FALL AND ROLL

T/C	PICTURE	SOUND	MUSIC
10:00:00:00	Title credits of 'Fall and Roll'		Title music by Amos Zamorski.
10:00:04:01	Fade into an image of a sofa, fade in a man sitting on the sofa playing a games console.	**VO of narrator:** Since computer games appeared in the 1970's…	
10:00:08:14	CU of mans hands on the games controller.	…they've grown into a 16 billion …	
10:00:09:24	Man sitting on the sofa playing games console, girl walks into shot and sits next to him and starts to play with the other controller	… dollar industry world-wide but though that sounds massive games are still not a…	
10:00:14:23	Sequence from a fighting computer game.	…mass market to match the music and movie industries.	
10:00:19:19	CU of somebody playing a games controller.	Like…	
10:00:20:14	CU of a mans face	…Hollywood movies…	End of title music.
10:00:21:09	Cu of somebody punching the buttons on a games controller.	…games currently have…	Incidental music by Amos Zamorski.
10:00:22:11	Cu of somebody punching the buttons on a games controller.	…a handful of…	
10:00:23:13	A sequence from a computer game of a car pulling away.	…genres. Most of them short on story but big on action. **VO of woman:** The games that I generally like to play are the driving games. I think it's the speed…	
10:00:40:12	CU of woman talking.	…I think its being able to something that you can't generally do when your on the road when you're driving for real.	End of incidental music.
10:00:45:01	CU of a man talking.	**Male interviewee talking:** I like playing what are called first	

		person shoot em ups where you either run around an underground maze or an outdoor landscape gun in hand blazing away at monsters, aliens or other human beings.	
10:00:55:02	Sequence from a shoot em up computer game.	Sound effects from shot.	
10:00:57:08	CU of a man talking.	**Male interviewee talking:** I like playing all the football games.	
10:00:58:23	CU of a man talking.	**Male interviewee talking:** I have all these boyhood wartime fantasies but the beauty of these games is that you can go and play them and relieve your stress without anyone getting hurt.	
10:01:05:15	Sequence from a football computer game.	Sound effects from shot. **Commentator on the game:** Chest is down, good control…	
10:01:09:17	Cuts to a man sitting on a sofa playing the football game.	**Man talking:** Yes…yes.	
10:01:11:21	Sequence from a football computer game.	**VO of narrator:** In the last few years the adrenaline…	
10:01:14:07	Cuts to a man sitting on a sofa playing the football game.	…pumping action …	
10:01:15:00	CU of the mans hands playing on a games controller which pans up to a CU of his face.	… has been suped up with ultra realistic graphics generated by…	
10:01:19:18	CU of the mans hands on the game controller.	…new games consoles like the	

		dreamcast and playstation.	
10:01:23:06	CU of man talking.	**Male interviewee talking:** Graphic realism is fundamental to the importance...to the pleasure of playing a game.	
10:01:26:20	Cu of man talking.	**Male interviewee talking:** Graphics have changed so much I mean about 3 years ago they were just really blocky and just really didn't move that much or animate that much and now the consoles…	
10:01:35:15	Cu of a games controller.	…are just amazing. **VO of narrator:** Though graphic…	
10:01:36:23	Sequence from a car racing computer game.	…realism is important there's more to creating games with mass appeal. **VO of Dave Cliff:** The problem isn't just…	
10:01:43:00	MLS of Dave Cliff from Southampton University sitting down talking.	…that we need more powerful computers we also need to know what to do with those computers in order to make the characters that appear in the games more lifelike or more human like or more intelligent.	Incidental music by Amos Zamorski.
10:01:54:11	CU of balls being juggled and pan down to see a mans face.	**VO of narrator:** For a start objects in computer games don't always behave as they would in the real	

		world.	
10:02:00:18	Computer graphics of a ball falling through a floor.		
10:02:01:09	LA CU of a Mans face.		
10:02:02:11	MS of Paul Topping, MathEngine Marketing, talking to camera in his office.	**Paul Topping:** Its hard to tell the difference sometimes between what you see on the screen and a television picture. Erm.. but when things look real but don't move in the right way it jars.	Incidental music ends.
10:02:12:23	LA bleached image of someone walking away from the camera.	**VO of Male interviewee:** People not walking through walls is important, people not banging into each other…	Incidental music by Amos Zamorski.
10:02:17:00	CU of man talking.	…in a totally, I mean people don't bang into each other on the street so if all your players in a computer game or in a game of football bash into each other consistently it does detract from the realism …	
10:02:26:00	Sequence from a motorbike computer game.	… of the game. **VO of narrator:** Not only does improbable action detract from the appeal of games…	
10:02:30:10	A man and a woman are sitting on a sofa playing a computer game. The couple fad out to leave an image of the empty sofa.	…they are also marred by a total absence of a plausible human or even animal characters.	
10:02:37:03	LS of Peter Molyneux, Lionhead Studios Founder, talking to	**Peter Molyneux:** Its all very well us making games that	Incidental music ends.

	camera.	look almost like movies nowadays but what they have to be filled with is characters that are believable and that's our big problem at the moment. Its rather like when the movie industry was in the black and white phase and then it first went to colour things went wrong and we need to create characters in games that look like and behave like and act like real human beings, characters that make you laugh and cry like characters that you have in a movie.	
10:03:09:09	CU of young woman.	**Female interviewee talking:** I've never cried over a game.	
10:03:11:09	CU of balls being thrown in the air against a white ceiling.	**VO of narrator:** But she might. With their eyes firmly fixed on…	Incidental music by Amos Zamorski.
10:03:13:23	Fade into a shot of the white ceiling, pan down to show a large office full of people at computers.	…making games appeal to everyone computer scientists at 2 British companies are putting all their efforts into injecting behavioural reality into virtual reality.	
10:03:23:20	Fade into a pan shot of an office shelf and a person sitting at a computer and various people in the office.	Peter Molyneuxs' company Lionhead studios is focussing on putting emotion into games.	
10:03:33:15	Fade into a shot of someone writing in a notebook.	While at MathEngine a 40 strong team of physicists and	

		mathematicians is thinking very hard about how to put convincing movement into games.	
10:03:43:23	MS of Tim Milward, MathEngine head of development. Fade to white.	**Tim Milward:** One way that people do that is to animate nice motion, nice behaviour of objects.	Incidental music ends.
10:03:51:08	Various cut sequences from a football computer game.	Football game is a typical example, you'll get quite a lot of variation in the animations so a footballer can kick the ball in 10 different ways or 20 different ways but that's it and the game jumps between different animations. **VO of Will Osborn:** After you've played the game 10 times you'll look at it and say well…	
10:04:07:11	CU of Will Osborn, MathEngine Director of Research, talking.	…hang on I've seen that happen before.	
10:04:09:02	Man sitting on the sofa playing a computer game.	Man shouting yes, yes.	
10:04:12:00	CU of Will Osborn, MathEngine Director of Research, talking.	**Will Osborn:** But with Physics your 2 footballers can come together and collide and they will react depending on that …	
10:04:19:05	Sequence from a computer game showing a racing car.	… actual instance **VO of narrator:** Physics is the key to making everything in the game world move like the real world,	Incidental music by Amos Zamorski.

		whether its race cars…	
10:04:27:05	Sequence from a computer game showing a rope bridge.	…rope bridges, more common in games than in life or water,…	
10:04:31:08	Sequence from a computer game showing a boat on water.	… they should comply with the same fundamental laws of physics that keep Tim upright…	
10:04:36:00	Tim in an office riding a unicycle. He falls off and walks off screen.	…on his unicycle **VO of Tim Milward:** Quite simple physics, new turn in physics…	
10:04:48:03	MS of Tim Milward, MathEngine head of development.	…we don't bother with relativity or quantum mechanics. The laws of the new turn in physics are quite simple but they have huge amounts of repercussions from a very simple set of rules all sorts of behaviour arises	Incidental music ends.
10:05:03:24	MS of Paul Topping, MathEngine Marketing, talking to camera in his office.	**Paul Topping:** Physics does all sorts of things for game play depending on what sorts of game you're playing. If you're playing a driving game it will make the car…	
10:05:09:09	Sequence from a computer game showing a racing car.	…feel more realistic. If you're playing a war game of some sort…	
10:05:13:19	Sequence from a computer game showing an explosion.	… we might be able to make the smoke look better and it just gives a richness and a depth to the environment	Incidental music by Amos Zamorski.
10:05:19:06	Shot fades into a CU of a	**VO of narrator:** As	

	computer screen.	well as the environments and…	
10:05:21:18	Shot showing more clearly the graphics on the computer screen	…inanimate objects physics effects the way human bodies move.	
10:05:26:02	MS of someone jumping in the air	People are often animated in games using motion capture techniques…	
10:05:30:08	LS of a man playing tennis.	…but this limits the game play.	
10:05:32:00	Shot of a screen tracking tennis players movements, pan to the left to see the tennis player.		Incidental music ends
10:05:39:01	MLS of Colm Massey, MathEngine Research.	…they tend to look alright so basically they can either use, its called motion capture or an animator can spend a lot of time making the motion look good so when there's no interaction it can look very good, its when they interact that you can see the flaws of the traditional methods for animating humans. So they…	
10:05:57:20	Cu of Colms right arm swinging with the office in the background.	…are bringing…	
10:05:58:20	MCU of Colm moving his head backwards and forwards.	…physical models in greatly improves,…	
10:06:00:07	Shot of his hand flexing.	…how you can interact with…	
10:06:02:13	Shot of his foot moving about.	…with the character in the game. What we tend to focus on…	
10:06:04:15	MLS of Colm Massey, MathEngine Research.	…is the skeletal structure beneath the	

		skin and some, some sorts of muscle models which will if you like bend and stretch the joints of the skeleton.	Incidental music by Amos Zamorski.
10:06:19:02	Shot of a wooden artists doll moving its arms and legs.		
10:06:20:07	Sequence from a computer game showing a rope bridge.	**Colm Massey:** Using the same physics as the rope bridge but the rope bridge and the joints are…	
10:06:22:12	MLS of Colm Massey, MathEngine Research.	…very simple they just…	
10:06:25:04	Screen shots of animation.	…rotate around. **VO of narrator:** Once physics are programmed in bodies aren't doomed to repeat pre-scripted animated moves. They fall differently as well as with painful realism every time. **Colm Massey:** The easiest example I can think of…	
10:06:39:14	MLS of Colm Massey, MathEngine Research.	…which is not so PC if you like but is fighting games. At the moment if your in a battle with another character in the game, once again its pre-scripted. When you…	Incidental music ends.
10:06:50:01	Image of an animated character punching.		
10:06:51:05	MLS of Colm Massey, MathEngine Research.	…either a pre-scripted punch one of the characters hits, they fall in a pre-scripted way so the next	

		generation of fighting games how hard you hit…	
10:07:03:02	MS of a boxer punching.		
10:07:03:14	MLS of Colm Massey, MathEngine Research.	…the character will fall in a completely unscripted way.	
10:07:07:06	MS of a boxer punching.		
10:07:07:17	Sequence of computer graphics. Fade into a shot of Tim Milward, MathEngine head of development.	**VO of narrator:** Once the laws of physics are introduced its possible to calculate the relative motion of hundreds of objects like shrapnel for explosions, a popular request for games. **VO of Tim Milward:** One of the problems with the way a lot of explosions are done today is…	Incidental music by Amos Zamorski.
10:07:34:09	MLS of Tim Milward, MathEngine head of development.	…they'll throw a few objects out of the middle and they'll spin and they'll land and they'll disappear. They might bounce once, the bounce won't be very realistic and the object will just fade away. With proper physics we would like to have…	
10:07:47:20	Sequence of computer graphics.	… those objects land and settle and shatter. How do you add physics to computer games?…	
10:07:57:18	Fade into a MS of Tim Milward, MathEngine head of development.	…you get out your University text books and you work out how to get the computer to solve Newton's	Incidental music ends.

		equations.	
10:08:05:19	MS of Will Osborn, MathEngine Director of Research, talking.	It's a classical level physics so the stuff you do at school with balls rolling down planes, erm restitution when you drop a ball, how much energy it looses, Newton's laws, principals of conservation of energy and momentum.	
10:08:22:10	MS of Will Osborn writing equations on a white board.	**VO of Will Osborn:** Newton's laws in themselves are very simple but…	
10:08:29:02	MS of Will Osborn, MathEngine Director of Research, talking.	…even if I have just three objects coming together then its…	
10:08:33:13	MLS of Will Osborn wiping a white board and walking off screen.	…intractable to solve that problem analytically and you must resort to computer simulation.	
10:08:39:01	Computer sequence of a teapot being made to look real.	**VO of narrator:** In all computer games objects start as mesh outlines the mesh is then blended with polygons and then shaded. To move the object around the game MathEngine then calculate its physical properties.	Incidental music by Amos Zamorski.
10:08:52:08	Computer sequence of a teapot bouncing off of walls.	**VO of Tim Milward:** If you wanted to simulate it moving you'd have to tell it how heavy it was, you'd have to tell it…	
10:09:00:13	MS of Tim Milward, MathEngine head of development.	…where the mass was distributed and then if you wanted to slide it	

		over the table you'd have to tell it how rough the bottom of the teapot was and how rough the table was, you'd have to tell it the friction between the two are.	
10:09:13:08	CU of a teapot.		
10:09:14:13	CU of Tim Milward, MathEngine head of development.	If you wanted to drop it and let it bounce you'd have to tell it what the restitution was, how bouncy it is	
10:09:19:02	Computer sequence of a teapot.	And that would be different …	
10:09:23:00	CU of Tim Milward, MathEngine head of development.	…depending upon whether the teapot was bouncing on the table or the floor. If you wanted to break the teapot you'd have to understand how fast cracks would propagate through the ceramic.	
10:09:31:24	Shot of a teapot dropping and smashing. At end of shot fad into the next.	**VO of the narrator:** Teapots don't feature prominently in games but mathematicians like a challenge.	
10:09:39:05	MS of Tim Milward, MathEngine head of development.	**Tim Milward:** When people were learning to do complicated graphics on computers the teapot was a nice complicated shape…	
10:09:43:13	CU of Tim handling a teapot.	…so historically it's a very useful…	
10:09:46:02	Computer sequence of a teapot.	…thing to be able to display. **VO of narrator:** When the physical laws of an object has been calculated …	

10:09:50:08	CU of words on a computer screen.	…and Newton's laws applied the team calculate the location of the location of the moving…	
10:09:54:18	CU of a man looking at a computer screen.	… object in every frame of the game. Films…	
10:09:58:13	CU of words on a computer screen.	… display a mere 24 frames a second…	
10:10:00:14	Computer sequence from a game of explosions.	…but computer games display up to 60 frames a second so that means making up to 60 calculations a second.	
10:10:07:15	CU of words on a computer screen.	Computer games need to go at…	
10:10:09:22	MS of Will Osborn, MathEngine Director of Research, talking. Fade between a MS and a CU at the end of the shot.	…50 or 60 frames a second in order to animate realistically and not physiologically to see a lack.	Incidental music ends.
10:10:19:19	CU of Will Osborn, MathEngine Director of Research, talking.	We have to do the physical calculations equally 50 60 times a second in order to get the realism.	Incidental music by Amos Zamorski.
10:10:26:14	LA shot of a man juggling.	**VO of narrator:** MathEngine is not the only company to create simulations of physics but it is one of the few doing it in real time. **VO Paul Topping:** The traditional way of doing it …	
10:10:36:18	CU of Paul Topping, MathEngine Marketing, talking to camera in his office.	… if you're doing film graphics or if you're doing engineering graphics is to actually pre-render it pre-calculate it so you can	Incidental music ends.

		take maybe a minute calculating the physics that happens in a fraction of a second.	
10:10:48:08	MS of Tim Milward, MathEngine head of development.	**Tim Milward:** They are prepared to wait days or weeks for the results to come out whereas here you want it to be interactive.	
10:10:52:19	Sequence from a computer simulation.	**VO of narrator:** MathEngine don't design games themselves. Their physics software is integrated into games by other companies Its also used in other types of software including engineering simulations like this tree logger which was designed to teach people to drive without the risk of crashing a multi-million pound machine. **VO of Paul Topping:** As computing power increases,…	Incidental music by Amos Zamorski.
10:11:18:02	CU of Paul Topping, MathEngine Marketing, talking to camera in his office.	…even with modern consoles we can actually put these simulations on everyday machines and perhaps one day we'll have everyone that's learning to drive, learning on a MathEngine simulator.	Incidental music ends.
10:11:30:01	CU of hands on a steering	**VO of narrator:** You	Sound effects of a

	wheel.	can't pass you're driving test on a MathEngine…	motorcar.
10:11:33:09	CU of a mans face.	… simulation yet…	
10:11:34:16	MLS showing the man sitting at a desk using a driving simulator.	…but their work is…	Incidental music by Amos Zamorski.
10:11:36:08	MS of a man behind a computer monitor with a pair of gloves on the top of the monitor.	…bringing the prospect of games never playing the same way twice closer.	
10:11:39:11	Sequence of computer graphics.		
10:11:45:17	MCU of Colm Massey, MathEngine Research.	**Colm Massey:** To be able to move beyond what the original designer expected, you can't escape from the size of a game that has been designed in a traditional game you basically have to do moves that are allowed. This will completely open up the kind of punches you can throw and how you're going to fall so there will be just larger space to play in.	Incidental music ends.
10:12:06:19	MS of Paul Topping, MathEngine Marketing, talking to camera in his office.	**Paul Topping:** There's a randomness and an unpredictability.	
10:12:09:06	MS of Tim Milward, MathEngine head of development.	**Tim Milward:** … and they're not restricted by um.	
10:12:10:23	MS of Paul Topping, MathEngine Marketing, talking to camera in his office.	**Paul Topping:** … um.	
10:12:11:19	CU of Tim Milward, MathEngine head of development.	**Tim Milward:** Situations that the programmer	

		originally conceived	
10:12:15:05	MS of Paul Topping, MathEngine Marketing, talking to camera in his office.	**Paul Topping:** They're not quite sure what's going to ha….	
10:12:17:03	CU of Tim Milward, MathEngine head of development.		
10:12:17:24	MS of Paul Topping, MathEngine Marketing, talking to camera in his office.	Happen.	
10:12:18:09	Shot of a kitchen with a dog sitting in frame. Man walks into frame.	**VO of narrator:** If creating believable objects in a game is important vital to making games more compelling is creating characters, animal and human who's behaviour can produce surprises.	Incidental music by Amos Zamorski.
10:12:37:19	MCU of Dave Cliff, visiting professor, Southampton University.	If a character in a game always gives a predictable response to certain situations then I think most people would very soon become bored with that game so having some kind of inventiveness or unpredictability or creativity on the part of the synthetic characters inside the game is something that could be really, really valuable…	Incidental music ends.
10:12:57:07	Blurred image of fairy lights on a wall panning left to see Dave Cliff sitting at a table typing on his laptop.	…and make games much more interesting. **VO of narrator:** Dave Cliff has	

		worked on these problems in University and in the games industry but believes competitive pressure will give industry the edge on solving them.	
10:13:10:15	MCU of Dave Cliff, visiting professor, Southampton University.	**Dave Cliff:** In the computer games industry if you work for one company and you're working on a particular project its probably a fair bet that you're…that there are other companies, your direct competitors that are working on similar if not identical ideas so there's this very big sense of time pressure and of trying to get you're system working and working first and making sure you're fast, that you can deliver it to the market fast and that you are in budget.	
10:13:42:03	Logo of saying Black and White.	**VO of narrator:** One company pursuing the goal of making…	Incidental music by Amos Zamorski.
10:13:47:15	Over the shoulder shot of someone looking at a computer screen.	…characters unpredictable, intelligent and even…	
10:13:50:08	Sequence of computer graphics. Fade into next shot.	…emotional is Guilford based games developer Lionhead studios.	
10:13:55:08	Shot of Peter Molyneux, founder of Lionhead studios, talking to camera. Fade out of shot.	**Peter Molyneux:** Making games more emotional is really something that we are all trying to strive for,	Incidental music by Amos Zamorski.

		its like the holy grail in the computer games industry. One of the things that you have to remember about the computer games industry is that we are still very young and haven't got the skill a lot of the time to fill stories with things called narrative. It's a new word in fact in the computer games industry, narrative and story. It's all very well having these simulations but unless they have you know a compulsive story wrapped round them its very hard its very hard too build up any relationship with them.	
10:14:30:06	Computer sequence from Theme Park.	**VO of narrator:** Peter started developing characters and story in his first best selling games, theme park and dungeon keeper. But in his new baby black and white he's taken these ideas much further. **VO of Peter Molyneux:** What black white is essential is it's a story, you play through a story and the story unfolds but the roll that…	Incidental music ends.

10:14:48:10	Shot of Peter Molyneux, founder of Lionhead studios, talking to camera.	…you play in the story is that of a God.	
10:14:51:18	Sequence from the game black and white.		
10:14:53:23	Peter Molyneux sitting in front of a computer demonstrating black and white.	**Peter Molyneux:** As a God in this world you can do absolutely anything you like.	
10:14:57:18	Sequence from the game black and white.	So I can go up and look at little villages and watch little people get on with their own lives and very much live their own lives and go down and be very intimate with them, look at all the things that they've got, watch them going around…	
10:15:13:00	Peter Molyneux sitting in front of a computer demonstrating black and white.	…doing their own thing, or I can pull back and make a more…	
10:15:18:06	Sequence from the game black and white.	…godly view on the whole world.	
10:15:21:21	Peter Molyneux sitting in front of a computer demonstrating black and white.	I can go down and have a little look at a person, and I can say well I'm not happy with you…	
10:15:30:14	Sequence from the game black and white.	I can pick that person up, I can throw them around…	
10:15:37:04	Peter Molyneux sitting in front of a computer demonstrating black and white	…and start throwing them at people and um…and just be really, really nasty and cruel and vicious and what I'm doing in this world is being an evil God, or I can be wonderfully kind, I can pick up a little person…	

10:15:50:20	Sequence from the game black and white.	…and I can say, you know if you want some food you can always go over here and help these farmers out and just really help these little people out living their lives so you can be whatever you want to be in the world. Now as you play through this story…	
10:16:08:22	Peter Molyneux sitting in front of a computer demonstrating black and white	…one of the first things you get to meet is a creature.	
10:16:12:11	Sequence from the game black and white.	My creature is an ape…hello!	
10:16:19:17	LS of office with a man working on a computer.	**VO of Narrator:** The creatures are created…	
10:16:20:22	MLS of office with man working on a computer.	…by Lionheads…	
10:16:21:22	MS of office with man working on a computer.	…chief scientist…	
10:16:22:16	CU of man working on a computer, he turns around and roars like a Lion.	…Richard Evans. (Roars like a Lion)	Sound effect of a Lion.
10:16:27:02	MS of Richard Evans, Lionhead studios chief scientist.	**Richard Evans:** The idea is that you are a God doing things in the world but you also have this agent who tries to perceive what you want and helps you out doing it so he's supposed to be a useful helper he's also supposed to be physiologically plausible and sweet,…	
10:16:41:01	Sequence from the game black and white showing the helper character.	…capable of making you feel some sort of empathy towards him.	Incidental music by Amos Zamorski.

		VO of narrator: You start to feel empathy towards him because although some of his actions and appearance are programmed in…	
10:16:49:08	CU of fingers on a keyboard.	…like this character…	
10:16:51:08	MS of someone programming a character on the computer.	…his personality isn't.	
10:16:53:15	CU of an animated character on a computer screen.	This he learns from you.	
10:16:57:12	Peter Molyneux sitting in front of a computer demonstrating black and white.	**Peter Molyneux:** All we've done is thought of 2 ways that you can teach you're creature, the first way is that he watches you play the game. If you're nasty and mean and vicious he will be inspired by that so for example if I just erm…go down here and pick a little person and throw that	Incidental music ends.
10:17:13:23	Sequence from the game black and white showing the helper character.	…little person around, he'll see that and that's like saying to him okay that's cool to be mean and vicious.	
10:17:20:19	Peter Molyneux sitting in front of a computer demonstrating black and white.	Equally if he sees me being nice I can pick up a tree and move that tree and place it down by the village just to be nice to the villagers he'll be inspired by that.	
10:17:33:01	Sequence from the game black and white showing the helper character.	That's the first way he learns,…	
10:17:36:03	Peter Molyneux sitting in	… the other way that	

	front of a computer demonstrating black and white.	he learns is by me telling him off.	
10:17:39:04	CU of Peter Molyneux.	Sound of a Lion roaring.	Sound effect of a Lion.
10:17:42:08	Sequence from the game black and white showing the helper character.	I can either give him a little…	
10:17:44:20	CU of someone using a mouse.	…clip round the…	
10:17:46:00	Sequence from the game black and white showing the helper character.	…head to say bad or I can really tell him off by really hitting him and really laying into him which he doesn't like at all and is probably going to feel a bit depressed by it. Or you can say that you've been good and you can do that just …	
10:18:03:01	CU of someone using a mouse.	… by stroking him.	
10:18:04:15	Sequence from the game black and white showing the helper character.	And the more I stroke him the more he likes it, I can tickle his feet.	
10:18:12:03	Peter Molyneux sitting in front of a computer demonstrating black and white.	And that was just playing with him and telling him yeah that was really good what you did. If you really want to you can…	
10:18:19:10	Sequence from the game black and white showing the helper character.	…tickle him down there which perhaps you don't want to do.	
10:18:25:23	MLS of Peter Molyneux sitting and talking to camera.	The first way was really inspired by me looking at young children.	
10:18:31:01	LS of a child playing with toys.		
10:18:36:20	MLS of Peter Molyneux sitting and talking to camera.	And the horrible realisation, and it was a horrible realisation that children actually	

		learn all the time. If I'm talking to a child and...	
10:18:47:16	LS of a child playing with toys with his mother.	…saying this is a pen you can write with it and they look up in your eyes and they say pen and you know that they've learnt about a pen.	
10:18:57:12	MLS of Peter Molyneux sitting and talking to camera.	And then I turn back and start looking at a football game on tv and I start swearing because they are not scoring enough goals. Then the realisation that the child doesn't stop learning at all.	
10:19:10:00	CU of child holding up 2 identical building bricks.	**Child:** Snap!!	
10:19:12:14	MLS of Peter Molyneux sitting and talking to camera.	**Peter Molyneux:** And that was the inspirational leap about the creatures learning is that why don't we get the creature to learn all the time.	Incidental music by Amos Zamorski.
10:19:20:08	Screen shot of a sequence from the game black and white showing the helper character.	**VO of narrator:** As the character learns his personality either turns to devilish or angelic	
10:19:28:08	MS of Richard Evans, Lionhead studios chief scientist.	**Richard Evans:** They learn what sort of a guy they want to be and they learn what sort of desires are important in certain situations so for instance the creature will start off and be frightened at night time, he'll just think oh no its night time I	Incidental music ends.

		don't like this but over time you can train him that you don't want him to be frightened at nigh time you only want him …	
10:19:45:12	Sequence from the game black and white showing the helper character fighting another character.	… to be frightened when something scary is approaching him that might damage him. **VO of narrator:** Something scary like a kick boxing cow. Although the creature learns he is born with some behaviour programmed in. **Richard Evans:** At some level…	Incidental music by Amos Zamorski. Incidental music ends.
10:20:00:07	MS of Richard Evans, Lionhead studios chief scientist.	…the creatures behaviour has to be programmed; it's not magic. We are writing a computer programme. So the basic building blocks that the creatures perform are programmed so I tell it how to pick things up, so the little building blocks of action are pre-programmed into the game. But then the way in which we sequence them together and the way in which they decide what to do in certain situations is determined by the creatures own mind	

		and his own mental state.	
10:20:23:23	Old footage of a robot talking.	I can perform 30 separate and distinct acts.	Incidental music by Amos Zamorski.
10:20:27:19	CU of robots feet.	**VO of narrator:** This technology …	
10:20:28:21	LS of the robot walking along.	… is called artificial intelligence…	
10:20:31:18	HA MS of a man twiddling knobs. Old footage.	…or AI. Philosophers	
10:20:35:09	LS of a woman hugging a primitive robot.	and computer scientists…	
10:20:35:09	CU of the robots claw like hands.	… have long hoped that it would …	
10:20:36:09	LS of a woman hugging a primitive robot.	… one day be possible to make …	
10:20:38:14	CU of a computer screen which unsteadily pans past other machinery. Fade into next shot.	… computers and robots as intelligent as humans and they've managed to create computers…	
10:20:43:17	Shot of 2 men playing chess. Fade into next shot	…that are brilliant at specific things like beating a grand master at chess.	
10:20:48:13	Fade into a picture of a computer screen. Fade into next shot.		
10:20:53:05	MCU of Dave Cliff, visiting professor, Southampton University.	**Dave Cliff:** For a lot of its history artificial intelligence concentrated on trying to get computers to do the things that a human needs a degree level training to do so typical examples were translating from one language to another say from English to French or diagnosing bacterial blood diseases from patients symptoms. Kind of	Incidental music ends.

		things that if you saw a human do it you'd say gosh that person must have gone to college. But it turns out that an awful lot of the intelligence that you need in computer games isn't that kind of degree level intelligence it's more like common sense.	
10:21:38:15	MS of Richard Evans, Lionhead studios chief scientist.	**Richard Evans:** In computer games its not like you're trying to make them clever or good at sums its more that you're trying to make them plausible…	
10:21:33:16	LS of 2 children playing with toys.	…so its more like artificial stupidity. **VO of narrator:** Which is just as well as most computers are incapable of thinking through things that even the youngest child can do like putting on a sweater. So Peter and his team had to start developing the model for the creature from scratch. **VO of Peter Molyneux:** We've got some very, very bright…	Incidental music by Amos Zamorski.
10:21:55:11	CU of Peter Molyneux sitting and talking to camera.	…people here and it soon became very apparent that there were no techniques that allowed us to	Incidental music ends.

		make this model because this model could learn in a very unique way, learn by experience and rewarding erm..we had to build a whole new model.	
10:22:17:00	CU's of scanned sections from the brain with computer graphics super imposed.	**VO of narrator:** One technique mimics the way our brains work. As we learn the connections inside our brains our reinforced creating pathways known as neural pathways. As the creature learns pathways are created from…	Beeping sound effects.
10:22:34:10	Over the shoulder shot of a man working on a computer.	…strings of computer code. **VO of Dave Cliff:** What happens in situations where …	
10:22:39:07	MCU of Dave Cliff, visiting professor, Southampton University.	**…** you want repeat the same behaviour is that the connection strengths are reinforced, they grow and stronger connections are made and where you want similar occasions where you want not to be the result of similar behaviours then you delete those connections or reduce the strength, its so called neural network learning. And it does draw some inspiration from what's understood of real	

		neural networks in real brains…	
10:23:04:24	LS of children playing.	…in real animals. **VO of narrator:** But to make computers as clever as a…	
10:23:08:21	CU of toys on the floor falling over.	… naughty boy…	
10:23:09:16	Screen shot of a sequence from the game black and white showing the helper character.	…they'd need to know everything we know about the world, an impossible task. So Lionhead is working on systems that learn what they need to know about the limited environment in which they exist. **VO of Peter Molyneux :** The reason why I…	
10:23:22:17	MLS of Peter Molyneux sitting and talking to camera.	…can say our creatures are as intelligent as any artificial intelligence is that we cheat.	
10:23:33:02	LS of Peter Molyneux sitting and talking to camera.	And the way that we cheat is that the creature is caught within our world and we have described this world to him so when he walks over to a tree he knows it's a tree, he knows its wood, he knows it burns, he knows all sorts of things about it. Its not like…	
10:23:50:11	Screen shot of a sequence from the game black and white showing the helper character.	**…** the real world. **VO of narrator:** But there was some early problems with the	

		technology. **VO of Richard Evans:** The first time the beast was…	
10:23:57:10	CU of Richard Evans, Lionhead studios chief scientist.	**…** let loose in the world quite a lot of things went wrong to be honest with you. Which I think is inevitable. To start with he just stood there looking down at his feet and I just thought why is he doing that he should be off doing something slightly more exciting but I de-bugged the code a bit and it turned out he was trying to eat himself, he was hungry as soon as he was born and he didn't realise that eating himself was impossible and so he tried to eat himself.	
10:24:18:14	MLS of Peter Molyneux sitting and talking to camera.	**Peter Molyneux:** Once you have this simulation of a human being, of the emotional content , and not only a human being but the animals of the world if you like then the permutations start coming through and are really fascinating in themselves.	
10:24:31:00	MCU, oblique angle of Peter Molyneux in front of computer.	Time to show you what you really can do with rocks. I want to pick that up and I	

		want you to throw it at those little people.	
10:24:41:01	ECU of Peter Molyneuxs face.	**VO of narrator:** Though Peter knows the design of the creature intimately, it still surprises him. **VO of Peter Molyneux:** The ape and me…	
10:24:47:18	Screen shot of a sequence from the game black and white showing the ape creature.	…have given many demonstrations to many people and he always overshadows me. **VO of narrator:** He dances well but is he actually alive,…	
10:24:58:08	MLS of Dave Cliff, visiting professor, Southampton University, with a dog.	…somewhere in the continuum of life between a rock and a human.	
10:25:03:13	MCU of Dave Cliff, visiting professor, Southampton University.	**Dave Cliff:** Well I think its actually a very difficult question to answer as to whether they're alive or not, and I suspect that if you've got a 100 biologists or a100 artificial life scientists in a room and asked them that question, they wouldn't all agree. I think some people would think that they probably could be…	
10:25:20:05	Sequence from the game black and white showing the ape creature walking forward.	**VO of Dave Cliff:** …classed as alive but others would say definitely not. **VO of narrator:**	Incidental music by Amos Zamorski.

		But as the computer power available to ordinary consumers doubles every 18 months, who knows what's possible with this kind of technology…	
10:25:32:16	Sequence from the game black and white showing the ape creature against the sea.	…in computer games in the future. **VO of Peter Molyneux:** There has not been a single moment for the computer games industry to ever catch its breath…	Incidental music ends.
10:25:42:00	MLS of Peter Molyneux in a blue room.	…to ever say, right, we're on a level playing field now. There's always new hardware, new innovations, new software techniques, new tools to consider. And also we are constantly pushing the barriers, we're constantly flying the envelope, and…	
10:26:01:03	MCU of person working in front of a computer.	…constantly doing that…	
10:26:01:21	Stressed man wearing headphones.	…means that we…	
10:26:03:14	MCU of three people in front of computers.	…constantly have to innovate and…	
10:26:05:08	Oblique MCU of person in front of computer.	…heartbreaking though it is you have to…	
10:26:07:04	LMS of Peter Molyneux in a blue room.	…archive all your stuff, stick it on the shelf and say, that's what I thought was the greatest thing in the world, then, and	

		this is going to be the greatest…	
10:26:14:20	Various ECU's of Peter Molyneux	… thing in the world.	Credit music by Amos Zamorski.
10:26:18:24	LS of Tim in an office riding a unicycle.		
10:26:20:15	Shot of a wooden artists doll moving about and then being pushed off a desk top. Credits start to appear at the end of the shot.		
10:26:23:00	LS of a child playing with toys and stamping on them.		
10:26:26:22	CU of the toys being stamped on.		
10:26:27:17	Shot of the helper character from black and white waving goodbye and various shots from the game.		
10:26:35:08	Sequence of computer graphics where a ball falls from the top of the screen.		
10:26:37:10	Shot of the helper character from black and white waving goodbye.		
10:26:40:04	Illuminations logo.		
10:26:45:06	End of programme.		End of credit music.