Elmar Eisemann Emmanuel Turquin

Lame Paper

The Making Of

Report for the animation course of the DEA IVR

I - Introduction

This report unveils the creation process of the short film *Lame Paper*, including all the technical details. *Lame Paper* has been realized as a project for the animation course of the DEA IVR. Each year, a new theme is proposed for movies created by students. This year, the theme is Hugo, from the name of a cute little robot who is also the mascot of the Eurographics 2004 conference in Grenoble.

In a nutshell, our movie relates the presentation given for a weird (to say the least…) paper on NPR during a computer graphics related conference. Hugo stars as an assistant of the paper's authors, and has to do all the work on stage. Of course, nothing really goes as planned, and the poor robot has to endure a lot of unpleasant experiences, while the speaker keeps his composure and does not seem to care about the misfortunes of Hugo… Actually, the original idea was to create a series of short movies related to CG, but due to time constraints, we had to restrain ourselves and only concretize one of the three or four film concepts we had in mind.

The report is organized as this: first, we coarsely indicate the role of each one of us in the different steps of the creation, then we present the original hand-drawn story board. The most important part is about modelling and animation, globally but also with the details for every scenes. And the last part before the conclusion is a description of the way the film editing has been done.

II - Organisation of the work

It is difficult to clearly indicate who has done what, since we both were involved in each creation step of every single scene, and applied lots of tuning operations. Nevertheless, we roughly followed the scheme just bellow:

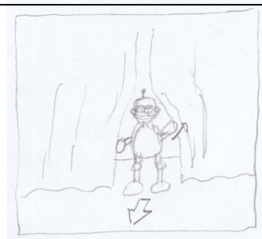
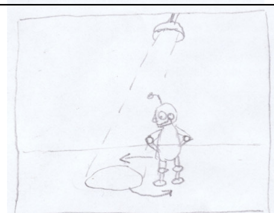
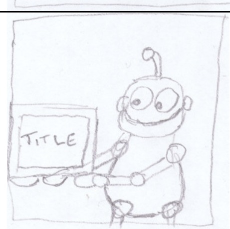
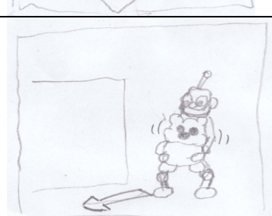
II.1 - Elmar

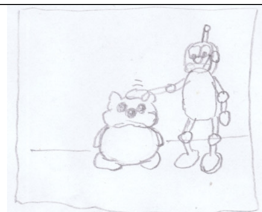
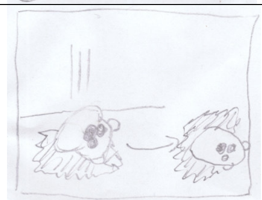
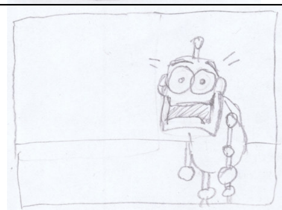
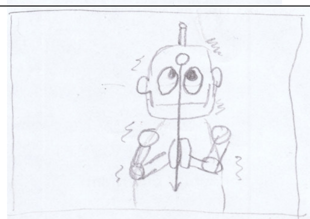
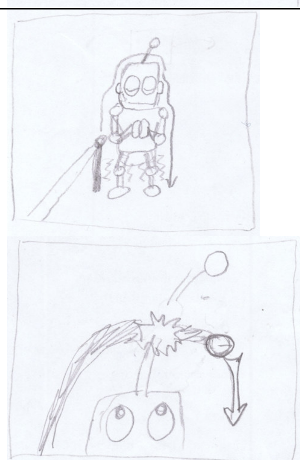
- Scenario and story board
- Modeling (Teddy Bear, laser related elements, chairs)
- Animation (scenes 1, 3, 5, 6, 8, 9, 11, 12, 16, 17)
- Report

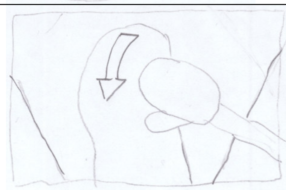
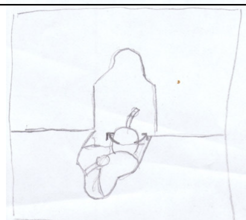
II.2 - Emmanuel

- Scenario and story board
- Modeling (Conference room, stage)
- Animation (scenes 2, 3, 4, 5, 7, 10, 11, 13, 14, 15, 17)
- Film editing (including SFX recording and soundtrack)
- Report

III - STORY BOARD

Nb	Drawing	Description
01		In this introductory scene, the camera flies through the conference room, and stops just in front of the stage, where you can have a glimpse at Hugo hidden behind the closed curtains. Meanwhile, the speaker welcomes the audience.
02		Hugo makes his appearance on stage. The speaker was waiting for him.
03		Hugo tries to stay in the center of the light cone, but apparently the spots are reluctant to ease his job. Hugo seems annoyed.
04		Hugo takes a computer monitor from behind his back, which shows the title of the *paper* presented: “Laser based Anisotropic Method to Extract Principal lines: A brand new Paradigm for Expressive Rendering”. This scene serves as the title scene.
05		The curtains open, which allows to see what is on stage: a simple wood board. Meanwhile, Hugo goes out of the screen/stage.
06		Hugo comes back, bearing a cute little Teddy bear. He brings it in the front of the wood board.

07		Hugo delicately puts the bear on the floor.
08		The laser based silhouette extraction process starts… and fails miserably. The poor teddy explodes.
09		The bear's head falls down on the stage floor.
10		Given that there is no teddy anymore, the speaker asks Hugo to replace it. Hugo looks shocked.
11		Hugo is terrified, he is trembling and praying. A red visor goes up and down on his body.
12		The silhouette is (almost) correctly extracted by the laser beam, apart from a problem with the antenna tub that is broken and falls down the floor. Hugo is angry.

13		While Hugo bends down to reach his antenna tub, the wood board makes worrying noises, and begins to move back and forth.
14		The board falls down on the poor Hugo.
15		The speaker seems to be proud of the result given by his method. He does not really care about Hugo's condition.
16		Hugo tries to get up, but he does not succeed and falls again. This is the end of the movie, fade to black. The credits start.
17		After the credits, the author makes an announcement for next year; Hugo imagines what it means for him, and reacts with eye twitching (just like the squirrel in *Ice Age*).

IV - MODELING AND ANIMATION

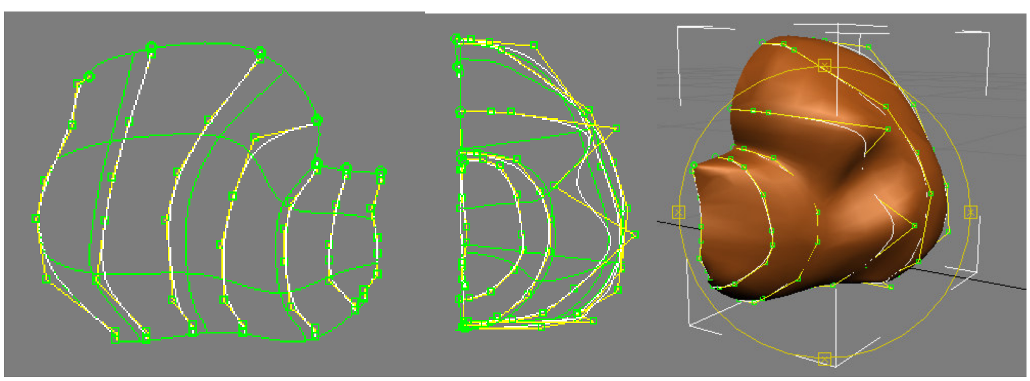
IV.1 - Global comments

IV.1.1 - How to create an exploding teddy


To model the teddy bear we decided to use NURBS as they are very comfortable for modelling complex surfaces.

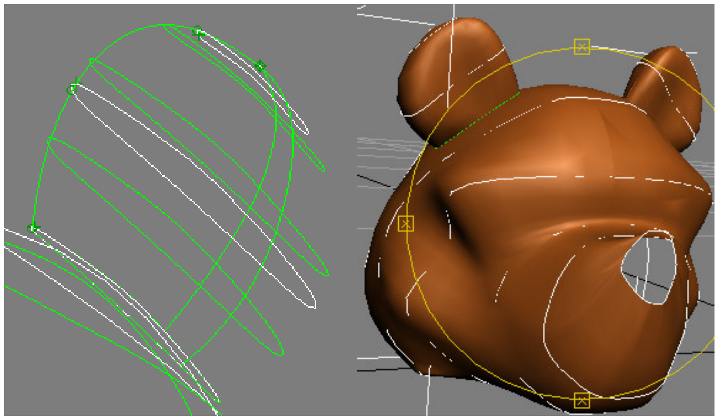
In a first step the design of the object is drawn using a classic paint tool. The resulting image is used as a reference image for the 3D construction. This sketch also helps to get an idea of what the bear will approximately look like (we want it to be cute...).

3D Studio offers the possibility to underlay an image while doing the construction. First we approximate the whole head in the front view with a half circle. It looks like a line in the left view. Having it transformed to a NURBS object, it's points are then placed in the left view to follow the contours (not only the outer, but also the inner ones) of the head, without taking the ears into account. In the same way the control points are arranged to fit the front view. A first preview of the head can be obtained by using a lofting.



To create the ear a curve is drawn on the NURBS surface, which describes the region where it will be connected. This curve is then copied at different sizes above this region. A simple lofting between these curves leads to the ear. Actually a hole will stay, which could be closed by adding a cap, but actually it suffices to scale the last curve small enough to make the hole disappear.

Having half of the head finished, one can not simply copy it, as the transition between the two halves would be not sufficiently continuous. Therefore the curves are copied and connected between the two halves, a lofting is then performed along the head, leaving a hole in the nose region and at the back of the head. The nose region is easily fixed, as we want to add a "real nose", which will close the hole. At the back of the head we apply the technique mentioned before.



In the next step the ears are properly connected to the surface. A new normal curve of the ear is projected onto the surface of the teddy's head. This is then used instead of the old one, therefore the base curve for the ear is simply replaced by the new one. A lofting completes this step.

The head is completely shaped and it suffices to add details, like nose, eyes and eyebrows. The nose is a simple sphere, the eyes and the eyebrows are cylinders being transformed using FFD. The whole head is slightly squashed to make the bear look cuter.

The next step is to construct the body. Most of the parts are cylinders deformed using FFD and some deformed spheres are used for the paws.

Finally the hierarchy between paws and legs is established, which completes the construction of the teddy bear. In a last step the materials have to be assigned. Taking a black plastic for the paws, eyes and nose and a diffuse brown with a slight bump mapping to simulate fur completes the work.

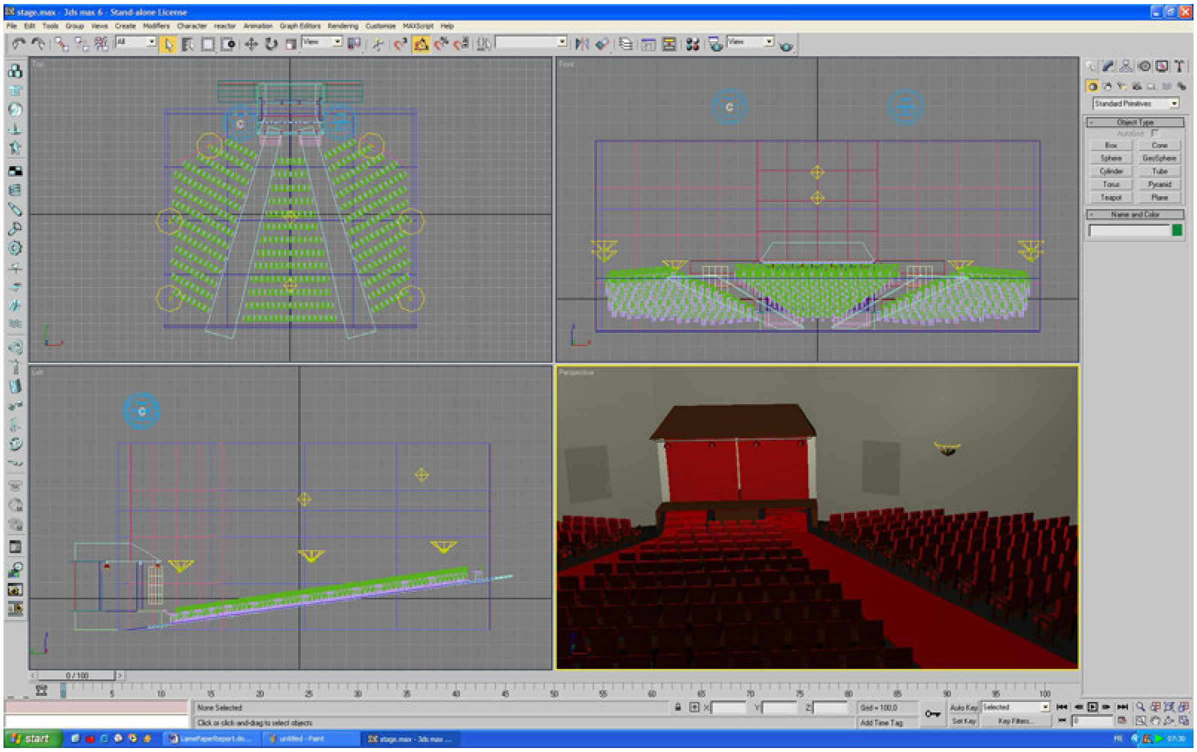
IV.1.2 - How to get the Hugo model ready for action

In fact the whole construction followed the description of the course's homepage. First Hugo is smoothed to give him a nicer shape. The biped is associated to the mesh and a hierarchy was created for the body parts. A skin modifier is applied to Hugo's body, hands and feet allowing him to bend those regions. The influence radii have to be corrected to make only the vertices of the mesh follow the corresponding movement of the biped which are supposed to. We modified the materials because it seemed as a self illuminating material had been assigned by default, which does not really allow for a nice shading.

IV.1.3 - How to create a nice stage set:

CONFERENCE ROOM:

The room, as it is supposed to be part of a modern building, is mainly composed by plane sections. In consequence, the primitives used to create it are in majority planes and boxes. The only exceptions are the spots and the lights in the room (a base shape defined with splines, and a revolving surface), the support for the spots and the curtains (a cylinder with a path deformation), the attaches for the curtains (basic tori), and the chairs, which are detailed bellow. There are five different light sources: an ambient and a diffuse spot for the whole room, six lamps directed towards the ceiling (spots), the spots on the stage and another diffuse source for the stage, to approximate the combined illumination supposedly generated when all the eight spots are on. Also, the stage evolves during the movie, and some of the modifications remain for all the remaining scenes (burning trace after the explosion, wood board cut).



CHAIRS:

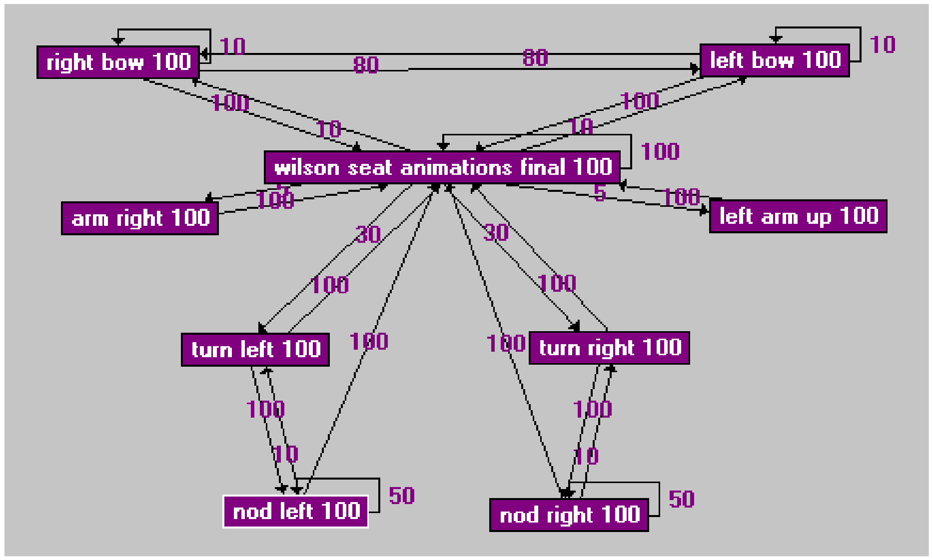
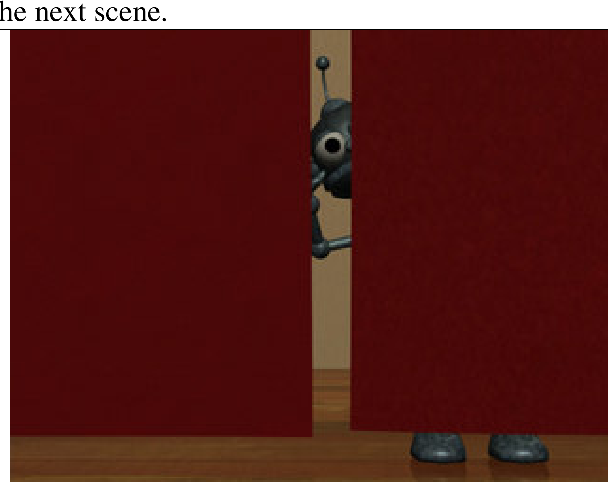
Creating the chair is rather simple. All of its parts are created in 2D using lines which are then deformed using the tangent vectors. To get the nice shaped "double" corners a chamfer *modificator* is applied to the corner vertices. All the elements are then extruded and assembled by placing them in the correct relative position. Placing of the chairs was almost easy, by copying them row wise. But as one chair is added per row they had to be modified manually.

IV.1.4 - Common animation methods

Some particularly common animation techniques are used in almost every scene, therefore they will not systematically be mentioned in the scene by scene comments bellow. These methods are *keyframing* (for bipeds as well as regular objects), *curves editing* (notably used for all the camera moves), the use of free or target cameras, and we probably forget to mention a few others.

IV.2 - Scene by scene comments

Nb	Author(s)	Images and comments
01	Elmar	 **Special techniques:** motion flow, shared motion, random scripts, (crowd) The OPENING SCENE was supposed to involve hundreds of people animated via crowd animation. Disappointingly the memory of the computer (256 MB) we worked on did not allow for more than ten people. After having done all the tutorials concerning crowd simulation we actually realized, that for this scene a shared motion is more practical, as the people stay on their seats. (The only reason to use a crowd simulation could have been to place delegates instead of the bipeds in the chairs, as it is easier to manipulate less complex objects. But this approach would only be useful when working with hundreds of objects. Ten being the limit, we recreated the scene, this time without crowd object and decided to abandon this idea and stick to shared motion.) To make the movements seem natural and non-repetitive a motion flow graph is used. Nine different motions are defined and connected in this graph, leading to smooth transitions. Weights are assigned to assure that more common movements (like head turning, nodding etc.) are performed more often than more specific ones (e.g. waving). The graph of the animation can be seen in figure. To avoid having similar movements at the same time a "pseudo" Animation is added, where actually no animation is performed, during 13 frames. This odd number shifts all the movements (with more regular lengths like 20 or 30) and creates therefore less repetitive motions (another possibility would have been to change the number of transition frames from one animation to the other, which we did, too, or to create the clips right away with different sizes). Based on this graph all the animations in the scene are calculated automatically. 3DS creates random scripts based on the motion flow and associates them to each biped, which then animates the underlying character. It is possible to define an entry point of the animation, but as the main goal is a non-repetitive motion, all the clips are declared as possible

		starting points.  During this scene the parameter for the lighting change continuously to be conform to the next scene.
02	Emmanuel	 **Special Techniques:** none Basic keyframed animations.

<table>
<tr>
<td>03</td>
<td>Elmar,
Emmanuel</td>
<td>

Special Techniques: biped animation mixing, inverse kinematics (slide/planted keys), interaction of objects with physically based fabric

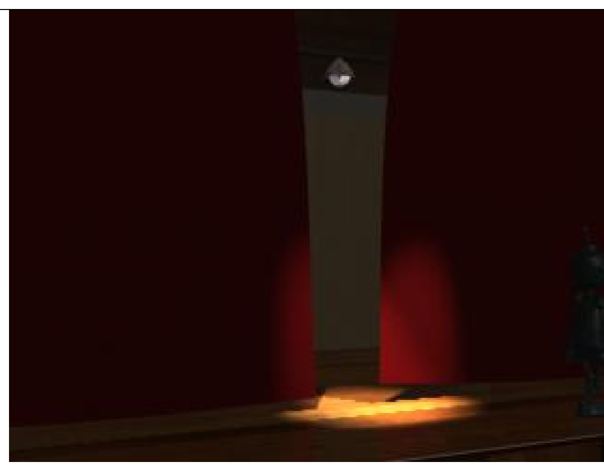
The interaction between Hugo’s body and the curtains has been realized thanks to a simulation provided by the *Reactor* plugin. The curtains are attached to rings, placed along an axis. Once this constraint is defined, a position that minimizes energy is found. Once this position is computed, it becomes the curtains default one. When Hugo hit them, a new simulation is launched that recreates the reaction of the cloth to the forces applied by Hugo’s gestures. Hugo’s entrance animation has been keyframed and then saved in a biped file.

To have a nice connection we used the mixing possibility for biped animations. The transition becomes completely smooth and the biped starts its motion exactly at the place were it stopped the other one.

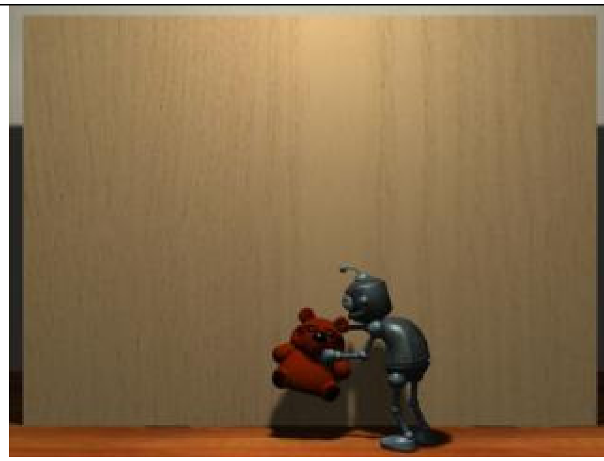
The animation with the spotlight itself involves inverse kinematics, as a side step is not predefined by 3D Studio. The feet are placed using so-called slide keys. A part of the body fixed like will not follow all the movements when affected by other body motions via inverse kinematics. Only a sliding will be performed if necessary. To make Hugo step to the right into the light cone mostly direct kinematics is used, whereas the other foot is only animated indirectly by placing a planted key on the moved foot and then bringing the body in an upright position.

The spotlight in this scene are animated using dummies and look at constrains. The pivot of the lamps is placed in a way that they seem to be connected to the ceiling while they are animated.

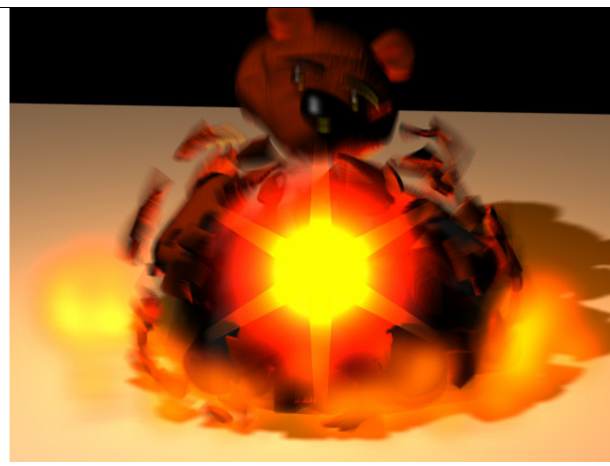
</td>
</tr>
</table>

04	Emmanuel	 **Special Techniques:** none Basic keyframed animations. Nonetheless, animating the appearance of the screen from behind Hugo’s back wasn’t an easy task, since the screen is way larger than Hugo. It had to remain realistic enough not to bother the spectator, but with a cartoony style. A meticulous change of scale was introduced in the animation to create the desired effect. The textures serving as monitor displays are captures from a well known slides creation program. One is applied directly on the screen, and the other on a plane linked to the monitor, that is invisible at the beginning of the animation.
05	Elmar, Emmanuel	 **Special Techniques:** biped animation, optimized footstep animation including feet placement, physically based fabric animation, *look at* constraint animation LEAVING THE STAGE in this scene the footstep mode of 3DS was used to create the movement of Hugo. As the result obtained via this option is usually insufficient for an arbitrary model (e.g. arms penetrating body) this movement had to be optimized. Using a simple keyframe correction at the

		keyframes specified by the original animation helps avoiding these problems. Next the footsteps on the ground are displaced to make Hugo walk around the corner and leave the stage. There is also a new simulation involved in the movements of the curtains. Once the attaches mentioned for the scene 3 have been defined, animating them and specifying to *Reactor* that we want to follow their moves is sufficient to compute the desired animation for the curtains. The physical parameters for the fabric have been modified in order to go back to a stable position very fast (we actually increased air resistance, and set a maxima of deformations).
06	Elmar	 **Special Techniques:** scripting The BEAR CARRYING scene was made using scripting. First of all one difficulty is that Hugo's hands have to be completely fixed in place on the bear, otherwise the carrying sequence would not be convincing. The solution in this case is simple. Starting from the automated walking, the arms are placed on the object and all their following keyframes are deleted. The bear is linked to the upper torso, which in fact is already the parent object for the arms. Therefore during the movement everything will stay in the same relative position. Two steps of Hugo are animated and the sequence is saved in a biped file. The animation involves mostly keyframe placing (a slight up down movement (here inverse kinematics of the biped are involved, banking, head and antenna movement). The antenna is animated by selecting all the corresponding parts of the biped at once and applying a rotation, which leads to a uniform rotation for each biped part (this kind of animation is actually used throughout all scenes). Hugo and the bear are then placed in the scene having a dummy attached to all objects. This dummy will then be used to define the starting position and orientation. In the biped's options we define a motion flow graph, which in this case only corresponds to the one entry of the carrying sequence. Next a script is created containing several times the stored carrying sequence. (Four times in the final scene, but finally only a part of this animation was used in the

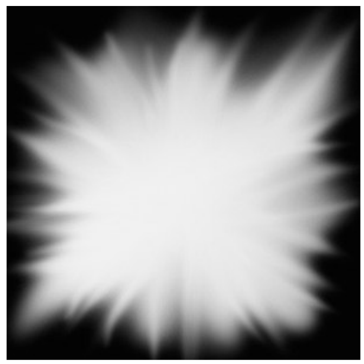
<table>
<tr><td></td><td></td><td>movie)</td></tr>
<tr><td>07</td><td>Emmanuel</td><td>

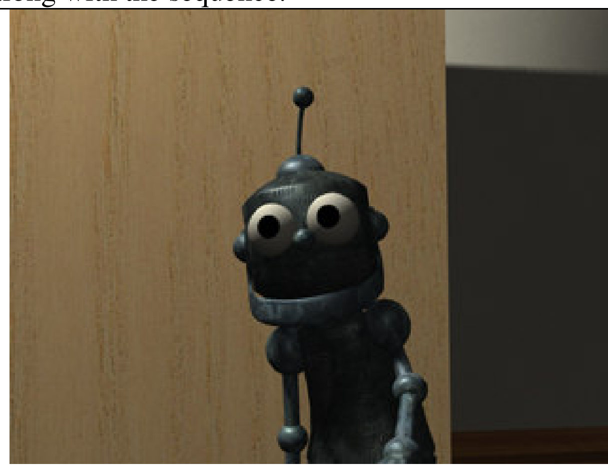
Special Techniques: none

Basic keyframed animations.</td></tr>
<tr><td>08</td><td>Elmar</td><td>

Special Techniques: particle Systems(PArray, SuperSpray,PFSource), post rendering effects on light sources and materials, Deflectors

The exploding teddy bear scene uses a lot of different techniques to convey the impression of a real explosion. The arms, legs and the head are simply animated using keyframes. The body explosion is based on a PArray particle system. This one allows the particles to be shaped like a reference object. Associating a deflector for the PArray to the floor and the back wall prevents the explosion tiles from penetrating the scene's objects. A second particle system is used to perform a smoke simulation, we decided to use a PFSource, because it allows for the greatest flexibility (the behaviour can be scripted). A super spray is used for a shockwave like explosion (a predefined animation for this kind of particle system). A post rendering effect is added, more precisely a glow (which's strength is animated, too) surrounds each particle, which are made invisible during the rendering,</td></tr>
</table>

		giving the impression of fire. Two other post rendering effects take place, a glow in the center of the explosion and a star around, both animated using the post rendering parameters. Two animated light sources are used to simulate the light created during the explosion. Two, because the first one casts shadows, giving a lightning effect on the ground and the second one, leading to a coloring of the environment coming from the center of the explosion. To finish, a burn mark is created on the floor. The idea for this effect is quite simple. A second “floor” being textured with the opacity map corresponding to the burn mark on the floor is added, which is invisible, when the animation starts. During the explosion, its parameter for visibility changes, making believe, that the explosion caused the trace. A last step consisted in adding a motion blur to the animation to better convey the rapidity and force of the explosion. 
09	Elmar	 **Special Techniques:** physical simulation for falling objects, space warps (gravity, wind), visibility The second part of the animation is the head, which falls back to the ground. To better take into account the shape of the head we applied a physical simulation (using reactor). The values on the other hand are not physically based, but chosen to give a nice result. It is tedious, but possible to create physically based but steered animations by observing the preview. A

<table>
<tr><td></td><td></td><td>spotlight is hierarchically linked to the head, as is a PFSource, to give the impression, that the head is still burning. Next several space warps are applied to the particle source to make it behave as wished. A gravity force is used to make the smoke coming from the head move upwards and a wind force is applied to make the shape more interesting. The wind parameters are animated during the sequence, to make the smoke describe a nice curve. The final step is the melting of the head. This is performed using the modificator melt on the head (plastic option) and manipulating the parameters along with the sequence.</td></tr>
<tr><td>10</td><td>Emmanuel</td><td>

Special Techniques: FFD animation

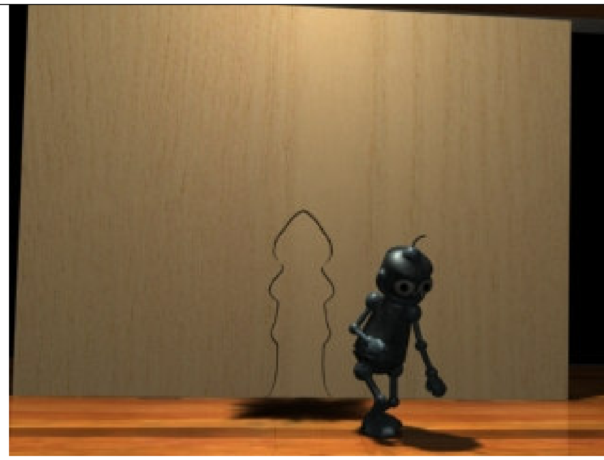
In this scene, Hugo must express a sentiment of terror. To effectively convey that feeling, we use a FFD animation of his jaw, which is literally liquefying. Combined with wide opened eyes (and a judicious soundtrack), the result seems convincing.</td></tr>
<tr><td>11</td><td>Elmar, Emmanuel</td><td>

Special Techniques: sub-animation controller, look at constraint

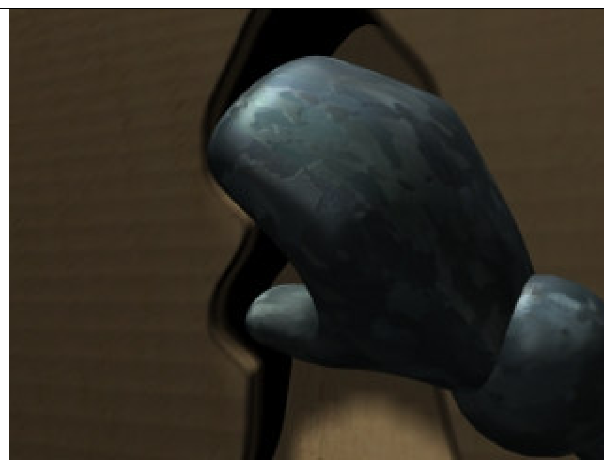
THE VISOR SCENE To show his fear (although Hugo tries to hide it) a sub-animation in form of a controller is applied to the whole body. More</td></tr>
</table>

		precisely, a rotation noise is added to Hugo's upper torso which makes him shiver while he performs the keyframed motions. The influence weight is slightly modified during the sequence to make the animation look nicer. A second technique in this scene is a LOOK AT constraint. The eyes of Hugo are connected via this constraint to two dummy objects. These dummy objects are then used to make his eyes follow the laser pointer on his face and body. Of course one could have linked the eyes to the spot directly, but in this way, the eye animation is more flexible, which is important for the end of the scene, where they redirect towards the audience. The body motions are all created using keyframe animation.
12	Elmar	 **Special Techniques:** Particle System (snow, Super Spray), texture animation, material animation, post rendering effect animation, repeated animations, path deform animation, path constrained animation, curve editor based animation, material animation THE LASER SEQUENCE uses a lot of different techniques. Two snow particle systems are used to animate the sparks resulting from the laser's impact on the wall. Snow is a good choice in this context, as the sparks become smaller. To make them follow the path of the laser beam both are simply hierarchically linked to it, as is also a small spotlight, giving the red glow on the wall and a yellow omni simulating the light coming from the sparks. As before all is combined with a post rendering glow. In this case the particles are not made invisible to give the impression of substance. Two animated, self glowing materials are applied to the two systems. The animation of the material was simply done by defining two keyframes and using the repeating operators in the curve editor to complete the animation. The laser movement is a quite tedious animation. First the laser's path is constrained to the silhouette of the robot, described by a spline curve. Then it suffices to place it a keyframe at the end of the animation to make it move around Hugo. The difficult part is the trace that should be left on the wall. Animating this part using a texture would have been difficult and would take a lot of space on the hard drive. The approach we have chosen is to use

		the animation modifier path deform. A very small cylinder with several segments, having the radius corresponding to the trace size is created. It is then deformed using the before mentioned modifier to stick to the path of the beam. A parameter, that describes the length of the resulting object, that is to say the point to which the cylinder is stretched along the path is sufficient to animate the trace. The value has just to be chosen to correspond to the position of the laser beam. It is possible to normalize the Bézier curves and the deformation, but it is easier to do this step by hand. For the movement of the laser beam, we first wanted it to behave as if it had been shot from a fixed source. To obtain this effect, it suffices to place a dummy at the source of the beam and a second one should follow the path. The dummy at the source is linked with a look at constraint to the other one. The laser beam could have been a simply linked to the source dummy to make it follow the robot's contour. (One could also link the laser beam directly, but then she would have to deal with placing the pivot point exactly.) Unfortunately the distance of the laser beam to the actual silhouette became quite big, as the robot also has a certain depth, therefore this idea was not applicable and we sticked to the "orthogonal" laser. When the laser passes Hugo's antenna it chops of the ball situated at the end of it. To allow for a very nice explosion we decided to place a billboard at this place, which is textured (involving an opacity map) with a fireball animation. This is very useful, as nice explosions can be found, which are often very professional and can be used without much effort. Here we decided not to use anything from someone else. To get the explosion animation we created one using several particle systems. To get an approximation of the opacity map we assigned in a second rendering the colour white to all the explosion elements. The moment the laser beam passes the antenna a particle system is activated and the animation on the billboard is played (and it is stopped on the last frame of the video without looping). To animate the ball that is falling down and bouncing on the robot and the floor, we decided to use the curve editor, as it is very easy to create spline curves that correspond to a bouncing ball in the up/down direction. Then we connected a dummy object which is used to move the antenna part easily in the plane. The animation done for Hugo is mostly based on keyframes. These have been repeated during the first part of the animation (e.g. the legs). The gesture of anger Hugo makes when his antenna is damaged is based on keyframes, too. This geste was not easy to find. We tried several ones (one was too explicit, the next one only known in Germany ;-).

<table>
<tr><td>13</td><td>Emmanuel</td><td>

Special Techniques: Changing link constraints

From now one, the wood board (which was basically a plane) is composed by two parts: the silhouette and the rest. To cut the board, we first extrude the silhouette defined by a spline, and then we create a Boolean object as the subtraction of this extruded silhouette from a box. We take advantage of this new situation in the scene, as the board begin to make worrying noises, and seems to be on the verge of falling down. Meanwhile, Hugo takes back his antenna with his left hand. To do that, we first link the antenna to the world, and when it is reached by Hugo, the link is updated and set to Hugo's biped hand.</td></tr>
<tr><td>14</td><td>Emmanuel</td><td>

Special Techniques: none

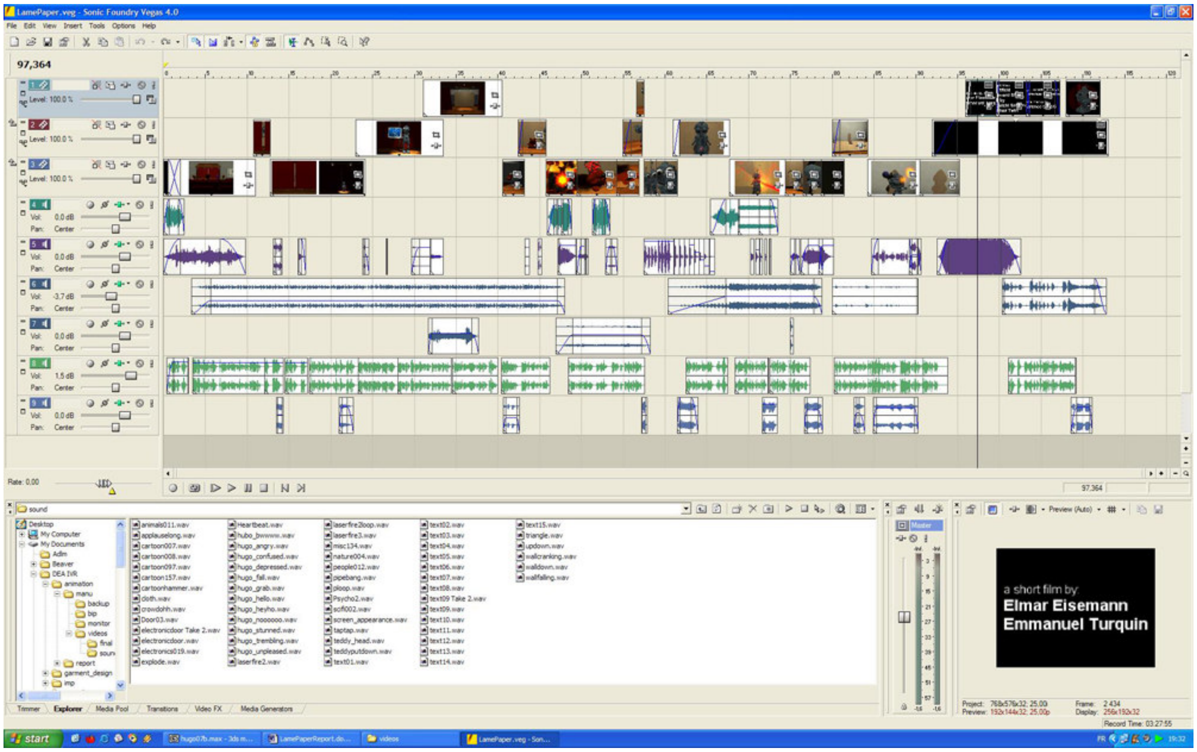
This is one of the only scene without biped, and also the only one that let the spectator see through the eyes of Hugo. As Hugo turns his head, the wood board falls on him. The challenge here was to make that scene understandable (it must not be all black, even though the wall is falling down quickly on the poor robot) but also realistic (in terms of the way Hugo is reacting, putting his arm in front of him in a self-preserving reflex). The</td></tr>
</table>

		only parts of Hugo’s body really present in the scene are his right arm and hand (smoothed for the occasion), attached to the camera. ☺
15	Emmanuel	 **Special Techniques:** none Basic keyframed animations.
16	Elmar	 **Special Techniques:** excessive hierarchy, weighted path constrained animation (with follow and banking), mesh blob animation, inverse kinematics KO SCENE the techniques used in this sequence are inverse kinematics and direct kinematics for the biped, a path animation for the main behavior of the objects touring around Hugo's head and several special techniques for themselves. The hand which is placed on the silhouette was animated using a planted key and the body was then moved upwards to achieve the effect of lifting. Otherwise several keyframe animations were used for the body. The more interesting methods concern the eyes and the other objects floating around his head. The eyes are linked with two dummies like in the visor sequence. The dummies were placed on circular pathes which leads to the eye rolling

		effect. The eyelids were simply animated using keyframes. In general for the animation of the floating objects, all three are constrained to a circular path around Hugo's head and a second path, also circular, but bigger and higher above. At the end of the animation involving the weighting of the two paths the objects are shifted from the one ring to the other. This leads to the impression of a tornado like motion. The objects themselves use a large variety of different animation methods. The planets flying around each other were animated by linking them hierarchically and placing the pivots inside of the corresponding "father" planet. As the path is linked to Hugo's head, the smallest planet is on the fourth level of hierarchy (if the path constrained itself is seen as a hierarchical level it is even the fifth). Another object is the plane, which uses some animation options coming from the path constraint. It follows the path around Hugo's head, that is to say the orientation is always in the direction of the movement and it banks, which means that it slightly rotates around the path as real planes would while flying a curve. The third object is some kind of comet. The animation technique used for it is based on a blob mesh. The idea of this compound object is to create a hull of liquid material around destination objects. If they get close the two hulls mix, when the distance gets bigger they separate. This is extremely useful when simulating liquids or foam, as it involves fusion (e.g. bowl of water) and seperation (e.g. drops). A very nice effect is obtained when applied to a particle source, as in this scene using a super spray. Parts collapse near the source and drops seperate when the particles get spread out. To get the impression of a glowing object the post rendering effect glow is applied to the material of the blob object.
17	Elmar, Emmanuel	 **Special Techniques:** morph FINAL SCENE the "Ice Age" like twitching sequence involves a morph between several objects. The head is morphed, which could also be animated using the vertices of an FFD applied to the head but the jaw is morphed between two different destination objects, therefore this part would have been more difficult to obtain using a simple FFD deformation approach. These two destination meshes involved in this deformation are

		differently weighted throughout the sequence. During the modification of the jaw, one sees that the right part of the jaw is at one point moving a little upwards, before deforming to the final shape. This is a very subtle effect but the result looked nicer using this composite morphing technique.

V - FILM EDITING



The film editing has been done with *Vegas 4.0*. The hardest part was to create a convincing soundtrack that mixes sound effects, the voice of the speaker and background music. In the end, about 70 sound files (.wav, .mp3) with finely tuned transitions have been used, and more than half of these were created from scratch, thanks to a mic (unfortunately, we had to do with a mic of poor quality) and the program *Goldwave*. The other particularly difficult task was to synchronize the text of the speaker with the video: for that, the timing has been precisely measured and taken into account during recording sessions. Compared to all this, the pure video part of the editing went rather smoothly.

In order to start working on editing before the final sequences were rendered, we created a low resolution version of all the scenes (without ray-casting, which drastically speeds up computations). This permitted to obtain the final cut of our movie long before the high quality renderings were available.

VI - CONCLUSION

Creating this short movie was a wonderful experience, and a great way to discover some of the huge amount of functionalities of a 3D modelling and animation professional software such as *3DS Max 6.0*. In that, the animation course proved to be really helpful, since it is much more efficient to benefit from the experience of confirmed users rather than having to discover all by ourselves, alone. We sincerely think that the aim of the course, which is to let us evaluate the complexity of use of such a system, and for an instant to take the place of an "end-user" rather than a scientist or programmer, has been fully reached. After all, what we are supposed to do in our future work is to conceive methods that could be integrated in a soft like 3DS and help the work of an artist/animator. And to be able to do that, it seems more than welcome to have at least a certain familiarity with the typical tools used in the business, like 3DS. Moreover, we tried to push our exploration of the features as far as we could. It was a nice challenge to try to integrate several techniques as smoothly as possible in the story-telling process we were building, and finding an equilibrium between technical (positive) constraints and artistic considerations was not always easy.

On a purely technical standpoint, we would like to point out some last elements of this journey: as an indicator of the complexity of our scenes, the rendering of the *final version* in a 768x576 resolution (25 Fps, for a total duration of about 2 minutes) took approximately 50 hours on quite powerful computers. Concerning the things we would have liked to ameliorate, the first things we can think of is a better sound recording environment (having a *real* mic would have been great :), and the quality of the encoding, which showed up to be a little bit disappointing compared to the quality of static images. Had we to re-render the film, we would probably use different codecs (*Cinepak* was used for the individual scenes, and *DivX* for the whole movie; *Cinepak* is the one concerned by our grievances, which is the default choice of 3DS). Also, we encountered several rendering problems with the standard ray-caster (and even some crashes), and would have liked to find enough time to try *Mental Ray*, which is now integrated in 3DS and is supposedly way better.

In the end, we are to confess that we are quite happy with the result, and are looking forward to see the reaction of the audience after its projection, planned during Eurographics 2004.