lifeClipper3

Script

Index

Introduction

lifeClipper3 is a game-like, interactive New Media Artwork which is implemented with immersive Augmented Reality Technologies in St. Johanns Park in Basel, Switzerland.

Augmented Reality (AR) can best be explained by comparing it to the better-known Virtual Reality (VR). When a user enters a VR-Space, reality is only used to track user behaviour, but the perception of reality is invisible. In an AR-space, in contrast, the audiovisual perception of reality is included in the user experience and gives context to it. Reality is then extended (augmented) by virtual content. In the case of lifeClipper3, the whole of St. Johanns Park is overlaid with a 3D model which hosts virtual audiovisual content and reveals it to extend the experience of the user during a visit.

lifeClipper3 invites visitors to walk around the park with a backpack and headset to experience alternative realities. Shifts between daily-life conventions and fantastic parallel worlds with different physical and cultural rules create interference and question our perception of reality.

Fig. 1: Expert with evaluation equipment in the St. Johannspark with the St. Johann Gate in the background
Fig. 2: Visitor with final equipment in the St. Johannspark at the riverside of the Rhine

Since lifeClipper3 is a multidisciplinary project, involving more than 15 international professionals, it was absolutely essential to develop a script in order to bring all the parts together. **The present script is based on the texts used for this collaboration process. It includes explanations for people not directly involved in the process, but excludes specifications on a management or codification level. As well as concrete instructions for the different tasks, the script therefore contains brief descriptions of ideas and concepts behind the artistic implementation and an explanation of technical conditions which influenced design solutions.** Basic lists of parameter settings and definitions of correlations between the introduced elements are combined with pictures, illustrations and montages, as well as examples from other media such as films, games and text quotations.

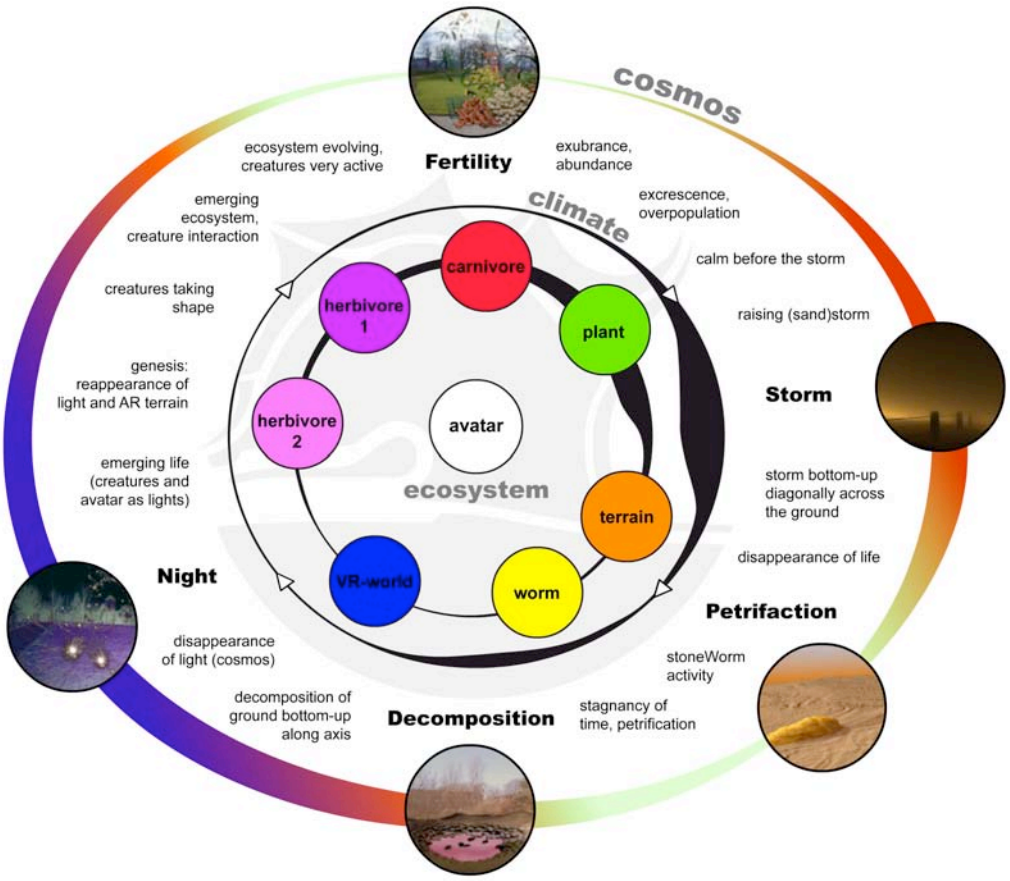


Fig. 3: lifeClipper3 script visualisation with its elements and their correlations

Because lifeClipper3 is based on a generative system, the script is a non-linear description and illustration of all the parts and their correlations. The parts are usually referred to as elements, or as players when they have a more active role, or as agents or creatures when they have their own behaviour patterns. All together, they form the **ecosystem**. The elements are the terrain and atmosphere, the cosmos, the climate, the creatures (fauna and flora) and the avatar, which are described in separate chapters later in this script. The **terrain** is subdivided into the separate local areas of VR-world, Glassland and Fogland, which have distinctive characteristics and features. The **cosmos** represents another parallel world with differential laws of gravity. Depending on the climate, the cosmos is more or less visible and responsive to user-interaction. The **climate** circle is a succession of the five climate types: Night, Fertility, Storm, Petrifaction and Decomposition, which vary in length and intensity, but not in their order of succession. The climates give the ecosystem an overall cyclic time structure. The **creatures** are virtual plants and animals with their own behaviour patterns, which correlate with each other and with other elements.

I prefer to talk about the **visitor** when talking about the person who comes to experience lifeClipper3, although it is sometimes more appropriate to talk about the user or player when referring to specific interaction issues. The **avatar** is the representation of the visitor in the virtual world. Since the visitor and the avatar are located in the same place at the same time, the boundary between visitor and avatar blurs and the avatar becomes the extended virtual skin of the visitor.

The spatiotemporal system

Differential reference systems

lifeClipper3 is staged in the St. Johanns Park in Basel, Switzerland. Unlike former lifeClipper applications, where historic content was referenced or interactive tools for urbanism or tourism were examined, this project takes no cultural context from its surroundings. The implementation of an augmented reality system, instead of a virtual reality system, is justified by using the real surroundings: the park's landscape itself. The natural features of the grass, paths, trees and the riverside, form the basic references to the real world. Virtual **narrative artistic content** extends their appearance, function and symbolic values. The limits of the park also represent the borders of the virtual stage. It is as if the visitor is walking on a **game plateau**, which is half reality, half fantastic parallel world.

Crucial to this project is the idea of **challenging what we take for granted**, like the earth-centred nature of our basic reference systems, gravity, or our notion of time and space. The implementation of other **parallel or superior worlds**, which form reference layers with alternative logic, dynamics and dimensions, question visitors' perceptions and offer them an opportunity to experience other dimensions. Fictional movies, like Emmerich's "Independence Day" or James Cameron's "Avatar", or the paintings of René Magritte, create this feeling of lost or shifted reference systems and generate an almost **visceral discomfort**.

Fig. 4: Still image from the movie "Independence Day" by Roland Emmerich, 1996
Fig. 5: Still image from the movie „Avatar" by James Cameron, 2009

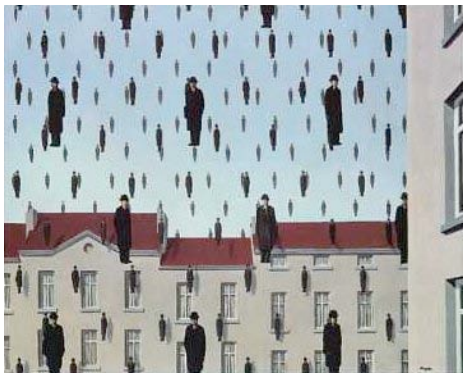


Fig. 6-8: Paintings of René Magritte. Golconde (1953), Das Schloss in den Pyrenäen (1959), Die Blankovollmacht (1965)

In lifeClipper3, several parallel reference systems reinforce the notion of a shifted reality system. An enormous, entire abstract **cosmos** surrounds the park plateau. Whilst at times it is barely visible through the sky, during certain climate phases it becomes the main reference system in an almost virtual world. The cosmic dimension, with its atmospheric bodies, is connected to the visitor's breathing, measured by a chest belt. This connection between the very personal rhythm and sensation on the micro level and the cosmic dimension on the macro level creates a self-referential feedback. The introduction of an overlaid virtual **climate system** with a cyclic iterative rhythm undermines the usual notion of time, and even stops time and dissolves the physical ground during the Petrifaction and Decomposition climate phases. Since the **terrain** reacts to user-interaction, as well as to the virtual creatures which inhabit the world, the feeling of safety on solid ground is not granted either.

Fig. 9: Montage: cosmic body perceivable through the sky during climate Fertility
Fig. 10: Montage: decay of the terrain during climate Decomposition

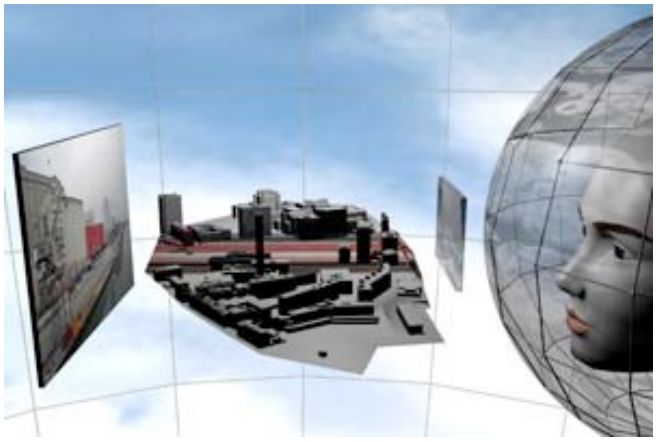
By introducing an **augmenting game-like system**, with its own spatiotemporal layer and players with unknown behaviour patterns and correlations, a parallel ecosystem is created, with its own logic, becoming yet another alien reference system. The French sociologist and anthropologist Roger Caillois (Caillois 1979) writes that games are "accompanied by a special awareness of a second reality or of a free unreality, as against real life". Alexander R. Galloway (Galloway 2006) describes actions of the game software without the input of a player as "diegetic machine acts". He describes the autonomous acts as follows: "While some games might not have elaborate narratives, there always exists some sort of elementary play scenario or play situation. When games (…) are left alone, they often settle into a moment of equilibrium. (…) The game is running, playing itself, perhaps. The game is in an ambient state, an ambient act."

Looking at Magritte's pictures or watching Roland Emmerich's "Independence Day" can be emotionally as immersive as the sensory immersion with polarized 3D-glasses offered by James Cameron's "Avatar". But **3D media technologies** do offer us a new field within which to experiment with the quality of immersion. In lifeClipper3, **narrative immersion is combined with sensory immersion** and the visitor can explore the shifted worlds by walking around freely and focusing on personal interests.

Technical basics for the spatiotemporal implementations

To create the audiovisual Augmented Reality experience of lifeClipper2, the predecessor of this project, a camera was fixed to a headset. The camera captured and represented what the visitor would be seeing in the real world and produced a real time video stream, which was then applied to a virtual background plane fixed in the visitor's viewing direction. Virtual content (3D bodies, textures, lights, etc.) were placed in front of that video backdrop. The reality plane therefore hosted all the virtual extensions on a flat background image (see figure below).

In lifeClipper3 the same hardware system is used, but the projection plane for the real-time video stream is only used for the park's **skyline and transparency effects**. The main part of the video is **projected directly onto the ground model of the park itself, using the "planar mapping"** technique. With this approach, the projected pixels of the video image coincide with the spatial representation in virtual space, which overlays reality at a scale of 1:1.



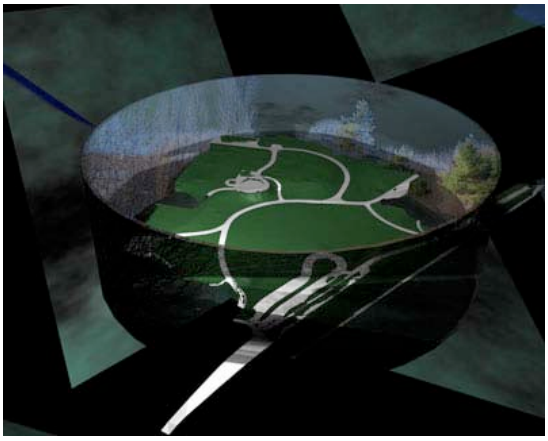


Fig.11: Augmented Reality projection system with video backdrop and 3D model, both textured with the real-time video stream. The globe around the visitor can be used to implement avatar skins (VR-representation of the visitor)
Fig. 12: 3D model with the luma-keyed skyline around the terrain

Although direct projection onto the organically shaped 3D body creates shadows and the calibration inaccuracies have to be hidden by semi-transparent layering, the new system offers a set of crucial possibilities: It allows a more intuitive placement of 3D models in relation to the camera image of reality; 3D bodies can intersect the real terrain and cast shadows on it; virtual lights can throw light onto the video textured terrain; and ambient effects, like fog, can be applied gradually in depth. For the decay of the video textured terrain during the Decomposition climate phase, it is also imperative that the representation of the ground and the video projection plane are the identical 3D object.

Using a skyline object in a fixed plane to the visitor's view allows the projection of the skyline and the sky onto a cylinder or sphere around the video-textured terrain. Adding a colour key to the skyline object opens the view to the 3D bodies and textures representing the cosmos.

Terrain and atmosphere – the interface between the real and the virtual

The terrain of lifeClipper3 consists of the **real park landscape and an overlaid virtual landscape**. A video camera fixed to the Head Mounted Display (HMD) captures the real park landscape, whereas the virtual landscape is a 3D model of the park at the same scale: one meter in the real park equals one meter of the overlaid 3D model. The two worlds must match precisely, even when a visitor moves around and changes their viewing direction. Calibrating the camera image with the virtual overlaid 3D space is the most difficult technical challenge of the Augmented Reality application.

The overlaid landscape coincides with the park's morphology to subtly extend the visitors perception of the real and to blur the borders between the real and virtual: Textures can coat the grass and paths with **varying amounts of transparency, thereby regulating the visibility of the real**; Virtual plants and creatures can be fixed to the ground; and **lights and shadows can be cast onto the real ground**. All virtual elements, even flying creatures, the climate or the cosmos, have a spatial reference to the terrain even though they may seem to be more independent. But whilst the real terrain and the position of the visitor in the real park will always obey physical laws, the virtual world is free of such earthly constraints: Colours, lighting and atmosphere can change at any time, and virtual creatures and climates can penetrate the ground or fly from below a visitor into the sky.

In addition to the augmentation by overlaid 3D models, image parameters can also be changed to vary the park's appearance. The captured **video stream can be altered** at any time: It can be coloured, darkened, saturated, inverted, or changed in many other ways. The option to alter the representation of the real, allows us to approach the aesthetics of the virtual and thus further blur the border between the two worlds.

Analogously to the visual extension, **the park is audibly extended**. A microphone captures the real sound of the park and the system can alter it in real time according to **dynamic parameter settings**. Additional sounds, composed of various layers and also parametrically adjustable, can be placed in space. **Positional audio** announces upcoming events directionally, aids visitor orientation, and improves the immersive experience.

Terrain areas

The virtual terrain coincides with the real park terrain in most areas: the paths, the grass, even the benches, fences and street lamps. The distinct virtual **areas** can therefore be altered separately and create a stronger reference to the real park. **There are four main park areas, which have distinctive audiovisual atmospheric qualities.** They have local micro-climates, which are subordinate to the main cosmic climate cycle and only perceivable during the Fertility climate phase.

Fig. 13: 3D schema of the 4 terrain areas which have specific local characteristics

The central grass (green area) is the most neutral area, in which the development of the Fertility climate is the only atmospheric event and where the ecosystem develops most visibly. It is surrounded by three different areas, which enclose it and hide the **borders around the park plateau**. This implementation helps to deal with the problem of the borderlines of the system, but also creates a feeling of being on an isolated plateau without the cultural context of the city of Basel. The 3D representations introduced into the Glassland and Fogland areas (described below) are a **consistent part of the park model**. They appear in the virtual model of the park after the Night climate phase, they form a part of the petrified landscape during the Petrifaction climate phase, and they are destroyed, together with the rest of the terrain, during the Decomposition climate phase. During the Fertility climate phase, they serve as a projection body for planar mapping, as does the rest of the terrain, but they develop their own distinctive characteristics as the visitor gets closer to them.

The area towards the St. Johann tower (yellow area) is called **Glassland**. This area evokes an Arctic ice landscape which does not change over time during the Fertility climate phase. It is bluish and crystalline, and feels cold. It builds up along the borders of the park as the visitor enters and walks towards the limits of the park plateau. Displacement functions, refraction and mirror effects (special mapping techniques and inverted grounds) are used to build the crystalline landscape from the underlying **polygon structure** of the 3D model. Whenever members of the ecosystem pass through this ice-scape they change their appearance: they become just a part of the projection shield for the video stream of reality (planar mapping). The **real-time video stream** gets altered too: it becomes inverted and its contrast and saturation increase when the visitor enters the area. These parametric changes increase towards the borders of the park until the image is nothing more than a blue or white screen. The atmospheric **sounds** of the climates are still perceivable but become clear, icy and distant and the sounds of the living creatures and from the real park sound far away and unreal.

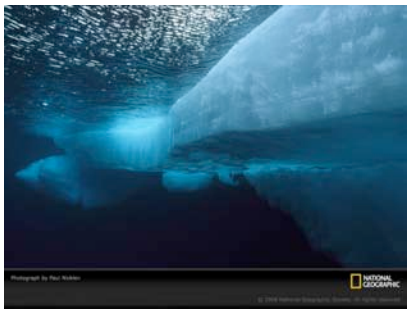


Fig. 14-16: Inspiration from nature: ice, underwater ice, water tunnel

Fig. 17-19: Studies and first implementations with mirrored virtual ground, glass effects and altered image parameters

The area towards the woody hill and the children's playground (orange area) is called **Fogland**. It reminds us of mystic swamplands. It is a ghostly, foggy, green zone with rising particles and strange noises of **audible but invisible** creatures, rivers, wind, etc. The **real-time video stream** is tinted green and blurred and the fog and vegetation become denser towards the borders of the park plateau, where the sounds become fuller, more voluptuous and spatial. Alongside the initiation process of the cosmos and the avatar's fertility interaction, which both revitalize life, this area is a fertility locus, from where life expands. The vegetation of the area is a fixed component of the virtual park plateau and serves, just as in the Glassland area, as a projection shield for the reality video stream (planar mapping) as long as the visitor stays outside. Whenever the visitor enters the area, it becomes vivid.

Fig. 20: Inspiration from nature: swamplands

Fig 21-23: Studies with particles and virtual grass which grows around the visitor if she doesn't move

As well as the walkable parts of the park area, lifeClipper3 introduces a **VR-world** (blue area), which does not coincide with the parks surroundings. This world can only be experienced at the promenade alongside the river. It is a completely virtual world but includes the representation of the promenade as

a reference to the real world. It converts the river into an endless space with an unexpected landscape and atmosphere. The 3D model of the riverbank is an integral part of the AR- and VR-landscape. The closer the visitor moves towards the Rhine, the more she perceives the VR-landscape. The fade between the two worlds is like a spatial fade. Similar colour tonalities and 3D effects like fog, which exist in the AR and VR world as a continuum, help to blur the transition. The sound cross-fades from the park atmosphere to a completely independent world with no context to the park. When a visitor has completely entered the virtual world and looks back to the park, she no longer sees the park, but another landscape which disappears into a dense fog.

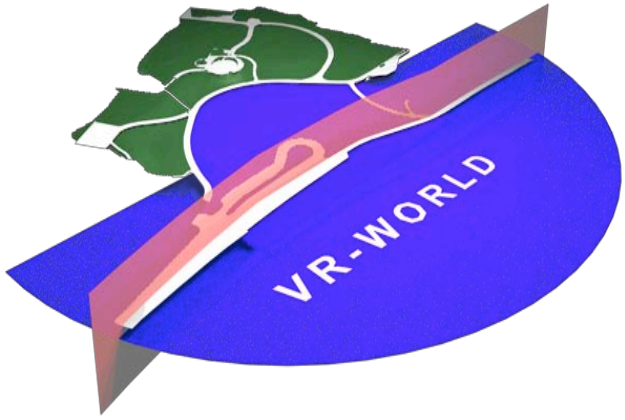


Fig. 24: 3D visualisation of the VR-world area, partly overlapping and incorporating the park model. The red plane represents the interactive barrier between AR- and VR-world positioned in the middle of the Rhine promenade.

Fig. 25-28: Montage illustrating the fade from the real environment (AR-world) to the VR-landscape

Fig. 29-31: Screenshots of studies with the lifeClipper3 system in the field

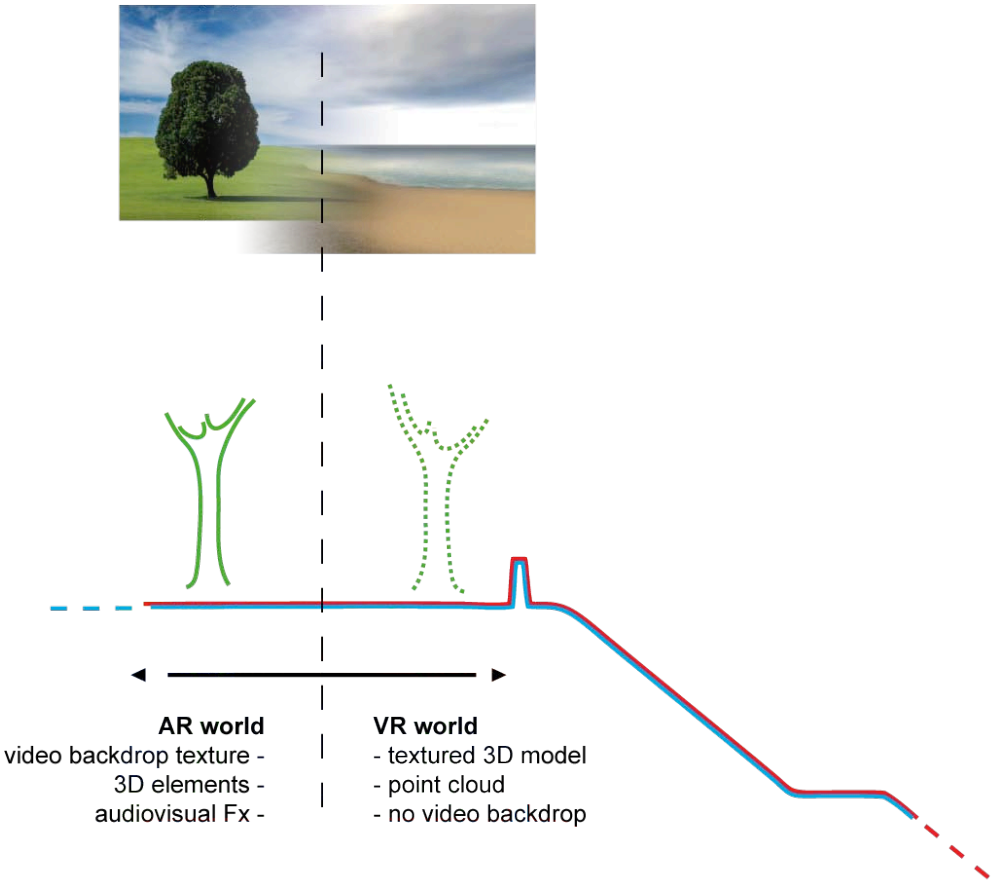


Illustration key:

Blue line: AR-ground (3D park model used for video backdrop projection)

Red line: VR 3D model of landscape overlapping and incorporating the riverbank of the AR-ground

Green line: representation of reality as video backdrop on ground and horizon model

Green dashed line: representation of reality as a coloured point could

Fig. 32: Scheme of the fade area

AR-world fade into the VR-world (characteristics and parameters):

- The fade is a linear cross-fade according to the closeness of the visitor to the river (on the promenade).
- The 3D model of the river promenade is also part of the VR-world.
- Audiovisual effects of the AR world (river area) are also part of the VR-world.
- Fog as continuum from one world to the other.
- 3D-sounds from VR-world become audible before the visual fade to the AR-world (attracting, 3D-positioned)

VR-world representation (characteristics and parameters):

- Realistic looking 3D-world.
- Colour similar to audiovisual effects of the AR-world.
- 3D-sounds from VR-world are very distinctive from the AR-world.

Climate in the VR-World (correlations):

- The iterative climate circle has no influence on the VR-world.
- There are no climate changes in the VR-world.

Ecosystem and the VR-World (correlations):

- Herbivore1 crosses the AR-VR border and always stays on the ground or under water.
- Herbivore2 does not cross the border since it is the prey of the carnivore.
- The carnivores live in the VR world and only go hunting in the AR-world.
- There are no interactive functions or avatar representations of the visitor in the VR-world. Visitors can only observe and explore this world.

Cosmos

The virtual cosmos system

The cosmos of lifeClipper3 is not a simple representation of a starry sky. It follows different laws, which are not clearly defined, but its local implications on the park plateau are perceived through its appearance and the passing cosmic climates. This alien cosmic system does not behave as though it is based on gravitational forces between planets, nor are the climates based on local atmospheric conditions. The cosmic motion is more like a stream, which penetrates the park plateau as if it was not made of solid material, from bottom-up, diagonally, along an invisible **differential gravitational axis**.

Fig. 33: The differential gravity axis passes diagonally bottom-up through the park plateau (green plane in the middle)

The cosmic appearance

The cosmos is represented by enormous wobbling rings and shells located around the park plateau and the diagonal differential axis. Their **visibility depends on the cosmic climate:** During the Fertility climate phase, they can only be seen in the sky; they are not present during the Storm climate phase; they are barely visible through the dust of the Petrifaction climate phase; and they are the main spatial reference system after the Decomposition climate phase during the Night climate phase. Only during this latter climate phase, when the park's real surroundings are invisible, can the cosmos be fully discerned. The rings reproduce themselves at regular intervals and slowly scale away perpendicularly to the differential axis. This process generates **a succession of growing rings slowly fading out, until they are lost in the distance**. The rings not only appear at the height of the park plateau, but also repeat themselves endlessly along the axis at regular distances. The visitor becomes aware of being at the centre of the ring system, and can **imagine other park plateaus** with other ecosystems and other avatars within the other ring systems endlessly repeated along the axis.

After the Decomposition climate phase, when the Night climate phase begins, **the ecosystem's life forms re-emerge**. Firstly, **particles rise up** along the cosmic axis with a slight turbulence. It is as if the origin of the cosmos is the genesis of all life on the park plateau. Later, **swarms of light**, moving around like flying creatures (like the herbivore2, during the Fertility climate phase), start to inhabit the ecosystem again and introduce the beginning of the Fertility climate phase.

Fig. 34: inspirational picture of tornado

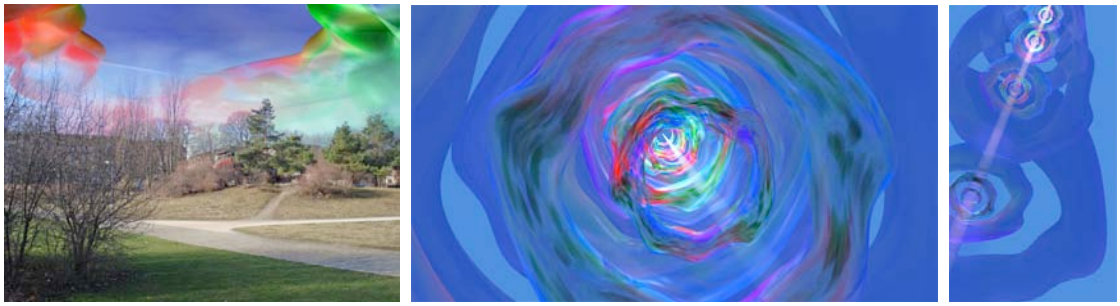


Fig. 35-37: Studies for cosmic rings during the Fertility climate phase

User interaction

The cosmic construct, which is most visible during the climate Night, somehow reminds us more of a hugely scaled up **machine, building or organism** than of a galactic dimension. **Connecting the visitor's breathing** to the motions of the rings, further reinforces the ambiguity of the situation. The rings wobble and pulsate, rhythmically increase in size and become more and more transparent according to the visitor's breathing activity. A visitor may only become aware of this interface after some time and, from then on, may choose to consciously play with it. The cosmic system can be understood as a macro representation of the visitor's inner rhythm and state, or even as an external self-referential view into their own body.

Only during the climate phase of Night, an additional feature is added to the biofeedback interface: **the visitor is now able to move up and down the differential axis by breathing**, which reinforces the feeling of floatation and allows more ground-detached cosmic views.

Fig. 38: The individual human (the visitor) represents the micro cosmos
Fig. 39: The cosmos system represents the macro cosmos

Cosmos (characteristics and parameters):

- 3D model (amount of distortion, size, transparency): The model wobbles according to the visitor's breathing and rhythmically increases in size and transparency. The same animated model gets repeated along the diagonal axis about 3-4 times in each direction until it is lost as a small motion in the dark (performance optimization for far-away ring systems and by deactivating the ones which are not in the field of view).
- Texture: Animated, semi-transparent texture on the rings.
- Virtual light (intensity, colour, position): There is a light in the centre of each ring system along the axis.
- Particles and swarms of light (during the Night climate phase): Particles rise up from the lower end of the cosmic axis and move along the axis with a slight turbulence. Swarms of light move around as they did as creatures (herbivore2) during the Fertility climate phase.
- Audio (parameters of live sounds): None.
- Audio (additional sounds): During the Night climate phase (and more during the Fertility climate phase), there is a cosmic atmosphere sound, and there are sounds (the cosmic sound and that of breathing) for the repetitive rings and for the floating avatar.

Climate (correlations):

The cosmos is most active during the Night climate phase and inactive (hidden) during the Storm phase.

- Fertility Climate phase: Only the rings around the park plateau are visible through the sky (blue-key).
- Storm Climate phase: The cosmic system is not visible.
- Petrifaction Climate phase: The cosmic system is not visible.
- Decomposition Climate phase: The entire cosmic system re-appears behind the decomposing ground.
- Night Climate phase: The scene is completely virtual (no real ground, the visitor is floating), the cosmos can be fully seen (ring systems along the cosmic axis). The reappearance of life is represented as lights (particle system and swarms).

Ecosystem (correlations):

There is no correlation between the cosmos and the ecosystem during the Fertility, Storm, Petrifaction and Decomposition climate phases. Only during the Night climate phase, the reappearing creatures are represented as lights emerging from a cosmic stream of particles along the differential axis.

Avatar interaction (correlations):

- Interaction (breathing): The visitor interacts with the cosmic virtual bodies (amount of distortion, size, transparency).
- Interaction (breathing, during Night Climate only): The visitor can float up and down the differential axis (position) by breathing.

The climate system

lifeClipper3 introduces **virtual climates** in an atmospheric, temporally-organized layer, alongside the locative implementations. The climate types appear to originate from different cosmic laws, rather than because of local atmospheric conditions. They are abstract time units, comparable to different types of weather, to times of day, seasons of the year, or even eras experienced through a time-machine. They constantly move through the environment, upwards along **the offset diagonal gravity axis** (see also cosmos system), and they penetrate the plateau as if it was not made of solid material. The climate types cause major changes to the playground, influencing the terrain, the atmosphere, the agents and the avatar (the visitor). In terms of the technology and media used, this means that they influence the 3D-models, visual and atmospheric parameters, sounds, and light. **User interaction has no influence** on the dominant iterative climate cycle, except for in the VR-World, where different climatic conditions dominate. For a detailed description of interactions, please see the parameter settings and correlations for each of the climate types later in this chapter.

The climates were first designed as separate units, with no fixed order of succession, influenced by user interaction, and having different impacts on different areas of the terrain. The advantage would have been a more complex and vivid system, but the testing and adjusting of all possible circumstances and combinations would have far exceeded the scope of this project. However, there are also advantages to implementing a fixed succession of climate types: The **cyclic iterative climate system** provides lifeClipper3 with its own sense of time and rhythm, and development and change between climate types can be designed much more carefully. Visitors can interact with their surroundings and the ecosystem, but are, at the same time, subordinate to a stronger influence from outer space. The combination of the temporally organized climate cycle and the visitor's spatial navigation and interaction in the field, still creates a random diversity of impressions and experiences.

The climate cycle

The iterative virtual climate cycle is subdivided into five main climate phases: **Fertility, Storm, Petrifaction, Decomposition and Night** (see figure below and the following description of these climate types). The climate types follow each other in a fixed order, which gives the system a defined temporal structure. There are parametric variations of intensity and length, as well as of the transitions between them. **The length of one complete cycle is about 15 minutes.** The starting point for each visit – which takes about 30 minutes – is the emerging ecosystem (springtime) at the beginning of the Fertility climate stage.

The visitor's experience

During the **Fertility** climate phase, the surroundings become increasingly alive: Virtual plants cover the real ground with increasingly sprawling abundance and virtual creatures – two types of herbivores and a carnivore – evolve, develop their activities, and become more numerous and present, through

visual appearance and audible presence, until they overpopulate the terrain. Towards the end of the Fertility phase, the plants start to seed. Particles begin to flow out of the plants towards the sky along the differential axis, which may cause the upcoming storm. The slowly developing **Storm** is initiated by an empty silence before the storm begins, where life seems to be on hold, preparing for it. Once the sandstorm-like tempest breaks out, it destroys all life and leaves a petrified desert-like terrain behind. The following climate phase, **Petrifaction**, is the period of the stone-eating worms, which dive through the terrain more and more numerously, fragmenting it. Their period ends with a general stagnation of time. Everything slows down and comes to a complete stop – even the worms freeze and become stone. During the **Decomposition** climate phase, which follows, the petrified and fragmented terrain decays into pieces, slowly moving up into the sky along the differential gravity axis (see also the cosmos system), initiating the **Night** climate phase. During this climate type, the only spatial reference is the cosmos pulsating as the visitor's breathes. The first life forms after Night are the light creatures, which later change into the creatures which inhabit the surroundings during the **Fertility** climate phase**,** thus closing the iterative cycle.

Design and technology approaches

For the implementation of the system described above by means of AR-technologies, several design considerations and technical approaches have to be taken into account. After the complete disintegration of the representation of the park during the Night climate phase, so-called reality reappears as a dark and inverted **video backdrop**, which slowly brightens up and "re-inverts". It builds up from a pale image to a more saturated one with higher contrast, first representing reality, and later gaining an unnatural saturation. During this process, virtual plants and creatures increasingly adorn the scene. Plant growth becomes more and more sprawling and virtual animal activity more omnipresent until the population overcrowds the scene. **Semitransparent textures on the ground (grass, moss, etc…) become more and more widespread and opaque and thereby slowly cover the video backdrop. After the destruction of life during the Storm climate phase, reality is mostly covered by the virtual desert landscape (about 75-85% VR including virtual sky and atmosphere).** Although the park is still recognizable within the display, the compositing between reality and **virtual reality also starts to take place at the edges of the HMD-glasses**. Since the movements and alignments of outstanding landmarks within the glasses correspond to the reality perceived from the corner of the visitor's eye, reality augmentation becomes a question of image section. After the Decomposition climate phase and during the Night climate phase, the video backdrop representing reality and the **reference to the ground completely disappears**. The visitor can now only refer to reality from the corner of her/his eyes, and is forced to stand still and wait or to move very carefully. During this moment of disconnection from references to reality, the visitor's breathing – measured by a **biofeedback chest-belt** – comes into play as the main connection to the surroundings. The cosmos pulsates according to the visitor's breathing and becomes an extended avatar-skin which self-referentially represents the aura of the visitor.

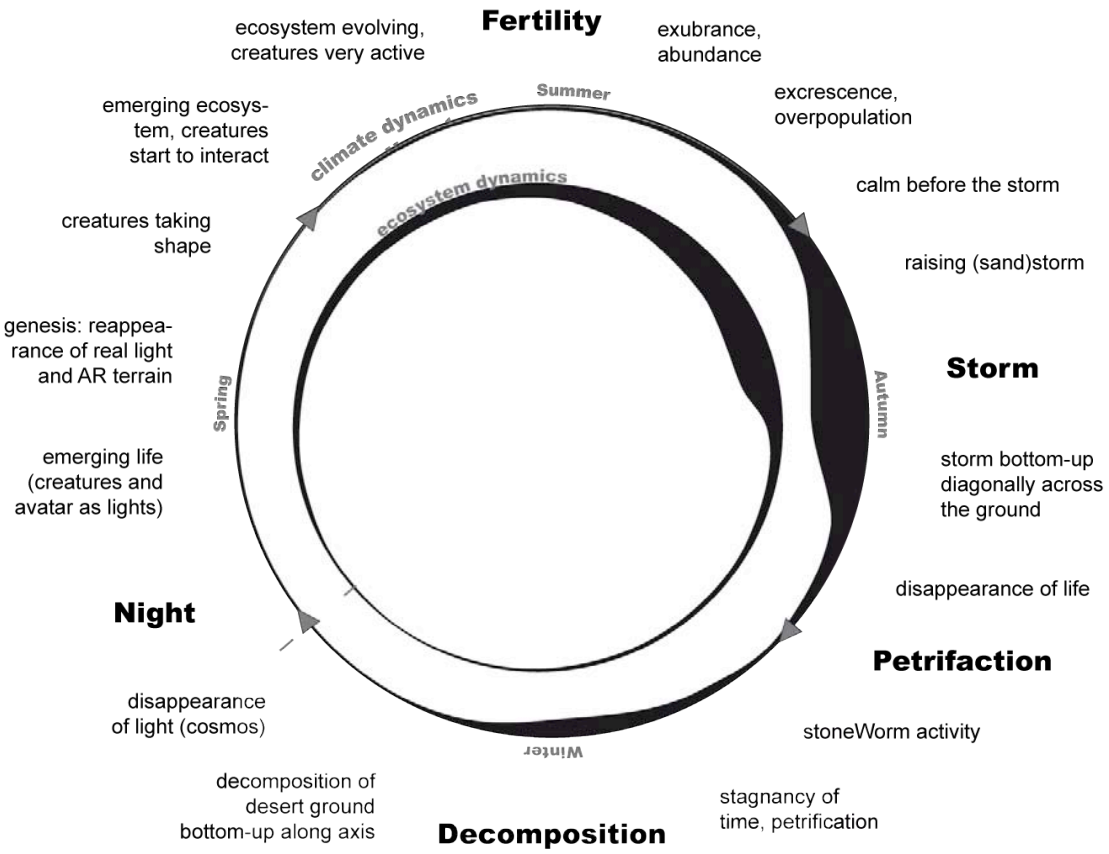


Fig 40. Scheme of the iterative climate cycle

Times per climate phase and fades between them (first test implementation):

- **Storm** (120 sec): Builds up slowly, maximum level for 90 seconds, then decreases over 30 seconds (leaving behind petrified terrain).
- **Petrifaction** (30 sec): Since there are no worms until now, just empty desert, only 30 seconds, leading into decomposition.
- **Decomposition** (30 secs): From the moment of the ground beginning to break until the complete fade out of pieces into the cosmos: 30 seconds.
- **Night** (120 sec): This is simply the fade-in of Fertility: In the beginning, only cosmic rings move according to visitor's breathing for 30 seconds; then lights enter and become more numerous, and the ground fades up to 50%, receiving the lights for 60 seconds; then the lights lose power and the ground fully fades in for 30 sec.
- **Fertility** (600 sec): The ecosystem develops and gets more abundant until the Storm climate phase, the interactive terrains of Glassland and Fogland are only now active.

Total time of one cycle: 900 seconds = 15 minutes.

The five climate types

Fertility

Fertility is the age of a complex ecosystem including plants, herbivores and carnivores. It emerges after the Night climate phase, as lights coming out of the dark, then flourishes, and later sprawls all over the terrain. It completely disappears with the storm which follows. The Fertility climate phase is comparable with the succession of seasons from spring to autumn. It is the mildest and most terrestrial period, which allows plant growth and animal reproduction. The flora and fauna have defined behaviour patterns, and interact with each other and with the avatar. During this period, the extended park landscape offers the possibility to contemplate and study virtually augmented nature, to become aware of life forms and their behaviour, and the correlations between them.

Fig. 41-43: Inspirational images for creatures

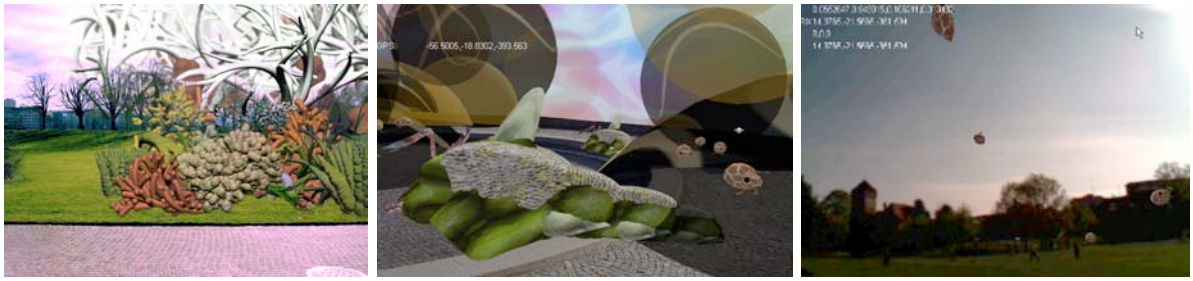


Fig. 44-46: Montage of plants, screen capture of the ecosystem in the simulator mode and in the field

The climate has implications for the elements of the system. The following list is a description of important **ambient parameters and ecosystem correlations** for the Fertility climate phase.

Terrain/atmosphere:

- 3D terrain: No physical changes to the terrain.
- Texture: POSITION: Textures (grass, moss, etc.) spread over the terrain (possibly more along the paths and where the visitor has walked), TRANSPARENCY: First semi-transparent, becoming increasingly opaque, SATURATION: Increasingly colourful, becoming unnaturally colourful.
- Virtual light: INTENSITY: From very dark to daylight, POSITION: Coinciding with the real sun (nice to have). SHADOWS: Hard and real-time (reacting to fauna, flora and avatar). COLOUR: From cold blue to yellowish, warm autumn colour.
- Atmospheric effects: Particles (representing seeding) start to flow from the plants towards the sky along the differential axis.

- Live video effects: Increasing brightness (fade in of texture), increasing saturation.
- Live audio effects: The park sounds are made increasingly dynamic.
- Additional audio: DIEGETIC: fading out cosmic sound, wind, sounds of creatures (including creatures which are never visible). NON-DIEGETIC: atmosphere sound becoming louder/richer, later collapses and degenerates.

Cosmos:

- 3D model: VISIBILITY: Only slightly through the sky (luma key).
- Texture: Animated texture. TRANSPARENCY: Semi-transparent.

Agents (plants, herbivores, carnivores):

- 3D plants: POSITION: Spread over the terrain (possibly mostly along the paths, where the visitor walks). GROWTH (parameters of mathematical systems for flora simulation): Get bigger (see different plant types) and volumetric. COLOUR: Become more colourful. TRANSPARENCY (texture): From semi-transparent to fully opaque.
- 3D creatures (see also individual creature descriptions): POSITION: Individual, not time-based. SIZE: Only herbivore1 grows over time. NUMBER/PRESENCE: Become more frequent, disappear during the calm before the storm. ACIVITY: More and more active until calm before the storm. TYPES OF ACTIVITY: First move around carefully, then play/fight/mate/hide/defend.
- Audio (see also individual creature descriptions): VOLUME/DIVERSITY: Increasing noises of plant growth (cracking and creaking, like tree trunks straining in the wind, small bells (wind chimes), etc …) and creatures (playing/fighting/mating/hiding/defending).
- Behaviours: See individual descriptions.

Avatar (interaction):

- 3D representation (see also individual description): TRANSPARENCY/VISIBILITY: Only visible when being attacked by carnivore or when almost trampled by herbivore1.
- Audio: Chance, funny human noises (like laughter) when close to plants (making them grow, like fertiliser), sounds of horror and defence (squealing) when being attacked by the carnivore or almost trampled by herbivore1.
- Interaction: POSITION: Influences on plant growth (grass texture grows around the feet), the herd follows the avatar when close enough (friendly encounter). VIEWING DIRECTION: Can defend himself with a laser beam when being attacked by the carnivores or almost trampled by herbivore1. BREATHING/GRAVITY: Flowers move according to breathing (through expiration, CO_2), interaction with cosmos in cosmo-connect, …

Storm

The Storm climate phase rises slowly after the overpopulation at the end of the Fertility climate phase. This period is introduced by a calm before the storm. Then, it slowly builds up, with particles (3D bodies: planes, spheres, etc.) flying fast through the air, diagonally upwards, from through the ground. Dusty air with poor visibility (sandstorm-like). The length and intensity of the cosmic storm can vary.

Fig. 47/48: Still image of animatic with particles streaming through the ground and screenshot of first implementations

The following list is a description of important **ambient parameters and ecosystem correlations** for the Storm climate phase.

Terrain/atmosphere:

- 3D terrain: No physical changes to the terrain. Street lamps, benches, etc. fly into the sky.
- Texture: POSITION: Textures (stone and desert) spread over the terrain, replacing the grass textures of Fertility. TRANSPARENCY: In the beginning, video backdrop is already 50% covered by grass textures, then stone and desert textures cover reality by about 75%.
- Virtual light: INTENSITY: From daylight to sandstorm-like darkness. POSITION: Main illumination coincides with the ends of the gravity axis. COLOUR: Orange, beige.
- Animated lights (intensity, colour, position, glow): Cosmic passing bodies glow.
- Atmospheric effects: Dust (haze).
- Live video effects: Colours tinted orange.
- Live audio effects: Park sounds are no longer audible.
- Additional audio: DIEGETIC: Increasing/decreasing rumbling and tumbling noise, sounds of the passing cosmic bodies (fizzing and whizzing). NON-DIEGETIC: Base tunes, dramatic.

Cosmos:

- 3D model: VISIBILITY: Not visible.

Agents (plants, herbivores, carnivores):

- 3D representation (position, rotation): They disappear, flying into the sky.
- Visual (parameters of life images, additional images): No changes.
- Audio (parameters of live sounds, additional sounds, 3D position): Sounds of agents fade away in the storm.
- Behaviours: No behaviour, just disappear.

Avatar (interaction):

- 3D representation: No representation (the visitor is an external observer).
- Audio: No body noises.
- Interaction: No interaction.

Petrifaction

After the storm, comes the **Petrifaction** climate phase. This is an era of stone-eating worms, which dive through the terrain. They behave as if the ground was not solid and did not represent an obstacle to them. They become more and more numerous and damage the ground, which starts to show cracks. Their era ends with a general stagnation of time. Everything slows down and comes to a complete stop – even the worms freeze and become stone (single colour, semi-transparent appearance). The vivid and interactive ecosystem becomes a sculpture, and the visitor an external observer out of a retrospective time.

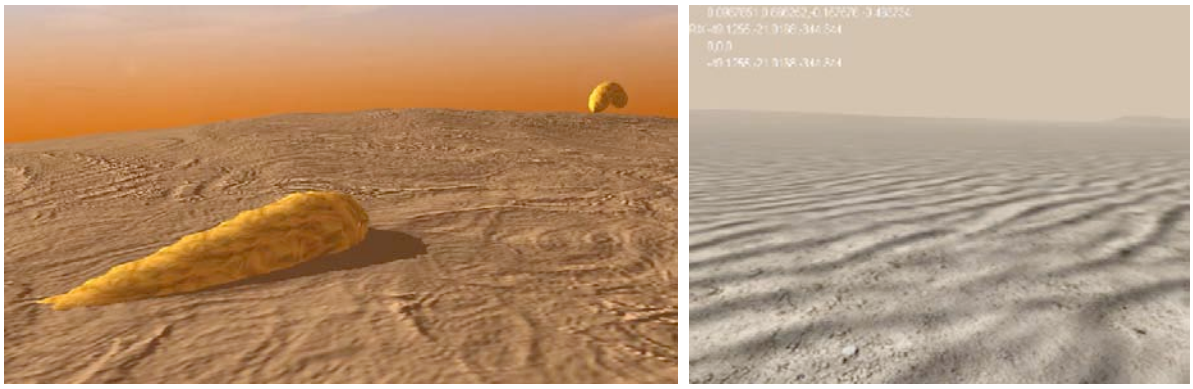


Fig. 49/50: Still image from animatics of stone worms and screenshot of first implementations in the field

Since the stone worms are not integrated into an ecosystem and do not interact with the visitor, they are treated as part of the climate, and not as creatures. The following list is a description of important **ambient parameters and ecosystem correlations** for the Petrification climate phase.

Terrain/atmosphere:

- 3D terrain: The terrain starts to crack and break as a result of the stone worm activity.
- Texture: POSITION: Textures (stone and desert) from Storm phase stay in place. TRANSPARENCY: Stone and desert textures covering reality by 75% turn 100% opaque with petrifaction.
- Virtual light: INTENSITY: Desert-dusk. POSITION: Very unreal, late afternoon position. SHADOWS: Hard and real-time (reacting to the worms). COLOUR: Red/orange, desert-dusk.
- Atmospheric effects: Dusty (haze).
- Live video effects: No video stream.
- Live audio effects: Not present.
- Additional audio: DIEGETIC: Worms penetrating the ground, cracking and scraping at the ground. When time slows down: pitch shift down, only wind. NON-DIEGETIC: Expansive atmosphere sounds.

Cosmos:

- 3D model: VISIBILITY: Barely visible through dust.

Agents (worms):

- 3D representation: The worms are textured chains of globes, following irregular sinus lines. More

than one worm can follow the same line at different intervals.

- Texture: Stony, lizard-like.
- Audio: No voices, but sounds when penetrating the ground.
- Behaviours: Worms tunnel through the ground, get slower and finally freeze, when time stops.

Avatar (interaction):

- 3D representation: No representation (the visitor is an external observer).
- Audio: No body noises.
- Interaction: No interaction.

Decomposition

After time has stood still at the end of the Petrifaction climate phase, the terrain decays into pieces during the Decomposition climate phase. Pieces of the ground fly into the sky at different times and at different speeds, following the direction of the differential axis. As the textured ground breaks away, it reveals the dynamic cosmos behind it. The completely virtual cosmos becomes the new spatial reference, as the context of touchable ground is lost. The visitor no longer navigates by walking, but by breathing: breathing influences the shape and size of the cosmic bodies and allows the visitor to move up and down the differential axis, thus gaining different perspectives on the cosmos (see also cosmos section). Meanwhile, the climate slowly turns dark and becomes Night.

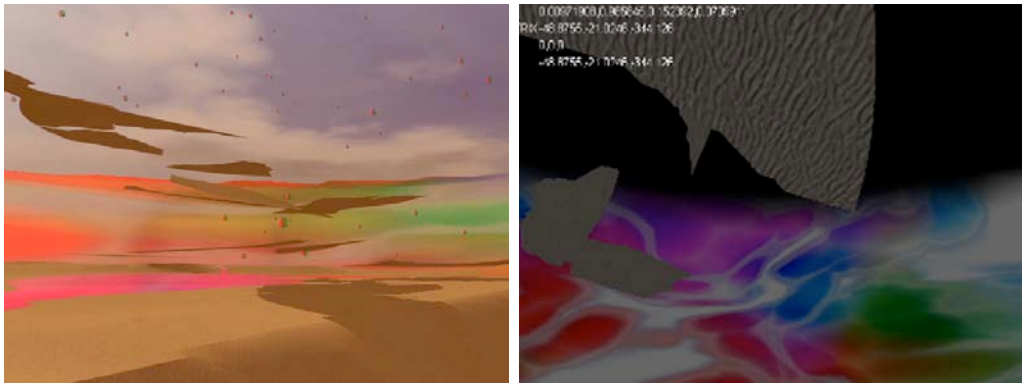


Fig. 51/52: Still image from animatics and screenshots of first implementations in the field

The following list is a description of important **ambient parameters and ecosystem correlations** for the Decomposition climate phase.

Terrain/atmosphere:

- 3D terrain: Textured virtual terrain decays into parts, which follow the differential axis upwards.
- Virtual light: At first the light coincides with the petrifaction light (desert-dusk), but as more pieces of ground disappear, the cosmic light takes over. POSITION (cosmic light): Always positioned in the centre of the cosmic ring systems (see cosmos). COLOUR: White and neutral.
- Live video effects: No video stream.
- Live audio effects: Not present.
- Additional audio: DIEGETIC: Cracks and motion sounds of the flying pieces of ground

disappearing, sounds of the animated cosmic bodies become more audible (they are strongly linked to the biofeedback/breathing), air-like sounds when moving up and down the referential axis. NON-DIEGETIC: Desert music fading out, cosmic tunes fading in.

Cosmos:

- 3D model: VISIBILITY: Becomes fully visible after the decomposition of the ground. See cosmos for detailed description.

Agents:

- Representation: There are no agents during this climate phase.
- *Avatar (interaction):*
- 3D representation: None.
- Audio representation: None.
- Interaction (position, direction, breathing): The visitor can influence the cosmic system and move up and down the differential axis by breathing.

Night

During the previous climate phase, the ground decomposed until the surroundings became completely virtual, with no ground reference left. Now, the scene becomes increasingly darker as light particles start to move up along the differential axis. The ground and the representation of reality (video textured ground) reappear (fade out of black) as an inverted lunar image. The agents re-appear as moving lights, and the avatar is reborn. The scene becomes increasingly bright, until there is a fade from the inverted image to the real image through a short “genesis moment” of total grey (when the real image merges 50/50 with the inverted image). From this moment onwards, a new ecosystem starts to build up and the Fertility climate phase slowly starts to develop.

Fig. 53/54: Montage and screenshot of first implementations in the field

The following list is a description of important **ambient parameters and ecosystem correlations** for the Night climate phase.

Terrain/atmosphere:

- 3D terrain: The textured ground reappears after some time (video backdrop).

- Texture: The ground is first textured with a dark inverted representation of reality (altered real-time video stream) until there is a fade from the inverted image to the real image through a short “genesis moment” of total grey (real image merges 50/50 with inverted image). From then on, the scene gets increasingly brighter.
- Animated lights (intensity, colour, position): At first, there is a particle stream from the lower end of the differential axis; later, moving lights represent the reappearing creatures (same motion patterns).
- Virtual light: INTENSITY: After the animated lights of the particles and creatures, the natural daylight of the Fertility climate phase grows lighter very slowly. POSITION: COLOUR: From cold blue to yellowish, warm, autumn colour.
- Atmospheric effects: None.
- Live video effects: At first, no video stream, then increasing brightness (fade in of texture).
- Live audio effects: The park sounds return with the video backdrop fading in, they become louder and more “natural” as the fade in advances.
- Additional audio: DIEGETIC: Sounds of the animated cosmic bodies become less audible, sounds of the moving lights appear. NON-DIEGETIC: Cosmic tunes fade out, music of night fades in.

Cosmos:

- 3D model: VISIBILITY: Cosmos is fully visible until the video backdrop fades in again. See cosmos for detailed description.

Agents (herbivores, carnivores):

- 3D representation (virtual light): Move as virtual lights or glowing outlines.
- Audio (parameters of live sounds, additional sounds, 3D position): Light sounds mix with their voices; silent when still, or murmuring.
- Behaviours: The creatures move as animated lights with the same behaviour patterns but no major correlated activities. See individual descriptions.

Avatar:

- 3D representation: After the last climate phase, the avatar reappears as a light source, lighting the ground around the visitor.
- Audio (parameters of live sounds, additional sounds, 3D position): Light body noises.
- Interaction (position, direction, breathing): Visitor's breathing influences the light intensity, illuminating more or less ground.

The ecosystem

The ecosystem of lifeClipper3 is a part of the game world system, which is composed of **artificially intelligent agents**. These creatures are virtual plants, three types of animals (herbivore1, herbivore2 and carnivore) and the avatar, each with their own appearance and defined behaviour patterns. During the Fertility climate phase, they interact with each other and with other elements of the game world. They form the most life-like virtual implementation of lifeClipper3.

Development

Although the AR system would have allowed us to develop completely abstract life forms, lifeClipper3 is oriented towards earthly nature. **Proximity to biological morphologies and systems** offers better merging with the real terrain and suggests more obvious associations to the visitor, improving emotional involvement. As in terrestrial nature, the ecosystem can be subdivided into flora and fauna. Flora is determined locally, whilst fauna moves around the entire system, and is sometimes not subordinated to physical laws.

The construction of the lifeClipper3 **flora** is based on L-Systems (Lindenmayer) and Subdivision Systems. Minor parameter changes within the system settings can completely change the appearance of the plant-like virtual models and, for example, transform a bush into a magnificent tree. Visitors can therefore interact with the ecosystem in real-time and, according to their position or biofeedback signals, cause plants to grow or move differently.

The **animal-like creatures** are based on swarm systems, wherein minor changes of parameter settings can change the characteristics of a group of creatures. Replacing the simple boids (agents) of a swarm by chained segments allows us to animate the motion of each member of the group in real-time.

The intelligent agents of flora and fauna have characteristic voices and noises associated to their different actions. The visitor perceives the **3D sounds** spatially, and therefore experiences better orientation and deeper immersion. The composition of sounds is also parametric and allows real-time changes of atmospheric sounds according to random events or the visitor's interaction.

To bring the artificial ecosystem to life, **correlations amongst the players of the ecosystem** are just as important as their appearance and behaviour patterns. Predefined interspecies dependencies, combined with random generators, create unique, life-like situations within the ecosystem.

Implementation in the real environment – merging the worlds

One of the major design problems when working with Augmented Reality, is the **perception of depth**. If there are no audiovisual links between the virtual content and the real environment, 3D bodies seem to float in space, without information about their position and size. This is especially problematic for isolated elements in the ecosystem. A spot in the air, for example, could be a small insect close to the

visitor's head or a jumbo-jet on the distant horizon. There are many acknowledged laws and tricks in the psychology of perception, which help humans to perceive depth in real life. Some of these can be transferred to the Augmented Reality system quite simply, and so improve the visitor's experience. Others are more difficult implement, and **limit the design options or force the story to be told differently**. Casting shadows or light from virtual objects onto the real ground, or atmospheric perspective tools, like fog, can considerably improve the merging between the real and the virtual. Varying sound volume, or changing the size of the same texture applied to different surfaces, or varying repetitive objects of a known size, can also help the visitor to position virtual objects spatially. Furthermore, since inaccurate technical calibration does not always position virtual content at its precise reference position in the real world, content and script design have to take into account the problematic of distance perception. In lifeClipper3, **the terrain is therefore subdivided into areas** which only reveal their content and appearance when the visitor gets close enough. For the same reason, plants mainly grow around the user and not as isolated items dispersed throughout the park.

To ensure the best **blend between the real and the virtual**, the audiovisual parameters of the two worlds have to be as similar as possible. Since the representation of the real world is a pixel-based low-resolution camera image and the virtual world is composed of vector graphics, this is not an easy task. Using pixel images taken from the real park to texture virtual elements is one technique to blur the borders between the real and virtual. Treating the borders of the virtual elements can also improve the illusion of an augmented reality: Plants, for example, can be textured in such a way that their stems fade into transparency as they get close to the ground. But as well as trying to make the virtual look as "real" as possible, video effects can also alter the image of the real, bringing it closer to the virtual world.

Overlaid semi-transparent textures of the virtual ground can further help the virtual flora and fauna appear to be in contact with the ground. Whenever the technical calibration is inaccurate, so that the virtual and real image don't correspond spatially, the virtual elements don't move around loosely, but are bound to a second dominant visual layer. In lifeClipper3 the dominance of the real or virtual world constantly shifts, depending on climate changes. During the Fertility climate phase, for example, a slow increase of opaqueness of the virtual ground allows the emerging virtual life to extend all over the park's terrain.

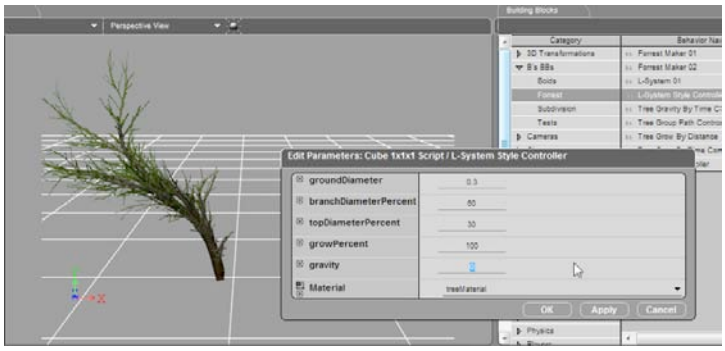
Creature development

Flora

There are three types of flora implemented in the lifeClipper3 ecosystem:

- grass-like plants (mainly textures, temporally covering the terrain, converting it to virtual ground)
- bush-like plants (increasingly mushrooming all over the terrain, most rapidly alongside the paths)
- tree-like plants (placement, grouping and size in relation to existing trees)

The plants live during the Fertility climate phase, becoming more and more numerous and sprawling all over the terrain. They start to grow after the Night climate phase and die out with the Storm phase, which they themselves cause by emitting pollen into the air along the differential gravity axis. They relate to the fauna: they get fertilized by the avatar, get eaten by the herbivore1 and are used for nesting and as hideaways by herbivore2.



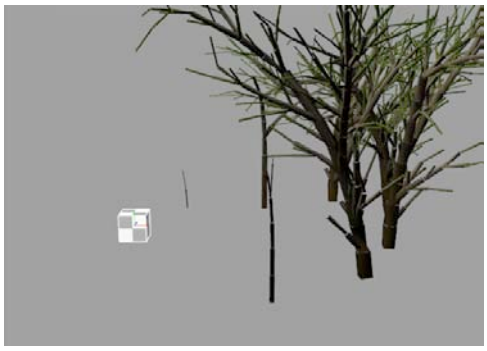


Fig. 55/56: L-system created plants for lifeClipper3

Appearance parameters:

- Model: Based on L-Systems and Subdivision-System parameters.
- Position (height): All over the plateau, but mainly along the paths and close to the visitor.
- Colour: Colourful, plant-like.
- Shape/animation type: Different shapes for trees, bushes and grass, based on L-Systems and Subdivision-System parameters.
- Volume: Different size for trees, bushes and grass, based on L-Systems and Subdivision-System parameters.
- Transparency, visibility: Semi-transparent trunks and stems to merge better with the real environment.
- Noise variety range: Variety within the categories of trees, bushes and grass.
- Gravity: Weight of the branches.

Spatiotemporal behaviour:

- Motion type: Grow in different manners.
- Motion direction: According to L-System and Subdivision-System parameters.
- Activity: Constant growth during the Fertility climate phase, becoming more and more numerous.
- Lifespan: Only live during the Fertility climate phase (starting to grow after the Night climate phase and dying out with the Storm climate phase).

Group behaviour for species

- Closeness, clustering: Grow mainly around the visitor and along the path of the system, not in the VR-world or Glassland.
- Arrangement, alignment: Casually grouped.
- Reproduction, cloning: Grow out of the ground, send pollen into the sky along the differential axis for galactic fertilization.

Correlations with terrain:

- Central grass: Dispersed all over but mainly along the surrounding paths.
- Fogland: Dispersed all over, submerged in dense fog.
- Glassland: Don't grow here.
- VR-world: Don't grow here.

Correlations with other creatures:

- Avatar: Flora fertilized by the avatar (grow faster around the visor's position).
- Herbivore1: Flora eaten and destroyed (leaving traces of destruction).
- Herbivore2: Flora used as hideaways, for nesting and feeding (branches and pollen).
- Carnivore Alien: Inaccessible to carnivores (hideaway of herbivore2).

Correlations with climate phases:

- Night: Flora reappears after Decomposition climate phase.
- Fertility: Flora becomes more and more numerous.
- Storm: Flora disappears (possibly flying up into the sky along the differential axis).
- Petrifaction: Not present.
- Decomposition: Not present.

Fauna: "Herbivore1"

This herbivore is very heavy, big (6-8 meters long), clumsy, and slow, and moves in small families and herds around the terrain. It has similar characteristics to the following animals, but looks more like a worm or snail without moving legs, and head.

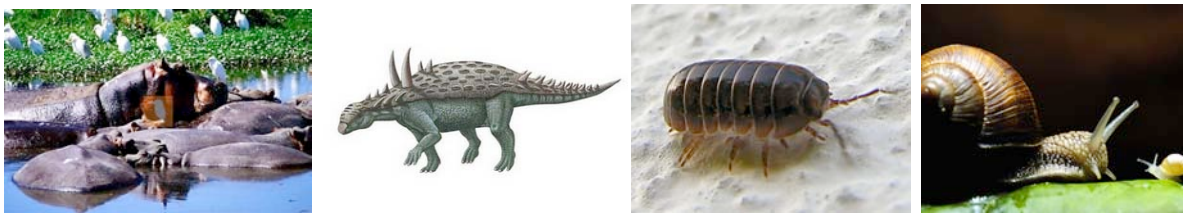


Fig.57-60: Inspiration from the animal kingdom

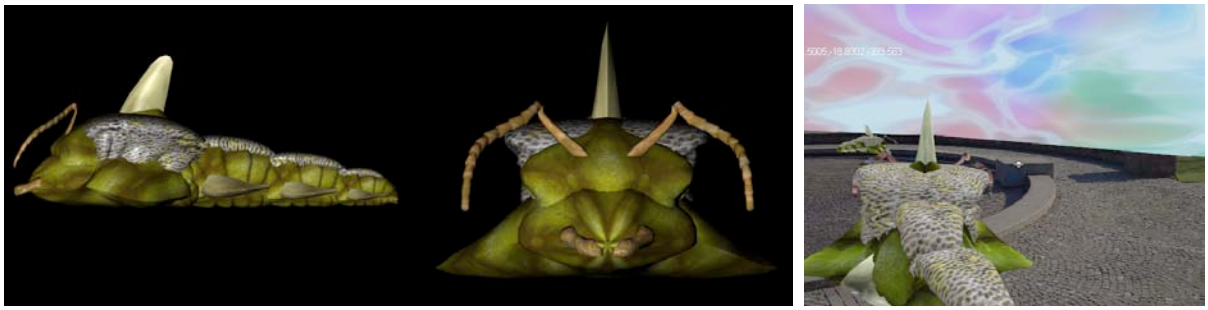


Fig. 61/62: 3D model of creature made of 4 segments for animation, creature placed in the simulator

Appearance parameters:

- Model: Ugly, clumsy, big, heavy, thick skin.
- Position (height): On or semi-submerged all over the plateau.
- Colour: Earthy: Grey, brown, green.
- Shape/animation type: Chained segments, implemented in swarm system.
- Volume: Big: 3x6x2m.
- Light: Glowing light during climate Night.
- Transparency, visibility: Possibly planar mapping when entering Glassland.
- Noise variety range: Very stable and slow.

Spatiotemporal behaviour:

- Motion type: Crawling on/in the ground, slow and regular movements.
- Speed, agility: Very slow.
- Motion direction: All over the plateau in random directions.
- Activity types: Only browsing.
- Activity level: Constant slow motion.
- Lifespan: Live forever.

Group behaviour for species:

- Closeness, clustering, sociability: Live in small groups.
- Arrangement, alignment: Casually grouped.
- Collaboration/independence: Independent browsing.
- Reproduction, cloning: No reproduction activity.

Character:

- Peaceful, dull ,confident, sedate, calm, indifferent.

Correlations with terrain:

- Central grass area: On or semi-submerged all over.
- Fogland: On or semi-submerged all over.
- Glassland: Don’t go here, or become semi-invisible (refraction or planar mapping).
- VR-world: Don’t go here.

Correlations with other creatures:

- Avatar: Can accidentally run over the avatar.

- Flora: Eat flora, leave traces of destruction in the flora.
- Herbivore2: None.
- Carnivore Alien: None.

Correlations with climate phases:

- Night climate phase: Reappear after Decomposition climate phase, represented as lights, but with usual behaviour patterns.
- Fertility climate phase: Become more and more numerous.
- Storm climate phase: Disappear (possibly flying up into the sky along the differential axis)
- Petrifaction climate phase: Not present.
- Decomposition climate phase: Not present.

Fauna: "Herbivore2"

This herbivore is volatile, nervous and restless. It moves in flocks in the atmosphere over and under the terrain's plateau and is hunted by the carnivore aliens. It has similar characteristics to the following animals, but is a more abstract creature, without moving legs and wings but with floating extensions.

Fig. 63-65: Inspiration from the animal kingdom

Fig. 66: 3D model of creature, appearance during climate Fertility and during climate Night

Appearance parameters:

- Model: Cute-looking.
- Position (height): In the air, on the ground, underneath the plateau.

- Colour: Colourful.
- Shape: Undefined (something between bird, fish and mammal) but elegant, with appendages.
- Volume: Size of a rabbit.
- Light: Glowing light during Night climate phase.
- Transparency, visibility: Possible planar mapping when entering Glassland.
- Noise (variety range): Same shape, but size and colour vary.

Spatiotemporal behaviour:

- Motion type: Restless, moves as swarm without individual body movements.
- Speed, agility: Fast.
- Motion direction: All directions, but mainly in circles around the terrain.
- Activity types: Flying (feeds from the pollen of plants), fleeing and hiding (is hunted by the carnivore), nesting and feeding (in the vegetation).
- Activity level: From inactive hiding to hyper-active flying.
- Lifespan: Short (about 10 minutes), combined with high birth rate.

Group behaviour for species:

- Closeness, clustering, sociability: Very close.
- Arrangement, alignment: Active and organized community.
- Collaboration/independence: Everything is shared and depends on the others.
- Reproduction, cloning: Often, because of short lifespan.

Character:

- Timid, nervous, insecure, restless.

Correlations with terrain:

- Central grass area: All over, in the air, and trough the terrain's plateau (terrain is no obstacle).
- Fogland: All over, in the air, and underneath the terrain's plateau.
- Glassland: Don't enter, or become semi-invisible (refraction or planar mapping).
- VR-world: Not present.

Correlations with other creatures:

- Avatar: Buzz around the visitor curiously for a while when close.
- Flora: Hide in the flora, which protects them from the carnivores, eat flora, nest and reproduce.
- Herbivore1: No interaction.
- Carnivore Alien: Hunted by this creature.

Correlations with climate phases:

- Night climate phase: Reappear after the Decomposition climate phase, represented as lights but with their usual behaviour patterns.
- Fertility climate phase: Become more and more numerous (there are more and more swarms).
- Storm climate phase: Disappear (possibly flying up into the sky along the differential axis).
- Petrifaction climate phase: Do not appear
- Decomposition climate phase: Do not appear

Fauna: “Carnivore”

The carnivores mainly live in the VR-world and only enter the rest of the terrain to hunt herbivore2 and the avatar. Before they attack, they cruise around the plateau at a distance. In order to protect themselves from the carnivores, herbivore2 can hide in the vegetation and the avatar has a defence shield. Carnivores only attack during the Fertility climate phase. They look somewhat like the following creatures, but are more abstract, fast, and aggressive.

Fig. 67-70: Inspiration from the animal kingdom, microcosms and film.

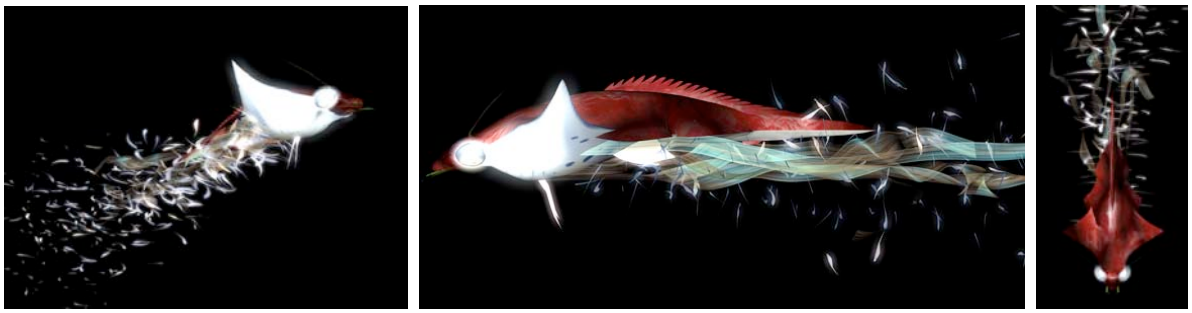


Fig. 71-73: 3D model of creature made of 4 segments for animation, with particle trail

Appearance parameters:

- Model: Volatile, elegant.
- Position (height): Coming from VR-world, getting close before attacking.
- Colour: Bluish, speckled.
- Shape: Chained segments, implemented in swarm system.
- Volume: Approximately human size.
- Light: No light.
- Noise variety range: When attacking, long and thin; when cruising in the sky, like a sheet.

Spatiotemporal behaviour:

- Motion type: Cruising, attacking.
- Speed, agility: Slow when cruising, fast when attacking
- Motion direction: Coming from and going back to the VR-world, cruising around the plateau, attacking herbivore2 and the avatar.
- Activity types: Observing, attacking.
- Activity level: Slow when cruising, fast when attacking.
- Lifespan: Live forever

Group behaviour for species:

- Closeness, clustering, sociability: Regularly dispersed.
- Arrangement, alignment: No alignment.
- Collaboration/independence: All attack at the same time.
- Reproduction, cloning: No reproduction.

Character:

- Cool, mysterious, strategic, superior.

Correlations with terrain:

- Central grass area: Attack here during the Fertility climate phase.
- Fogland: Attack here during Fertility climate phase, but with less chance of success because of poor visibility.
- Glassland: Don't enter, or become semi-invisible (by refraction or planar mapping).
- VR-world: Originate here, live as an alien life form.

Correlations with other creatures:

- Avatar: They attack the avatar but can't overcome the protection shield.
- Flora: They can't attack herbivore2 when hidden in the flora.
- Herbivore1: No interaction.
- Herbivore2: They attack herbivore2 and take them as prey to the VR-world.

Correlations with climate phases:

- Night climate phase: Do not appear.
- Fertility climate phase: Invade the terrain coming from the VR-world.
- Storm climate phase: Do not appear.
- Petrifaction climate phase: Do not appear.
- Decomposition climate phase: Do not appear.

The avatar (augmented visitor) and interaction system

The AR-avatar

The visitor is physically on-site when walking in the park and, at the same time, is represented as an avatar in the virtual world. Avatars normally represent players in virtual worlds with no context to the real world, or serve as visual elements in collaboration and communication systems. In lifeClipper3, they coexist locally and temporally as the figure visitor in the real world, and as the creature avatar in the parallel virtual world. The **avatar or augmented visitor** (AR-avatar) is the only boundary point between the two worlds, enabling the augmented visitor to experience them both, separately, or as a merged new reality.

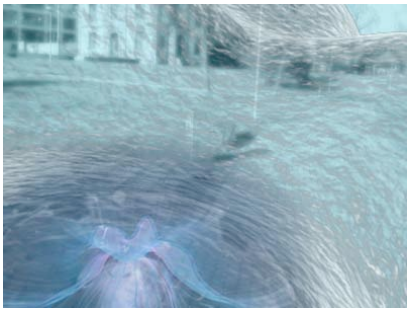




Fig 74: The visitor is connected to the flora by her own breath patterns
Fig 75: When being attacked, the avatar makes use of a defence shield (a semi-transparent texture)
Fig 76: The visitor's aura (breath patterns and proximity) influences the terrain, vegetation and cosmos

Role play: AR-avatar identity and mission

The visitor enters the lifeClipper3 experience as a spectator and explorer, without any previously assigned mission. After some time, the visitor becomes aware that she is not a neutral observer, but another ecosystem creature, with a **her own appearance and behaviour**, and defined correlations with other virtual players. She can learn more about herself by observing the reactions of other elements and by experiencing her own aura. The avatar, inhabited by the visitor, is not the only one of its kind in the ecosystem. There are similar looking creatures around the avatar, which behave in a similar fashion, and represent a herd: her **family** (social term). Observing other family members allows the visitor to better understand her own appearance and her influence on the ecosystem. The "look from outside" at this avatar skin extension considerably improves the awareness of her own "augmented identity", once the relationship has been perceived.

The visitor has no obvious game mission, but rather explores the surroundings like a movie. But, in the same way that a cinema goer normally wants not only to enjoy, but also to understand, a movie, the lifeClipper3 explorer will want to understand the environment. Building on human **curiosity and thirst for knowledge**, the challenge or mission of lifeClipper3 is to find out how the ecosystem works and how the different elements relate to one another. Unlike most games, where a player is given a character to identify with and a mission to accomplish, lifeClipper3 is about exploring surroundings,

and finding out more about the **nature of play** and one's own **“forced-into” character**.

The avatar creature and its correlations with the ecosystem

The **avatar fertilises** the vegetation and provides a base for life in the **ecosystem** during the Fertility climate phase. Plants grow faster around the visitor and their growth-rate is dependent on the visitor’s breathing (measured by biofeedback sensors). Plants only grow when the visitor exhales – breathing life into the system. The vegetation thus becomes an extension of the avatar and provides the visitor with an experience of her physical context and the connection to her surroundings. The avatar can also influence the **terrain**, bringing the ground into motion.

When the avatar is **attacked by the carnivores or nearly trampled by herbivore1**, a defence shield unfolds around it, which keeps the creatures at a distance. This **semi-transparent skin** pulsates around the avatar according to the visitor's respiration. The avatar can even fight back like a **first-person shooter:** A light beam streams out of the protecting skin in the viewing direction (the visitor becomes aware of this when moving his head). The beam is coated and integrated into the semi-transparent skin, and eliminates creatures which it intersects with.

The avatar family slowly grows after the Night **climate phase** and is only fully visible during the Fertility climate phase when being troubled by other creatures. The avatar plays the role of a passive, bodiless observer during the Storm, Petrifaction and Decomposition climate phases and is therefore not visible. After the Decomposition climate phase, the only reference to space is the **cosmos**, which pulsates according to the visitor’s breath. During the Night climate phase, the avatar is a light source, like all the other reappearing creatures. The area around the avatar is illuminated by this light, which pulsates according to the visitor’s breathing.

Two types of **sounds** are mixed together: Sounds, which come from the real world and the ones that are pre-processed. The sounds from the real world are recorded by microphones and altered in real-time. They make the AR-link from the virtual world to chance sounds in the park, as well as to noises the visitor may make when moving around the park. Altering the sounds of the visitor in real-time (or even just using the volume level to trigger other sounds) offers us the possibility of creating body sounds which seem to be from the virtual world. The pre-processed sounds are additional recordings of noises, atmospheres and music, which are attached to the different players and elements of the ecosystem. Merging sounds from the virtual and the real world gives a further set of possibilities, for example when the semi-transparent shield surrounds the visitor, the sound of the ecosystem becomes filtered and dull, while recorded body movements become more present, and a whizzing sound of defence is introduced. The laser beam is ironically given the sound of the Star Wars Jedi Knight lightsabers. The sounds of inhaling and exhaling are combined with plant growing sounds during the Fertility climate phase. During the Night phase, the cosmic sound merges with breathing sounds.

The avatar is defined through a set of **parameters and behaviour patterns**. They are dependent on the climates and relate to the other elements.

Correlations with terrain:

- VR-world: No appearance.
- Rest of the terrain: Appears everywhere during the Fertility climate phase, when being attacked, and during the Night climate phase.

Correlations with flora and fauna:

- Flora: Avatar fertilizes, catalyses growth.
- Herbivore1: Almost tramples avatar.
- Herbivore2: None.
- Carnivore Alien: Attacks avatar.

Correlations with climate phases:

- Night climate phase: Appears as light.
- Fertility climate phase: Appears as defensive skin (when attacked).
- Storm climate phase: No appearance.
- Petrifaction climate phase: No appearance.
- Dissolution climate phase: No appearance.

Correlations with cosmos:

- Influences the cosmic shell's shape, colour, visibility etc. by breathing.

Appearance and behaviour parameters during Fertility climate phase:

- 3D model shape: Globe-like virtual defence shield.
- Position (height): Fixed to the visitor (approx. 1m below the virtual camera, only position, not direction).
- Size: Diameter approx. 2.5m.
- Colour/texture: Colourful, animated texture rotates on the defence shield.
- Animation: Organic wobbling of globe, orbiting texture, strength/saturation/luminosity according to proximity to the attacker, pulsating size according to breathing.
- Transparency/opacity: Fades in and out according to proximity of attacker (carnivore, herbivore1).
- Sounds of body: Body sounds cross-fade out when defence sound enters, real-time parameter sound effects get louder over time until the Storm climate phase, additional pre-processed sounds get louder and more numerous until the Storm climate phase.
- Sound of defence: Aggressiveness (volume, pitch, reverb, …) according to proximity to the attacker.

Appearance and behaviour parameters during the Night climate phase:

- 3D model shape: Point of light.
- Light: Point of light, blueish (possibly animated texture), fixed to the visitor (approx. 1m below the virtual camera), reflecting on the terrain.
- Animation: Pulsating brightness according to breathing.
- Colour/texture: Possibly animated texture on light.
- Sounds of body: None.
- Sound of light: According to breathing.

Group behaviour of the avatar family:

- Closeness, clustering, sociability: Quite close.
- Arrangement, alignment: More behind and beside the visitor (not in front), according to the walking direction.
- Activity: Follow the visitor, react to attacks.
- Collaboration/independence: Not perceivable.
- Reproduction, cloning: Not perceivable.
- Noise (variety range): Distance between the members (min. 4m, max. 10), number (max. 8).