, select a motherboard that allows you to upgrade at your convenience, not your dealer's. If you needed only 8 MB of RAM, why get two 4 MB SIMMs? Many dealers will do this because the motherboard they have selected for you does not support a single 8 MB SIMM. Most of the time when you see this sort of limitation on a motherboard for 8 MB, it will work the same for 32 MB, 64 MB, etc.

The bottom line is to make sure the dealer knows where you are heading. If you need 32 MB two months from now but you can afford 16 MB today, then do not have the dealer put in four SIMMS of 4 MB each. This would fill most motherboards' allotted SIMM slots! Get a motherboard that would accept a single 16 MB SIMM or at least two 8 MB chips. If you don't, even the friendliest of dealers will charge you for what the conversion is—an upgrade.

8. Disk controller type. IDE or SCSI. This choice depends on what you have and where you are going. IDE control is built into most of the better motherboards these days, and IDE disk drives are pretty darn cheap these days. However some people swear by items like SCSI CD-ROMS and the idea of swapping drives with their PAR when drive density/price ratios get better. The IDE versus SCSI can be risky at best these days. The worst thing we've seen SCSI do is take up an extra PCI slot from the precious few there are. And wide SCSI vs. regular? Give me the classic SCSI, please. The bottleneck in most LightWave systems is not the disk controller, which is what we are talking about here.

Rather, the bottleneck is the CPU and the rest of the barnyard. When you need to write data out, the disk drives themselves on most systems cannot keep up with what the controller is giving them. Look at these numbers. Most SCSI disk controllers can support up to 125 operations per second. An operation is a seek, a write request, a read request, etc. Most disk drives can do about 25–30 operations per second. So, if you have four hardy, eager disk drives doing their data thing, then you are using your SCSI controller to its max. If you wish to speed up your system at this point, check out the idea of getting another SCSI controller and splitting the disk drives across the controllers.

Meanwhile, save your hard-earned dollars and wait for the technology to come down to meet your pocketbook. One last word on drives: Windows 95 still has problems recognizing an extended IDE, a wide SCSI, etc.

9. Slots. How many PCI, how many legacy slots? The current Pentium motherboards have an average of four PCI slots, one 8-bit ISA slot and three 16-bit ISA slots. The bad news is that usually only one of the PCI slots allow the use of double-wide PCI adapter cards. The other slots are too aligned with the CPU or a heat sink in order to allow the use of long adapter

see LightWave Tech, page 16

Adversely Inverse Kinematics

by Alan Chan

Yesterday, my mom built her first IK chain in LightWave. She meticulously modeled some robot arms in Modeler, then laboriously loaded the arms into Layout, after which she proceeded to parent the arms and assign a goal object to the end of the chain.

No, really. My mom doesn't understand the first thing about LightWave (does yours?) and couldn't IK her way out of a polygon bag. You, on the other hand, have probably been building robot arm IK chains ever since that 4.0 package dropped on your front door. Who hasn't?

Don't let that fool you into narrow assumptions though. There are plenty of other uses for IK aside from simply doing robot arm simulations. Case in point:

Inversing Intake Vents

I recently found the need to have articulated vents in the intake of a jet-type engine. Figure 1 illustrates the vents in question—six of them positioned to open and close simultaneously. Rather than saving and loading motion paths and adjusting each one manually, I elected to use IK to fashion a more elegant solution; a null object that would open and close the vents as it moved. Given a bit of planning, I would be able to design a scene file where I could simply move the null object and, once I was happy with the scene, simply go down the list and keyframe the positions of the vents as necessary.

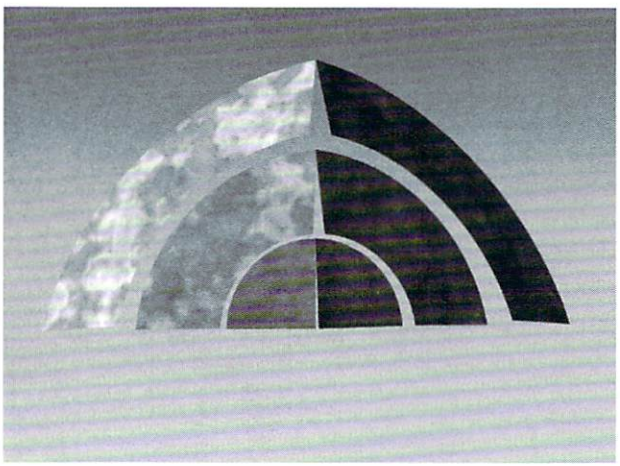

Figure 1: Jet intake vents that will be manipulated using IK.

The synapses fire in this fashion: If IK allows you to target an object to another object, it stands to reason that I can open and close the vent objects by setting a goal object for it and restricting every axis of rotation except one.

LightWave's Inverse Kinematics function works by drawing an imaginary line between the pivot points of each object in the chain (Figure 2), where the last line in this chain points to the goal object. Therefore, in order to make the vent point at the null object, it needs to be parented to a null object.

Figure 2: A "typical" IK chain.

We need six of these vents, and therefore six separate null objects, so the vents should be parented to a master null object for easy positioning. To keep things modular, we should also parent the goal null to the master null. So, let's begin!

Modeling Mania

To model the vent intakes, we'll take a simple disc and cut it up.

- Starting with a new Modeler layer, select the Disc tool (Objects panel) and click on Numeric. Enter the following values for the disc:

Axis	Z
Sides	64
Segments	1
Bottom	0m
Top	0m
Center	0, 0, 0m
Radii	1.2, 1.2, 0

We will turn half of this disk into six vent sections shown in Figure 1. This requires the disc to be cut in three radial sections, which make up the inner, middle and outer vents.

- Before making any other adjustments, immediately select a new layer and the previously created disc in the background layer. With the Disc tool still selected, click on Numeric and make the following changes to the values (all other values will default to the settings we chose for the initial disk in the previous step.):

Bottom	-0.2m
Top	0.2m
Radii	0.8, 0.8, 0

- Still with the Disc tool selected, go to a third empty layer and click on Numeric. Change the value for the radii to read 0.4, 0.4, 0, and make the disc (Figure 3).

We will now use the discs we made in the last two layers as cutting tools for the vent.

- Choose the original disc as the foreground layer and the second disc as the background layer (Figure 4), and select Solid Drill (S Drill) from the Tools panel. Choose Stencil and perform the operation.
- With the same foreground layer, select the third disc as the background layer and perform the same Stencil operation to it. You should now have something like Figure 5.

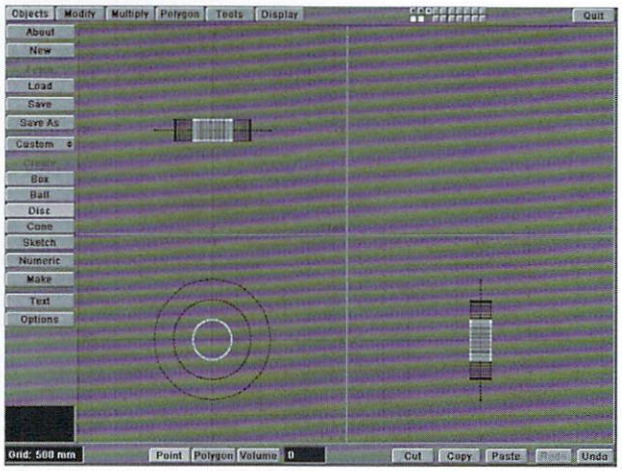

Figure 3: The disc sections that will eventually become vent intake objects.

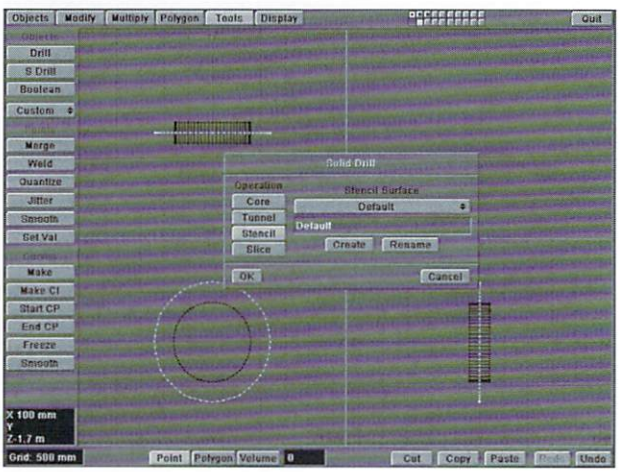

Figure 4: Preparing to Stencil the disc.

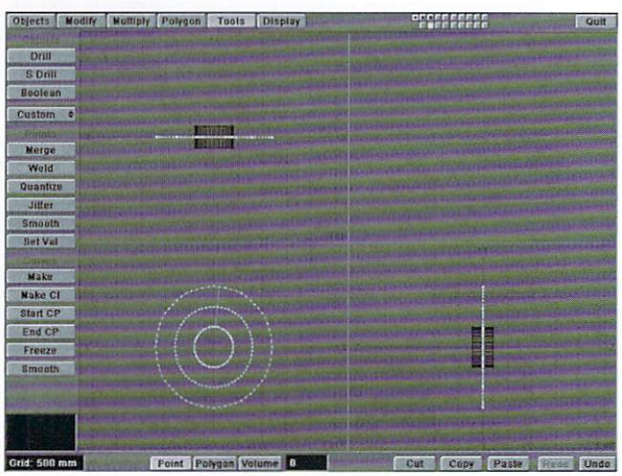

Figure 5: The results of two Stencil operations.

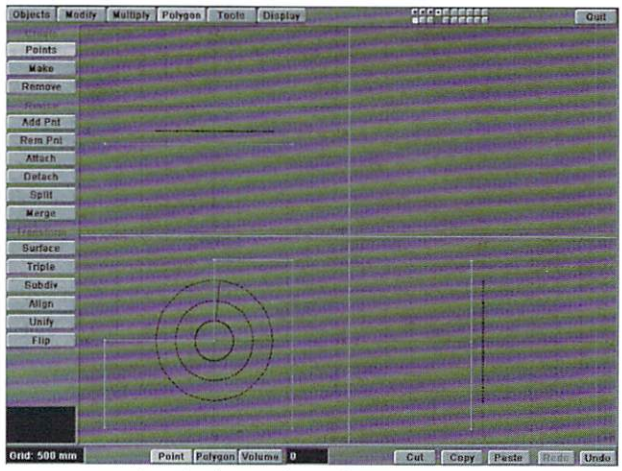

Figure 6: An L-shaped polygon to be used as a cutting tool.

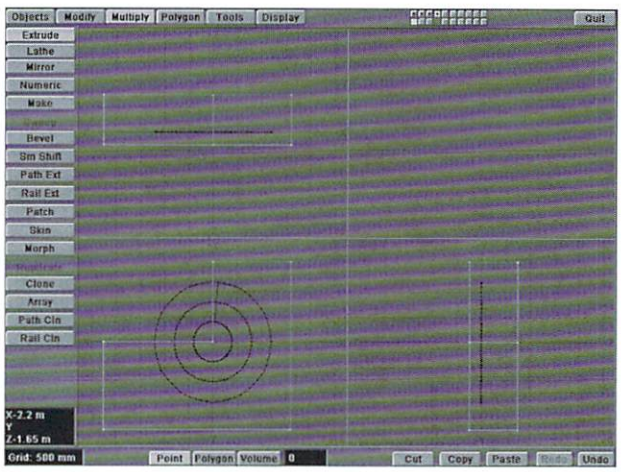

Figure 7: The L-shaped polygon extruded.

Referring back to Figure 1, note that each slice of the vent is identical; therefore, we only need one side of the disk, making a copy of each to rotate into place in order to make up the other half of the vent.

- Select a new layer and place the disk in the background. Using the Points tool in the Polygon panel, create an L-shaped polygon (Figure 6) and extrude it (Multiply panel) so that you get an object as shown in Figure 7. We will be using this object as a cutting tool, so be sure that it is properly positioned (the top of the object should not be on the same plane as the disc).
- Select the layer with the disc, and place the L-shaped object in the background. Double-check to make sure that the surface normals for all three disc polygons are facing the correct way (the negative Z-axis, in this instance). From the Tools panel, click on Boolean and select Subtract. You should get three polygons representing each one of the three vents (Figure 8). You may also get stray polygons from the Boolean operation because your disc object is one-sided, not a closed volume. Disregard this and delete the unnecessary polygons.

Finally, we will need to rotate all three vent objects 45 degrees to align it with a single rotation axis in Layout. This positioning will give us more control over the vents. (Doesn't make sense? Don't worry; it will later.)

- In the Modify panel, select Rotate and click Numeric. Rotate the vents along the Z-axis, with a 45-degree angle and center point at 0, 0, 0 (Figure 9).

Before saving, it's always a good habit to do a Merge Points operation (Tools panel) and name your surfaces. We'll give all three polygons the same surface name of "Vent Panels".

- Now it becomes just a simple task to select each polygon in turn, cut it out and paste it in a new layer, saving it as a separate object. For easy reference, name your objects "VentOuter.lwo", "VentMid.lwo" and "VentInner.lwo".

Getting Down to Business

Having modeled the vents, it's time to build the IK

vent. Since each slice of the vents is identical, we can simply set up one side, and then clone the vents to mirror the other side. Let's begin:

Creating the Hierarchy

- In LightWave, begin by clicking on the Add Null Object button (Objects panel) nine times to create nine nulls (Figure 10). The first null will be our "Master Null", so click on Save Object to rename it. Name the second null "Offset Null", the third null "IK Goal Null" and the other six as below:

  LeftInnerVent
  LeftMidVent
  LeftOuterVent
  RightInnerVent
  RightMidVent
  RightOuterVent

By setting up our nulls first and in order, it becomes a simple process, after we've set up the IK chain, to move the IK null and then go down the list, keyframing the next six items, which just happen to be what the IK Goal Null has been affecting. (Necessity may be the mother of invention, but planning is the big ol' granddaddy of elegance.)

We will now begin to set up the base of the chain, before further confusing the issue with the actual objects.

- From the main Layout screen, parent the following nulls to the Master Null:

  Offset Null
  IK Goal Null
  LeftInnerVent
  LeftMidVent
  LeftOuterVent

- Next, parent the following nulls to the Offset Null:

  RightInnerVent
  LeftMidVent
  LeftOuterNull

- With the Master Null selected as the current item, click on the IK Opts button (I) and toggle on the Unaffected by IK of Descendants function. This establishes the Master Null as the beginning of the chain, or the base of the mechanical arm, to use a more common IK analogy.
- Select the Offset Null and make it Unaffected by IK of Descendants as well.
- With the IK Goal Null as the current object, deselect the X and Y movement axes, thereby allowing the null to only move back and forth in the Z-axis. The position of this null in the Z-axis will determine whether the intake vents are open or closed.

With this done, it's time to begin loading in the objects and setting up the IK chains for it.

Setting Up the Chain

As we set up the IK chain, we need to determine the position of the axis that each vent object will pivot on. In Figure 11, I chose the pictured axis for the vent objects; in the real world, a vent object like this would need to be attached to the intake in some way, and the only logical position to make this attachment would be at the tips of either side of the curve, which passes through the axis.

- Load in the VentInner.lwo object, select the Front view to eliminate parallax, and click Move Pivot Point. Disable movement in the X- and Z-axes and slide the pivot point upwards until it sits on an imaginary line between the two edges (that is to say, the axis we've selected for this object) (Figure 12).
- Note the pivot point's Y value (0.275 in this case) and select the Move function. Note that the Y position of the vent object has also been automatically shifted to 0.275. Click on Numeric (n), enter 0, 0, 0.001 for the X, Y, Z values and keyframe it at 0. Your vent object will now be displaced downward (Figure 13); this is normal.

Note too that we added a slight displacement on the Z-axis; this provides a slight offset between the vent's pivot point and the null. In order for IK to work, there must be a positional offset between pivot points in the chain. This is important! This offset allows LightWave to draw the 'imaginary line' between pivot centers, the basis of IK in LightWave.

- Parent this object to its corresponding null (LeftInnerVent, in this case).
- Select the parented null (LeftInnerVent) and move it up in the Y-axis by the same offset used for the vent object (remember 0.275?). Keyframe this at 0. Your vent object is now returned to its proper place.
- Select Rotate for the null, and disable the Heading and Bank axes, leaving only the Pitch axis. This makes the vent act as if it is anchored and able to rotate in one direction (Figure 14).
- Return to the VentInner.lwo object and click IK Opts (I). For the Goal Object, select IK Goal Null (Figure 15).
- Select IK Goal Null as the current object, and slide it up and down along the Z-axis. Note that the vent is affected by its movement. However, there is still a slight problem—the vent flips up too far! This is because we haven't set limits for the rotation yet.
- In order to determine the limits, slide the IK Goal Null until the vent object swings to the furthest position you want it to go. Select the null object associated with the vent (LeftInnerVent, in this

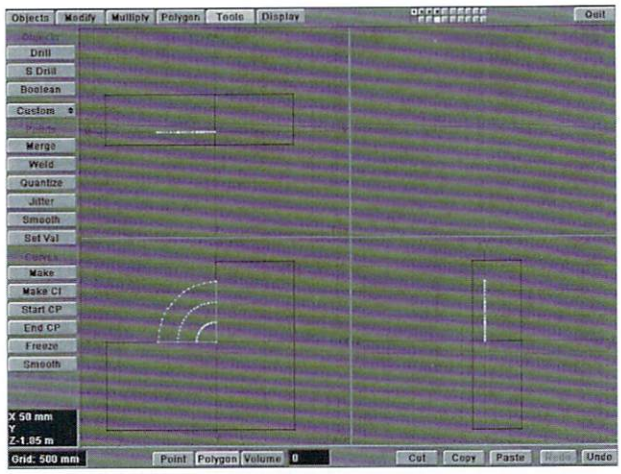

Figure 8: The results of a Boolean Subtract operation.

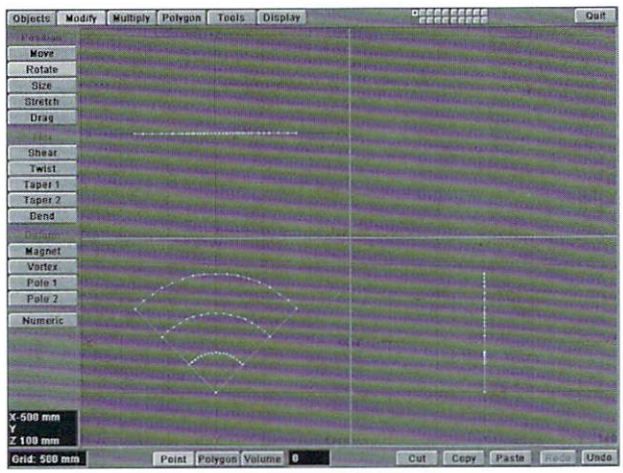

Figure 9: Rotating the vents 45 degrees to line up the rotation axes.

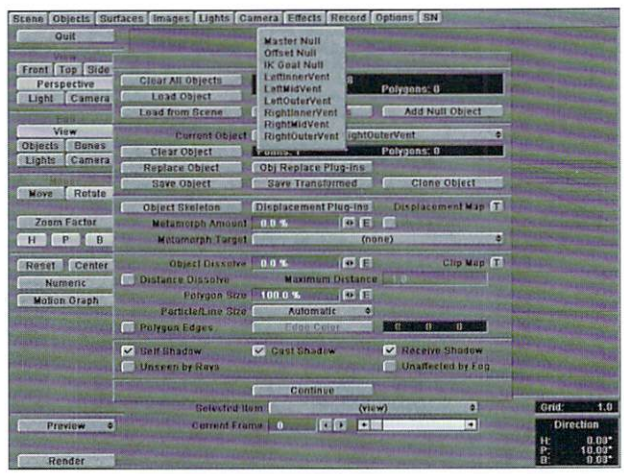

Figure 10: The nine null objects as named in Layout.

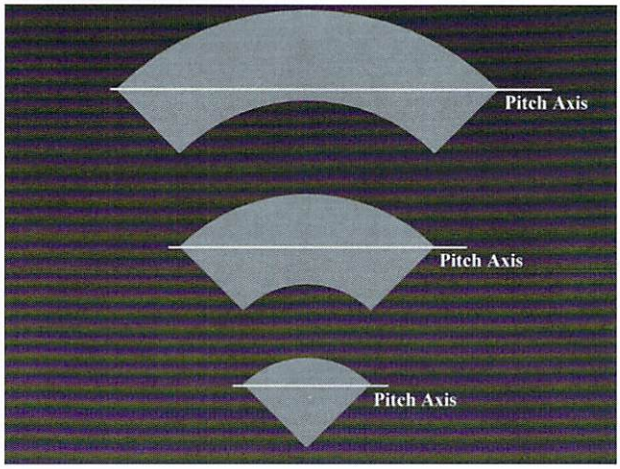

Figure 11: The rotation axes for each of the vent objects.

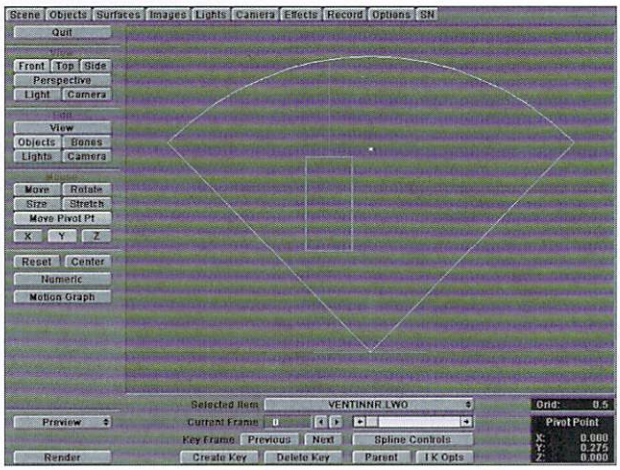

Figure 12: The VentInner.lwo object with its pivot point shifted in the Y-axis.

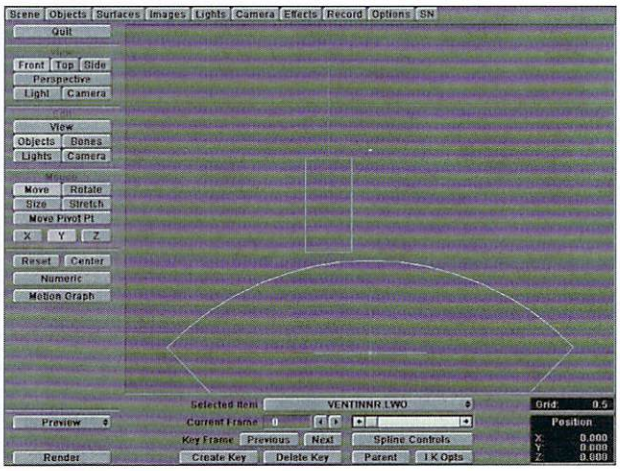

Figure 13: The vent object after resetting the Y-axis position.

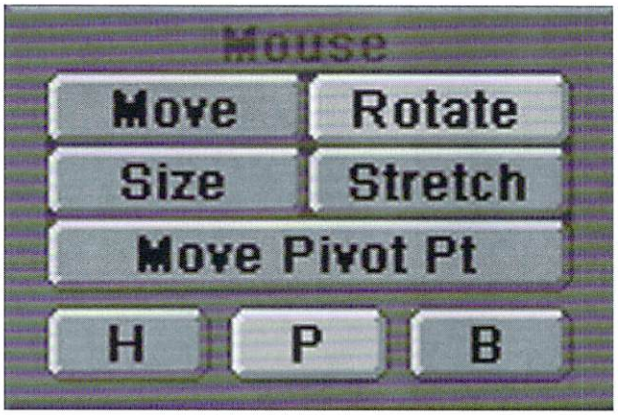

Figure 14: Heading and Bank axes are deselected, allowing only movement in the Pitch axis.

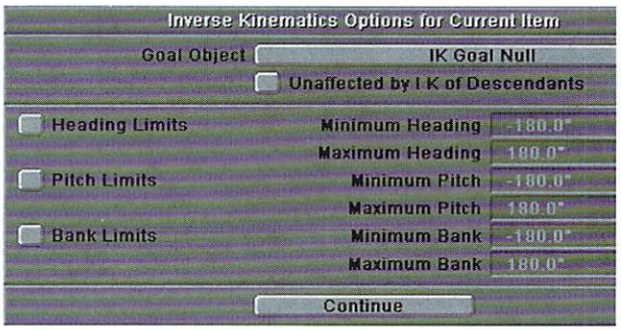

Figure 15: Selecting the goal object for the vent.

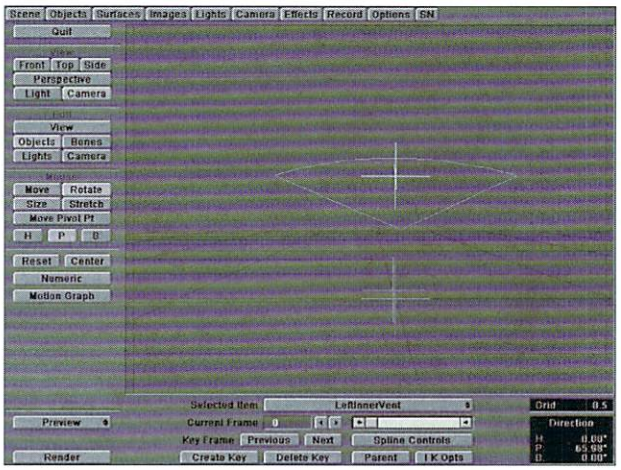

Figure 16: Noting down the maximum pitch value.

case) and choose the Rotate function (Figure 16). Note the rotation value in the coordinates box in the lower right corner. (65.98 was what worked for me; this value is extremely fudgeable.)

- With the null still selected, click IK Opts and activate Pitch Limits for the null. Enter 0 degrees for the Minimum Pitch and 66 degrees for the Maximum Pitch (Figure 17). Click OK, and when you move the IK Goal Null again you will note that the vent will only rise up to a certain degree before staying in position. *[Editor's note: Heading, Pitch and Bank Limits can be set interactively by using the "{" and "}" keys. The "{" key will set the minimum limits, and the "}" key sets the maximum limits. Note that limits are only set for any rotation axes buttons that are selected. Also, make sure that your minimum limit value is less than the maximum limit (by watching the coordinates window) or LightWave will choose the same value. —JG]*

You've just IK'ed one vent object. Simple, huh? We only have five more to go.

- To complete the rest of the vents, repeat the above steps (starting in the Setting Up the Chain section) for the other two vent objects (VentMid.lwo and VentOutr.lwo), and inserting the appropriate offsets for each separate pieces.

Once you have all three vent objects for one side

see Adversely Inverse Kinematics, page 15

Impact!
Motion Dynamics for LightWave 3D

by Mark Thompson

When an object moves in LightWave, it is because the animator has defined two or more keyframes. Nothing happens without defining every aspect of the motion. Objects pass through one another as though each did not exist. And creating something as simple as a truly realistic bouncing ball can be a difficult task that requires mastery of timing. But how about twenty bouncing balls, colliding with each other and falling down a flight of stairs. Such motion would be a LightWave animator's nightmare. That's where Impact!, from Dynamic Realities, comes in. Impact! is a dynamics package for LightWave and it models real world physics. The aforementioned twenty bouncing ball scenario is made virtually trivial by Impact!, as are numerous other applications that demand realistic object interaction and motion.

Of course, Impact! is not the first program to take a whack at dynamics. There have been other packages, but they were plagued by crashes and hopelessly slow. This performance made many people very cautious about dynamics packages. In addition, one company collected thousands of dollars from customers and never even shipped a product. In this case, customers weren't the only ones out in the cold—so were the programmers who developed the code. Having been paid nothing for their efforts, they took their code and decided to develop it into their own package. This is essentially how Dynamic Realities came to be, and how its product, Impact!, began. It is not surprising that some LightWave users have been a bit skeptical of the product, considering its origins and predecessor. Rest assured, however. Impact! does deliver on its promises.

So what exactly is dynamics? It is the study of objects in motion, and the physical properties that govern that motion. Kinematics is a subset of dynamics, accounting for object trajectories based on velocity and acceleration. But dynamics goes much further, taking into account friction, mass, inertia, inter-object attraction, collisions, gravity and other forces. If you were to throw a ball into the air, kinematics would tell you where and when the ball would hit the ground. Dynamics would go on tell you how many times it would bounce, how high, and where its final resting spot would be. Clearly, this could be a powerful tool for easing the burden of the animator in many situations.

There is a downside to using dynamics, however. Because dynamics completely calculates an object's motion without user intervention, it's kind of a crap shoot. Where an object will be at any point in time, while completely deterministic based on the math, is a mystery to the animator until the simulation is played out. So, while dynamics makes for very realistic motion, the animator loses a great deal of control over the object. If a client wants to see his or her logo tumble down a flight of stairs and land right side up, squarely facing the camera, you are in for some problems. You could be trying for some time, through trial and error, to get the right initial conditions that will result in the desired outcome. Also, because of the tremendous complexity of the calculations involved, dynamics simulations can be extremely slow, taking many hours for a single second of motion. But with the right application and a little careful planning, dynamics can take a lot of drudgery out of manually keyframing.

The Impact! interface (Figure 1) is somewhat similar to LightWave in that the major functional areas each have their own panel. They include Projects, Objects, Materials, Engines, Preview and Algorithms. Rather than having a single central 3D view of your scene (as in Layout), Impact! allows you to add as many independent, fully configurable 3D view windows as you like.

With the similarity in interface comes a parallelism in work flow, starting with the Objects panel. Standard LightWave objects are loaded into the scene and placed in their initial positions. Each object may either be keyframed or kinematic. Kinematic objects are those that Impact! is calculating motion for. Keyframed objects, while having their motion specified externally by LightWave, are unaffected by Impact! but may be set to become kinematic at a later time, such as after a collision with a kinematic object.

With the objects loaded, materials are created and assigned. The Materials panel is analogous to LightWave's Surfaces. Each object in Impact! is made up of a named material type, and that material is defined by its density, elasticity and roughness. The material specification will determine how a kinematic object will react based on the forces applied to it. Unlike surfaces, there is only one material assigned per object. Interestingly enough, each material parameter may be enveloped.

In the Engines panel, different forces are defined and assigned to the objects in a project. The available engine types include: Force Field, Gravity, Law of Gravity (massive body attraction), Springy Thingy, Thruster, Torque Motor and Viscous Drag. From these seven types, instances are created that assign parameters, and possibly envelopes, to the behavior of a given engine. For example, the Force Field engine may be used to create an instance called explosion with a large enveloped force. Each instance is then assigned to any number of objects in the scene (note that only kinematic objects will be affected). Although most of the engines do pretty much what their name implies, Springy Thingy may be a bit unclear. This engine simulates the presence of springs connecting the centers of all the objects it is applied to. One possible application is creating the motions for a series of bones that would deform a planar mesh, thereby simulating a trampoline.

Once objects have been loaded, collisions enabled, materials set and engines applied, simulation is ready to begin. The Project panel is used to set the details of how the simulation will proceed. The duration, frames per second, and whether or not to bother with collisions are all set here. Once a simulation has run to completion and the preview looks correct, a scene file can be exported to LightWave for final rendering, or incorporation into a larger more complex scene. Likewise, LightWave can be used to place all the objects in a scene, and then that scene file may be imported into Impact!

For arranging large numbers of objects in either a random or very regular manner, the Algorithms panel can provide a major time savings over manual placement in Impact! or LightWave. In this panel, random, algebraic or trigonometric functions may be used to set the initial position, orientation and scale of a set of objects. Creating a large brick wall or a cloud of

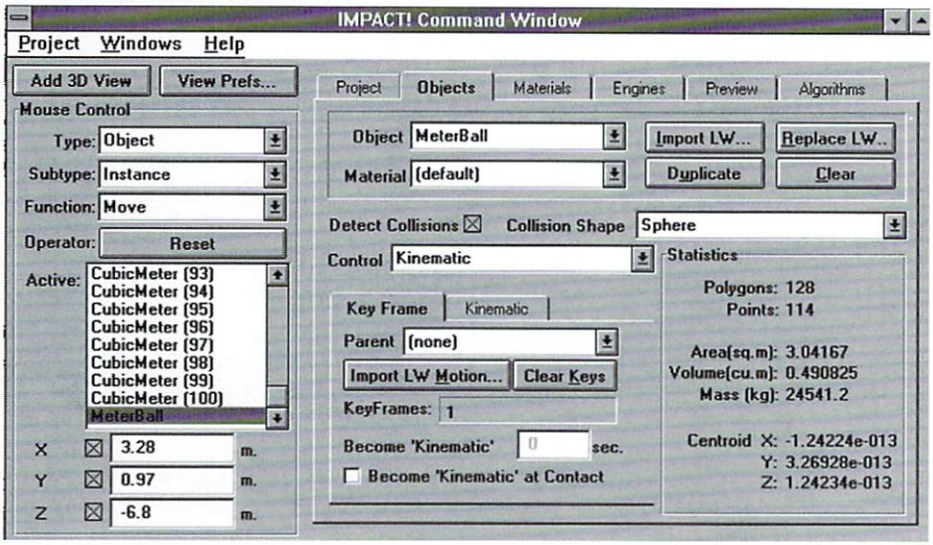

Figure 1

spheres becomes a minor task. Further, these functions may also be used to setup initial velocities or the time at which a keyframed object becomes kinematic. A simple example would be a tile floor in which the tiles randomly burst from the ground. The Algorithms panel is a truly powerful part of Impact! that should not be overlooked.

Although the basic operation of Impact! is fairly straightforward, getting useful results in a timely fashion can be difficult. This has a lot to do with the complexity of dynamics and the calculations involved. Just like when you're making a good LightWave scene, some thought and planning when using Impact! can make your life much easier.

There are some steps to take to make things run faster and more predictably as well:

- Eliminate collision detection from those objects that don't need it.
- Avoid arbitrary shape collision detection as much as possible—it is tremendously slower than sphere or box.
- When creating objects for simulation in Impact!, they should comprise fully closed bodies. Much like Modeler's Boolean function, Impact! can get confused when working with solids that have openings in their surfaces.
- For complex objects that require arbitrary shape collision detection, create a stand-in object that occupies the same approximate volume, but has much fewer polygons. The detailed version can be substituted back in LightWave after simulation.
- When placing objects, make sure they are not penetrating one another. Note that the box or sphere shape that is used to detect a collision on an object may occupy more volume than the actual object. You must account for this when avoiding object interpenetration at setup.
- The default elasticity for an object (set in the Materials panel) is 1.0. This is much too high and results in objects that bounce like a Super Ball. A value of 0.3 is much better for typical use.
- Finally, when creating a project for Impact! to simulate, use only the minimum necessary objects to complete the simulation. The rest of the scene can be completed in LightWave after Impact!'s simulation has been run.

Now for some sample simulation times. One cylinder with arbitrary shape collision and gravity dropped on a rectangular plate with box collision took 18 minutes 25 seconds on a 100 MHz Pentium system for five seconds of motion. The same simulation took 6 minutes 39 seconds on a 275 MHz Alpha, about 2.75 times faster than the Pentium. Not surprisingly, this is identical to the speed difference between the two systems when rendering in LightWave. When changing the cylinder from arbitrary to box collision, the speed increased by a factor of seven! Of course, this is a terribly simple simulation. Projects that are both more practical and complex take significantly longer to simulate. I find that my typical projects run anywhere from two to 30 hours on an Alpha. That is about five to 80 hours on a Pentium or one to 12 days on a fast Amiga. When you think about LightWave render times for animations, this seems right in line.

One thing to keep in mind—in LightWave, you can run very quick simplified tests before committing to a lengthy render. This option is not possible in Impact! because any change that would speed things up for a quick test would alter the outcome, and in some cases, drastically. For this reason, it is essential to really learn the software with simple projects before moving on to complex tasks. Otherwise you may find yourself wasting an enormous amount of time on simulations that just don't work as you would like. There is something else to consider: Many dynamics-oriented animation tasks might be better done manually in LightWave. You must be the judge of what tasks are better suited for computer simulation, based on your available time and the speed of your system. An Amiga may be fine for simpler tasks, but if you are looking to do anything substantial with the software, you might consider moving to a faster machine.

If fully understanding the software is essential to making Impact! work in a timely and predictable fashion, then the supplied documentation and examples will probably help only marginally. The manual is weak at describing the details of operation. This would not be so bad if there were some good sample projects included. However, the examples that currently ship with Impact! are extraordinarily inadequate. The vast majority of the software's powerful features are left untouched and unexplained. If it weren't for a well-designed user interface, users would probably be lost.

I have been getting periodic software updates of Impact! for several months. The version I have now, 1.0.4, is at a stage where I feel comfortable recommending it. In the digital world of discreet time steps, simulated collision detection becomes a very tricky beast. But the current code is now reasonably robust, properly dealing with moderately complex arbitrary collisions. It passes the simple test of letting a donut slide down a thin pole without a hitch. As simple as this may sound, this scenario is a stumbling block for many dynamics modeling programs. Reliably detecting collisions of arbitrary shapes is no small feat, and its one that Impact! is readily capable of. Impact! has come a long way since its initial beta release, but it still has some annoying bugs. One of the more heinous ones is the occasional virtual lock-up. This happens when a particular task is going so slowly that the software neither updates the status information nor responds to abort commands from the user. If you wait long enough, Impact! will likely respond, but it looks far too much like an actual hang, which does still occur occasionally. On the plus side, the programmers have been very responsive to fixing problems, and they are well aware of areas that need improvement.

If you want to take some of the drudgery out of modeling realistic motion, or add some highly charged kinetic activity to your animations, Impact! is not just *the* choice—it's the only choice. With the addition of a good particle system, you have LightWave's answer to Wavefront Dynamation. Not surprisingly, Dynamic Realities is working on just that right now.

LWP

Mark Thompson is director of Animation and Special Effects for Fusion Films, Inc. and producer of the in.focus LightWave training tape series. Send questions or comments to Fusion Films, Inc., 51 Derry Street, Merrimack, NH 03054 or e-mail Mark at mark@fusion.mv.com.

Zap!
A VertiLectric Tutorial

by Bryan Blevins

Recently, while channel surfing, I came across a program about lightning. I quickly pressed the record button on my VCR and continued to watch the amazing time-lapse footage. I started thinking about how to create the same effect in LightWave 3D. I quickly realized that while I could model one or two lightning bolts, doing a few dozen in order to create the effect I was after would be better accomplished with a plug-in.

Herein lies the problem: I do not program. My brother and business partner, David, who does program, is busy working on other plug-ins. He does not like to take time out of his busy schedule just to make yet another specialty plug-in for me. The answer was clear—I would have to con him.

The next day I took in the video of the show and nonchalantly mentioned it to him. His interest was piqued. After watching the first minute, he was onto my plan. He said nothing, however, as it would spoil the game we've perfected since childhood. It was too late, he was hooked. Over the next hour, we and others in the office discussed what a lightning generator would need. The plug-in was soon boiled down to bare necessities. I left the office knowing that I would get my lightning generator, but figured it would be three or four days before I had anything useful. I was wrong.

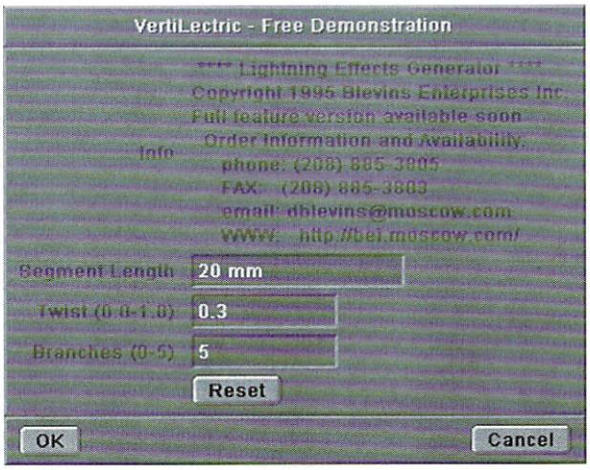

Figure 1: The VertiLectric Control panel. Zeus never had it so good.

I had underestimated how inspirational the lightning footage was. David stayed up until 2:00 a.m. finishing the plug-in. When I came in the next morning, it was waiting on my computer. To say the least, I was amazed. I played with lightning the whole day. It soon became apparent that not only could the plug-in create cool lightning bolts, but electrical arcs of all kinds could be made.

Over the next few days, minor changes were made and features were added. This resulted in the VertiLectric Demo plug-in included on the *LIGHTWAVEPRO* disk. (Internet users can get the demo from our Web site listed at the end of this article.) Over the next few paragraphs, I'll show you how to use the plug-in and hopefully give you some ideas for new effects you can create.

Plug Me In

Versions of the plug-in are available for Amiga, Intel and DEC Alpha systems. This plug-in requires LightWave 4.0.

- To install, copy the appropriate plug-in file to your plugins/Modeler directory:
  vldemoam.p for Amiga
  vldemopc.p for Intel
  vldemoax.p for DEC Alpha
- Start LightWave Modeler and choose Add Plug-in from the Custom pop-up (Objects panel).
- Select the plug-in file you just copied.

When you pick the Custom pop-up (Objects panel), you will find VertiLectric Demo added to the list. When you exit Modeler, the plug-in will be saved in the configuration file.

If You Build It, It Will Strike

The demo plug-in creates a jagged string of two-point polygons (a bolt) between two or more points in Modeler. Options are available via a control panel to determine how the bolt looks.

Let's dive in and make a basic bolt.

In Modeler, use the Create Points button (Polygon panel) to make a point at approximately two meters on the positive Y-axis. Make a second point at the origin.

- Run VertiLectricDemo to display the control panel (Figure 1).

The first option in the Control panel is Segment Length. This is the approximate length of each two-point segment of the bolt. Smaller values produce more segments. I like to set this value to about 1 percent of the length between end-points.

- Enter 20 mm as the segment length.

Twist controls how much the bolt varies as it moves between points. The value can vary from 0.0 to 1.0. Larger values produce more twisting.

- Enter .3 for the Twist value.

The VertiLectric demo plug-in allows up to five branches in a bolt. Each sub-branch has half as many as the one before.

- Enter 5 Branches, and press OK.

In a moment or two, a bolt is created in Modeler (Figure 2). (Note: If the first bolt is not to your liking, select Undo and generate a new bolt. VertiLectric generates a different bolt every time.)

VertiLectric can handle more than just two points. If you would like more control on the overall path of the lightning, add a few more points in Modeler. VertiLectric will construct a bolt through the points in the order you select them.

- When you have made a bolt you like, press the Surface button (q) (Polygon panel) and name the polygons "lightning". Press Apply.
- Save the object as "Bolt1.lwo".
- Select the main, central bolt by picking a few of the polygon segments toward the bottom and then choosing Sel Conn (]) (Display panel).
- Copy the main bolt and paste it to a new layer. All that should be on the layer is the main bolt. If you accidentally grabbed a branch section in addition to the main bolt, select the polygons and delete them.
- Save the bolt as "Bolt2.lwo".
- On an empty layer, make a flat plane 100 meters square in X and Z centered on the origin. Name the plane surface "clouds" and the object "Clouds.lwo".

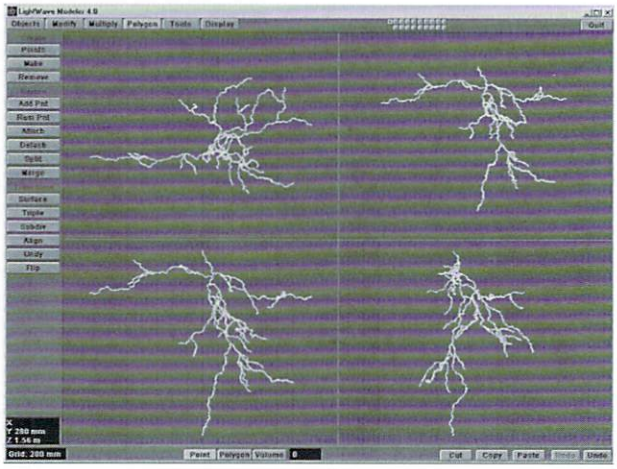

Figure 2: A lightning bolt fit for all you LightWave gods.

Strike Me Down

Let's go into Layout and whip up a lightning storm.

- Enter Layout, and load the two bolts and the cloud objects saved in the last few steps.
- Turn off Self Shadow, Cast Shadow and Receive Shadow (Objects panel) for the bolt objects. Because we are dealing with "light", we don't need these options activated.
- In the Objects panel, add a null object. Select Save Object and change its name to "target-null".
- Change View and Edit modes to Camera. Pick the Target button and choose target-null to point the camera to the null object.
- Move the target-null object up so that is positioned about halfway up the lightning bolt. Create a keyframe to save its position.
- Move the Camera so that the lightning bolt fills the frame. Lower the camera position so that you're looking up to the lightning bolt (Figure 3). Create a keyframe.
- Raise the Cloud object so that is at the top of the lightning bolt and make a keyframe.
- In the Surfaces panel, set the attributes of the lightning surface to:

Color	220, 235, 255
Luminosity	100%
Diffuse Level	0%
Glow Effect	On

Remaining settings are default.

- Set the cloud surface to:

Color:	70, 70, 80
Luminosity:	100%
Diffuse Level:	100%
Transparency	Texture
Texture Type	Fractal Noise
Texture Value	100%
Frequencies	5
Contrast	1.0
Texture Size	2, 2, 2

Remaining settings are default.

- Open the Effects panel and enable Gradient Backdrop and set Zenith Color to 0, 0, 10. Set the remaining gradient colors to 0, 0, 40.
- Set Fog Type to Nonlinear 1, Minimum Fog Distance to 10, Maximum Fog Distance to 40 and enable Backdrop Fog.
- Turn on Enable Glow Effect and set Glow Intensity to 50%, and Glow Radius to 20.
- Render your scene. If all goes well you should have a glowing, jagged, voltage filled arc of killer lightning!

Now, let's add some flash. Looking at a lightning strike in slow motion, you notice three distinct flashes. The first is a big flash with branching arcs as the lightning bolt searches for the easiest path through the atmosphere. The second and third flashes are a single bolt through the air.

- Select Bolt1 and set Object Dissolve to 100% (Objects panel).
- Bring up the Envelope panel (E). Create keyframes at frame 15, 16 and 17.
- Set all keys Spline Controls to Linear. Change the value at frame 16 to 0%. Click on Use Envelope to return the Objects panel.
- Select Bolt2 and set Object Dissolve to 100%.
- Bring up the Envelope panel and create keys at 17 through 21. Again set all keys to Linear. Change the value at frame 18 to 0% and the value at frame 20 to 30%. Save the envelope as "Flash.env", then click Use Envelope.

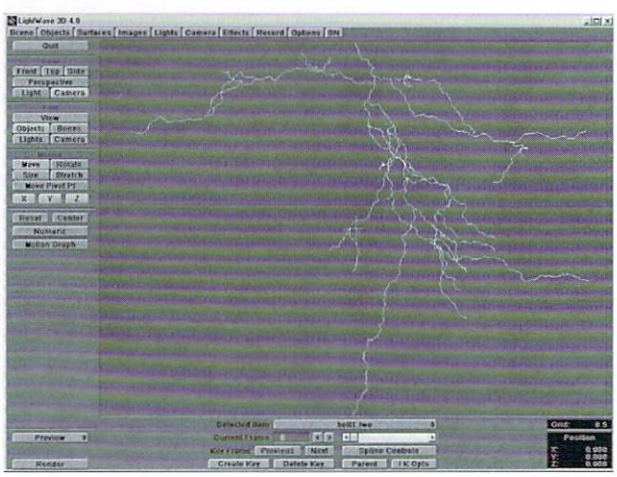

Figure 3: A mortal's-eye view of impending doom.

Because the bolt objects aren't actually lights, we need a source to cast light during the lightning flash. Should you add other objects to the scene, this will make the lightning look as if it is illuminating them during the flash.

- Open the Lights panel and set Ambient Intensity to 0%. Change the Light Type to Point and set Intensity Falloff to 10%.
- Press the E button next to Light Intensity to open the Envelope panel. Load "Flash.env" to load the same settings used from the Bolt2 object.
- Create linear keys at 15 and 16 and set the value at frame 16 to 0%.

You may have realized the settings are just the opposite for the flash of light that we are hoping for. Though we could change the current values easily enough by hand, if this envelope had a hundred or so keys, we would be looking for a shortcut. Fortunately, LightWave gives us one in the Shift Keys and Scale Keys buttons.

- While still in the Envelope requester, Select Scale Keys. Enter -1 in the Scale Values by field and press OK. The envelope is flipped but the values are too small—negative, in fact.
- Press Shift Keys and Shift Values by 100. Press OK. Now the envelope is as it should be.
- Position the light source in the middle of the lightning bolt. Set a keyframe at frame zero.
- Render out a short animation to look at the results. As with all things in LightWave, experiment with different settings to control the flash intensity, duration, glow amount, etc. until you find settings that you like. Make more lightning bolts and add them to the scene to create a nice electrical storm.

Energize Me

Electrical arcs and lightning are always changing. The path the arc takes through the air jumps rapidly from moment to moment. This gives life and energy to them. We can simulate this flickering effect by using a morph target. In many cases, bolts created with similar parameters can be morphed in Layout.

- Return to LightWave Modeler. On an empty layer, create two points on the X-axis, straddling the origin (e.g., 100 mm and -100 mm).
- Run VertiLectricDemo, set Segment Length to 3 mm, Twist value to .3 and 0 Branches. Press OK.
- Save this bolt as "Bolt3.lwo".
- Press Undo to get the original points back.
- Rerun the plug-in and use the same parameters as before. Save the new bolt as "Bolt4.lwo".
- Enter Layout, clear the scene and load Bolt3 and Bolt4. Target the camera to Bolt3. Set the surface settings to those used in the first example.
- Return to the Objects panel and choose Bolt3 as the current object. Set Bolt4 to be the Metamorph target of Bolt3. Press the Metamorph Amount envelope button.
- Create keys at frames 1 and 2. Set the value at frame 1 to 100%. Set End Behavior to Repeat. If you're using the final version of LightWave 4.0, you can use the Envelope plug-in (Modeler) to generate a random envelope and produce a more realistic flicker.
- Set the Object Dissolve (Objects panel) of Bolt4 to 100%.
- Generate a preview.

A final note about morphing bolts. In this demo,

see Zap!, page 17

lwpro@internet.online

by Dan Ablan

Welcome once again to another fun-filled column, dedicated to LightWave, the Internet and you. I was going to be cheesy right there for a second, and say, "dedicated to LightWave, the Internet, and *beyond*!", but I vetoed that idea. I was going to say that because of all the talk about the movie *Toy Story* in the LightWave areas on the Internet.

Three Great Things

There has been a lot of conversation in the LightWave newsgroup (comp.graphics.apps.lightwave) area about *Toy Story*'s animators, the machines PIXAR used, the time it took to create the characters and much talk about the story itself. Most of you can agree that there are some outstanding 3D animations floating around out there, many of which are created with LightWave. But how often do you see an animated story that starts out just great—the timing is good, the music fits right in there and, all of a sudden—wham! The story falls off a cliff. If you've ever seen any of PIXAR's work, you know that they have great storylines. There's always beginning, a middle and an end. I've seen some really incredible animations over the past few years, but none of them make me laugh the way a PIXAR story does. *Toy Story*, in my opinion, would have bombed, if not for the great storyline.

Special effects can only carry a movie (or TV show) so far. I had to go see *Toy Story* twice because the first time, I got so wrapped up in what was happening that I forgot about the animation. Some of PIXAR's earlier work is so simple, yet it truly captures your attention, due partly to their technique but mostly due to the story. *Luxo Jr.*, for instance, is an animated short PIXAR created in the late eighties. In the animation, there are two desk lamps, a floor and a ball. That's it. But after just a few frames, you believe that the big lamp represents a parental character, and the little lamp represents a rambunctious child. It's an amazingly simple animation (especially now with LightWave's Inverse Kinematics feature), but very effective.

There are three elements that come into play when creating an animated tale: story, character and technique. If you can bring all three factors into play, you've got the makings of a winning animation. In *Toy Story*, you've got a great story. Characters are certainly there, and the technique also helps bring the characters to life. You should consider the "story, character, technique" method in that order. If the story is good, the viewer will stay focused, and not get bored. Therefore, your character can be simple, and so can your technique. If you reverse the order of the three factors, you've got the workings of a poorly done short film. Technique alone cannot carry an entire piece, nor can lovable characters. Both certainly help, but it's the story that carries you from the beginning through the middle to the end.

This method applies not only to animation, but to video and film as well. The movie *When Harry Met Sally* is a good example. There are no special effects, no stunt doubles, no 3D animation. But, it's a great movie. Why? Because the story is good, the characters are good, and the technique is good. It all works. Think about it; you get wrapped up in the story, just as you would with some of the great old films of the 1930s and '40s.

In the Beginning

With LightWave PC opening up doors for new animators, we've seen a number of posts from "newbies" in the LightWave newsgroup and mailing list. It seems that all sorts of people are buying a copy of LightWave and starting a small animation business in their spare time. Others, who've been working full time in video, are now branching out their services to include animation. All of this is great news! I receive e-mail from quite a few people who don't know where to begin when dealing with a client.

Dealing with clients is like dealing with nature. You never know what might happen. One day, it's sunny and pleasant, thunder and lighting the next. In either case, it's important to remember that it is only business. For every bad day, there will be a good day, and vice versa. I've talked with many animators at trade shows and training seminars, and it's quite interesting the way the beginning animator thinks vs. the seasoned animator.

I can relate because the same process happened to me. In the beginning, you tend to take just about any animation job you can get. Nine times out of 10, you're not getting paid what you should be, and the client adds more work at the last minute but has no more funds. You'll work twice, even three times, as many hours as you thought you would have, and even then, the client isn't happy. Beginning animators take everything to heart and, in a sense, are purists when it comes to the work they create. They may get into creative arguments with the client about how an animation should look. The client wants it one way, but the animator wants it another. Well, did you ever hear the phrase "The customer is always right"?

Seasoned animators stand their ground. "Here is what I can do for your price range" is what you'll hear. Seasoned animators will do a job and deliver. Just get it done. Who cares if the animator doesn't like it? It's what the client is paying for, and as long as that client is happy, the animator has done his or her job. If a client wants you to create the most horrid animation but you are worried how it would look on your demo reel, I've got a great solution—don't include it on your reel! Rework the animation later for your own use, but don't get into a personal argument with the client, because it's not "your type of work." Just do what the client wants and get paid for it.

People have always asked how to charge for animations. I can tell you this: In the four years I've been animating, two years independently, I have never once done a project that was computed on a per-frame or per-hour price. Every client has a set budget for the animation they want to have produced. By saying your rate is $45 an hour for modeling, $35 an hour for animation and so on, two things will happen. Number one, you'll drive your client away. Number two, you'll be paid less than you should be. Don't nickel and dime your client because you'll *never* see that client again.

So, here's what you do. Find out what the client wants and how much money he or she has to spend. Next, you, as an animator, need to sit down, and storyboard the project. Figure out how long it will take

you to gather your resources, such as image maps, objects, etc. Determine how long the project will take you to model and how long rendering will take. Think about how you work. Most often, you never just model for an hour, then animate for an hour. Why, then, would you charge an hourly rate for modeling, scanning or animating? Set a flat rate, based on what you do. A daily rate also works nicely. I've been quoting a daily rate the past few months, and it works out very well. Most jobs take about two to three days, and I get paid what I should for that job. With an hourly rate, I'd lose. I'd spend more time calculating and figuring hours, possibly finding ways to add or subtract hours so the client likes the dollar amount.

A few years ago, an animator suggested in a book to "never do a job for less than $500." Well, I've got news for you—some jobs just aren't worth $500. Another point, there are a lot of 3D animation businesses out there, and it can get pretty competitive. Base every job on its own merit. What if a client has $350, is open to any idea you have, and the project will take you 20 minutes to set up and 5 hours to render? That's $67 an hour. Not too shabby, full time or part time. Lastly, make a letter of agreement. State a time line. Agree on what work will be done, and for what price. Agree on a payment schedule, and make sure to include your late fee terms and copyright status. Make sure you have permission to reuse any image, object, or scene file in other projects. And, ensure the client knows that you have rights to all finished work for inclusion on your next demo reel.

That's going to wrap it up for this month. Next time, get ready for another dose of cool Web site listings, laser beams with LightWave and, as usual, more news from the Net!

LWP

Dan Ablan is president of AGA Digital Studios in Chicago. AGA creates LightWave animation sand graphics for video production and Internet sites. Reach him at dma@mcs.com.

Adversely Inverse Kinematics

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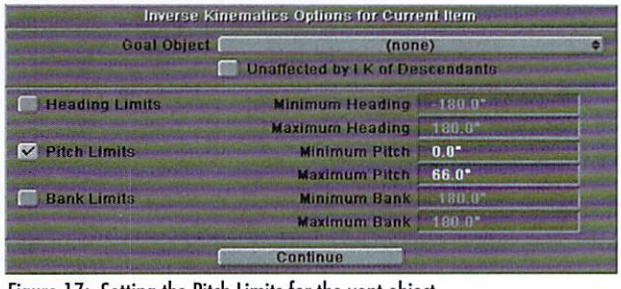


Figure 17: Setting the Pitch Limits for the vent object.

done, it's time for the other side.

- Begin by copying the Y position for each of the left vent nulls to the right vent null (i.e., if the LeftInnerVent null's position is 0, 0.275, 0, the RightInnerVent null should also be 0, 0.275, 0—keyframe this, of course!). Also remember to restrict rotation only to the Pitch axis, and under the IK Opts panel, set the appropriate Pitch Limits.
- From the Objects panel, use the Clone Object button to make one copy of each of the vent objects (VentInner.lwo, VentMid.lwo and VentOuter.lwo).
- Returning to Layout, select each cloned object in turn and parent it to its respective null (e.g., the VentInner.lwo(2) object should have its parent changed from LeftInnerVent to RightInnerVent). If you are doing this correctly, there will be no apparent changes on the Layout screen, because the vents are still overlapping each other. Now for the coup de grace...
- Select the Master Null object, click Rotate and bank the entire setup 45 degrees. This positions the vent off to one side. Next, select the Offset Null and bank it -90 degrees. Voilà! Vents! (In all of this excitement, don't forget to keyframe these nulls.)

From here on, it becomes a simple matter to move the Master Null and position the intake vents where necessary. The IK goal null, as you will notice, will always be centered on the vent, and you can slide it forward or backward to open or close the vent. When satisfied, keyframe the next six objects (the nulls,) and you've set up your vents!

While this technique takes a little longer to set up than a Load-Save envelope function, the setup is useful in instances where you will be using a model over and over again in different scenes and shots, or where another animator will be using your model and may be unaware of the need to load-save envelopes for each vent. It also serves to break out of the mechanical arm mentality that most people will have built up about LightWave's IK function; with a clear understanding of IK and a little bit of imagination—hey, you could build and animate just about anything.

LWP

Alan Chan has been spending a lot of time blowing up alien fighters. Report in to achan@ix.netcom.com.

COMING IN
Future Issues of LIGHTWAVEPRO

Due to space constraints, our ScreamerNet article was not in this issue, but it will appear soon. Also, look for innovative bone/IK uses and new plug-ins.

continued from page 5

cards such as multimedia, serial adapters, graphic animation and video capture cards (such as a PVR card). The industry average of 9 inches only fits into one PCI slot in the average Pentium motherboard. The conclusion here is that you should make sure that your selected motherboard is able to fit something like a PAR or PVR if that is in your or your company's future plans.

10. Documentation. You need well-written documentation. There are not too many motherboard manuals yet that are written in perfect English, but the current state of many manuals shows that manufacturers are not that far away.

One more update: Most people know that the Pentium-Pro Processor (also known as the P6) is now shipping. Motherboards for these beasts are being developed and are available now. The P6 is a whole new architecture that will no doubt open new doors in PC-rendering performance. I'm sure we are all curious about its capabilities. Unfortunately, we don't have any numbers to publish at this time, but we most likely will be seeing more of it in 1996.

So, to sum it all up, if you're looking for a Pentium-based machine (which everyone knows is the most cost-effective route to take), do the research into what you're looking at. Have the machine built to *your* specifications. You may need to spend a few extra dollars here and there, but it'll be worth it.

LW/P

Todd Aubin is a specialist in PC Systems and NT, and is a LightWave animator. He currently works out of D.J. Software & Computers in Westford, Mass. Todd can be reached at taubin@gkp.ultra-net.com.

Joe Dox owns Galaxy Imaging, based in the Boston area. He can be reached at jdox@galaxy.shore.net.

What's on the Disk?

This month's disk includes objects and scene files from Alan Chan's IK tutorial and Bryan Blevins' Zap! tutorial. Also included are the VertiLectric demo plug-ins for Amiga, PC and Alpha computers. Adam Chrystie's hand-splint objects are also included from last month's "LightWave 101" column.

Zap!

continued from page 13

only branchless bolts can be morphed. If you need to morph a branching bolt, create all the points and create the branches one at a time. (Note: the commercial version of VertiLectric has options to ensure bolts will always morph.)

Other Ideas

I've given you some basic uses for the VertiLectric demo plug-in. Please don't think that you're limited to only these lightning examples or even lightning at all. The beauty of 3D graphics is that we as artists have the freedom do what ever we please with whatever option or plug-in we have. As long as the client is happy with the final product, do it.

In my experimentation with the demo plug-in, I've been able to create scenes that go beyond a simple strike of lightning. Let me list some of them. Maybe you'll want to recreate some of these examples or hopefully they will stir up some ideas of your own.

Plasma Balls

You find these items in electronic stores. They consist of a clear ball with random arcs emanating from the center to the surface of the ball. When you touch the ball, the arcs are attracted to you.

To make this object, generate about a dozen bolts similar to those in the second example. Place one end of the bolt at the origin. In Layout, set up six pairs of morph objects to add some flicker, and set each pair to a different, random rotation. Apply a heavy amount of glow. For an interesting surface (and glow), apply a color texture map.

Electrifying Logos

Bad pun, I know. The points that define the bolt path do not have to be loosely placed. Points can be placed in the shape of letters for some interesting logo effects. One hint: Leave room between the points for the bolt to wander.

Vines and Plants

Lightning has an organic shape that, when viewed upside down, looks similar to some plants. You can use and texture the existing two-point polygons or give the plants more substance. Here's how:

- Generate a simple bolt and remove the polygons (k) (Polygon panel). Select the remaining points and make (Tools panel) (Ctrl–p) a spline curve.
- On an empty layer, make a six-sided disk at the start of the curve. Place the curve in the background and use Rail Ext (Multiply panel) to extrude the disk shape down the curve. The resulting cylinder bends to conform the shape of the curve. Branches can be given thickness in the same way.

Hopefully, this tutorial will give you some ideas for using the free VertiLectric demo on this month's disk.

LWP

Bryan James Blevins is vice-president of Blevins Enterprises, Inc. When he's not tricking his brother into making plug-ins, he creates models for the Hercules *and* Xena *television programs. You can reach Blevins at (208)885-3805 or e-mail him at bblevins@ moscow.com or WWW: http://bei.moscow.com/*

Editor's Message

continued from page 3

show them some of the "work I do." I was embarrassed to discover that I didn't have anything on my hard drive that was fun to look at. I was (and am) sorely lacking in LightWave "art."

Allen Hastings and Stuart Ferguson created cool programs because they wanted to create cool movies. I don't know if they knew what they were getting into at the time, but I doubt that Allen has done anything for himself in quite a while. Stuart was a bit luckier and had a chance last year to finish a short film that had been a while in the making. But I think both of these guys would play around more if they could. It must feel like a luxury to them when they get a chance to just goof off. I know it does for me.

I guess where I'm going with this message is this: Take some time out and create something for yourself. Give yourself a challenge—build something and create a piece of art for yourself. Not your client. Take your time and make it right. It will make you feel better and give you a chance to use all of those skills you've discovered while making things for other people. And once you've created something for yourself, share it with others.

John Gross
Editor

LWP

Tip of the Month:

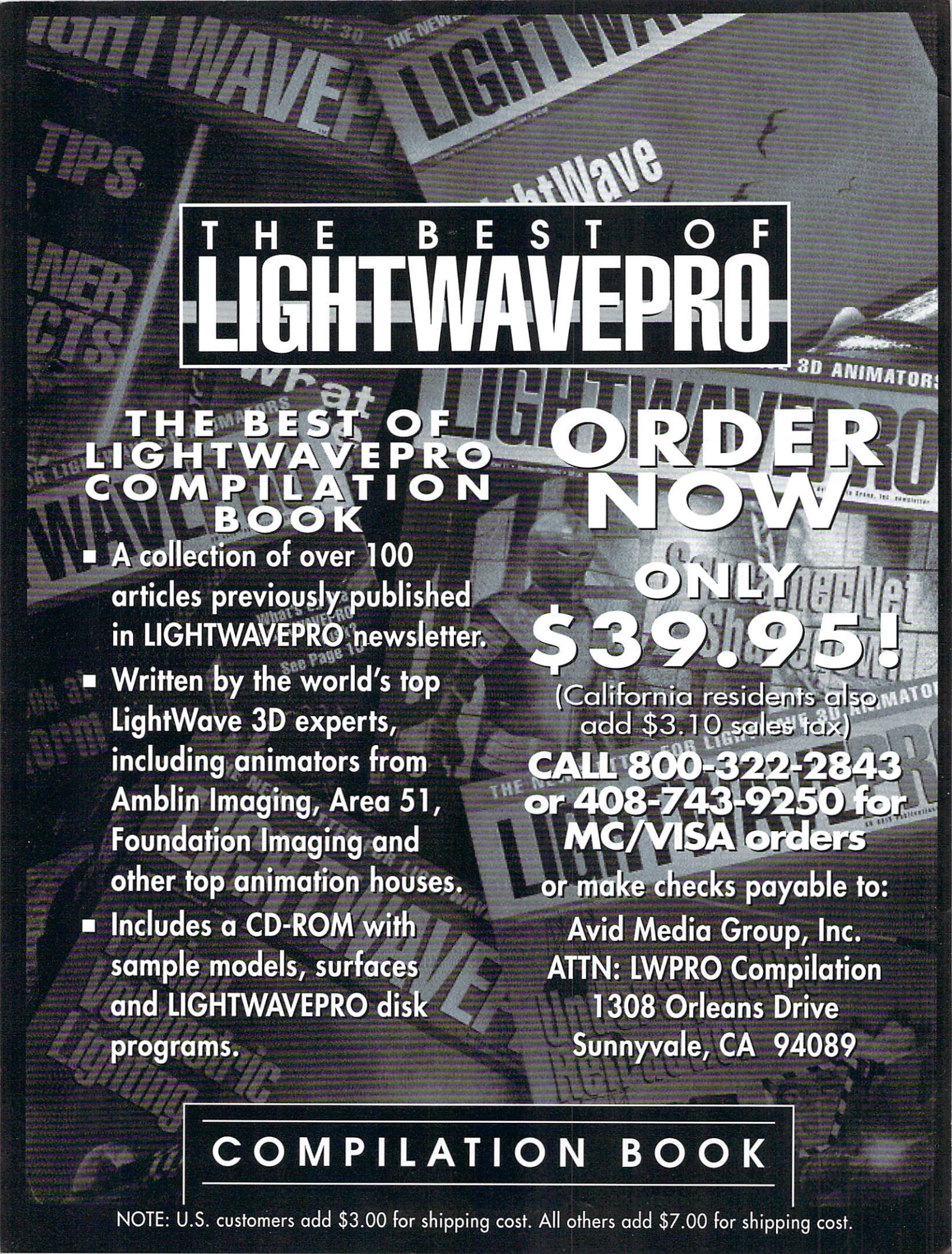
LightWave 4.0 no longer has the option of selecting the Letterbox function or deselecting Overscan in the Camera panel. However, you can use the Limited Region function to create the exact same settings by using these values for Limited Region:

	Limited Region Settings	
Overscan Off	Left	7.5%
	Right	92.5%
	Top	8.4%
	Bottom	91.6%
Letterbox	Left	0.0%
	Right	100.0%
	Top	16.7%
	Bottom	83.3%

Of course, if you load a scene using Letterbox or non-Overscan settings created with 3.5 or earlier into 4.0, LightWave will automatically adjust the Limited Region settings to these values for you.

If you just want the look of a letterbox effect, but don't want or need to crop your frame/objects with Limited Region, you can set up your scene using the following Custom Size settings for the specified Pixel Aspect Ratio. This will give you the proper frame aspect for the old Letterbox effect:

	Pixel Aspect	Custom Size
Letterbox	D2 (NTSC)	752 X 320
	D1 (NTSC)	720 X 324
	Square	640 X 320
	D2 (PAL)	752 X 384
	D1 (PAL)	720 X 384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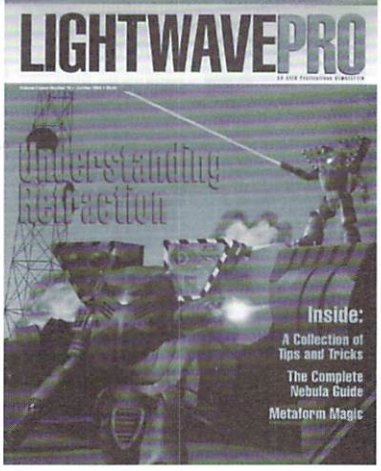

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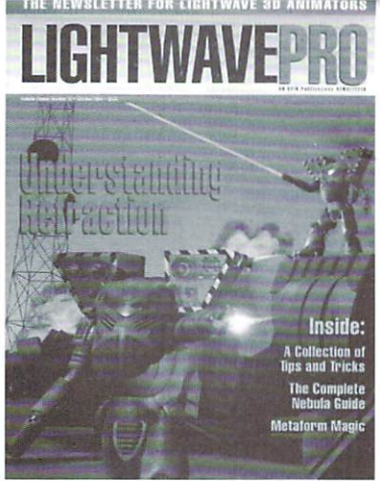

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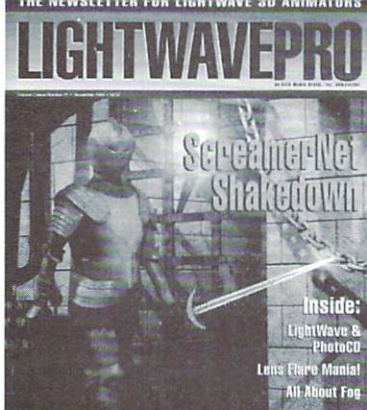

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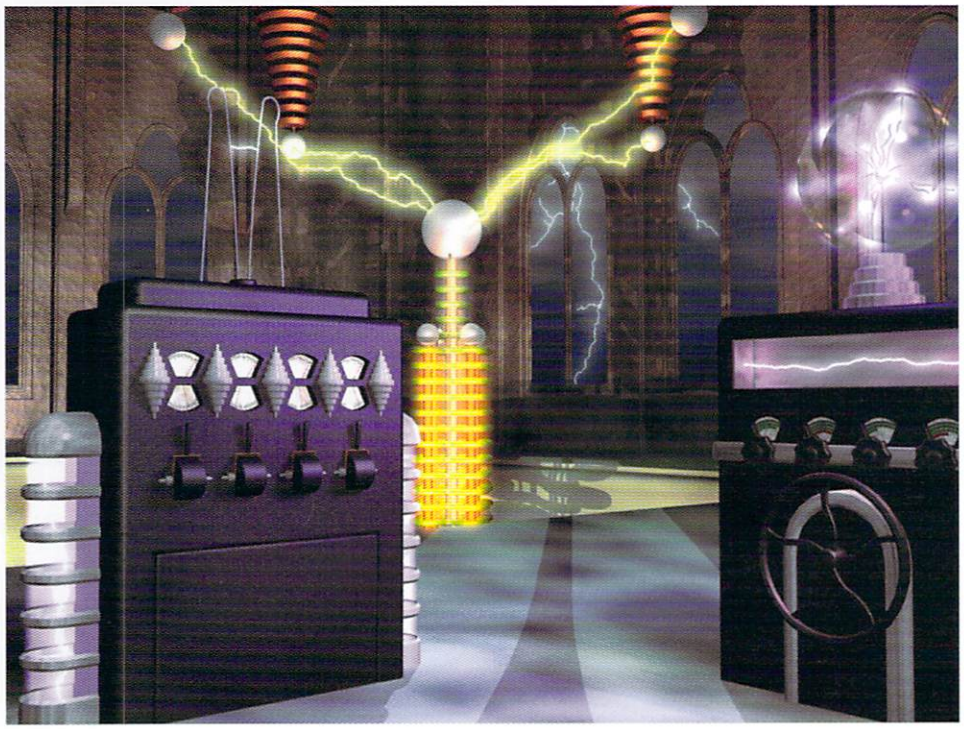
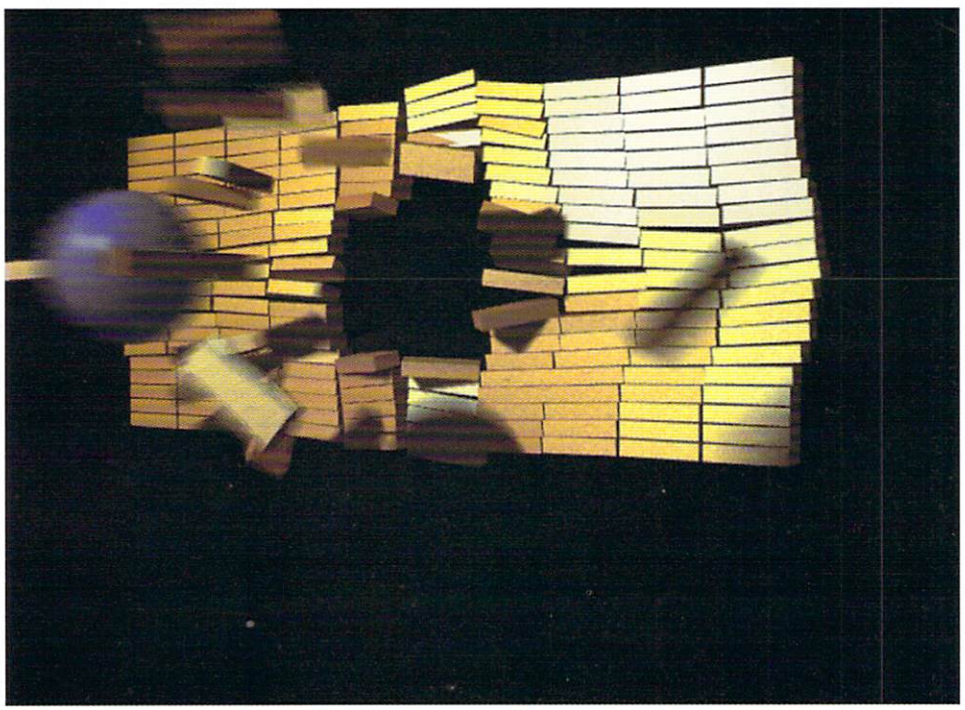


Late night in the laboratory.
This is an example of the kinds of effects you can add to your scenes. All arc effects were created with the VertiLectric demo included on this month's *LIGHTWAVEPRO* disk.

Impact Wall
A scene like this is fairly simple to set up in Impact! Read the Impact! review by Mark Thompson on page 10.



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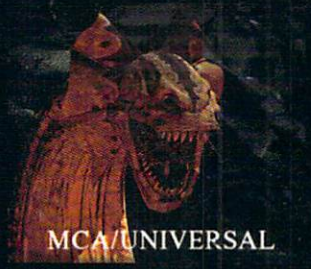

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