



First Workshop on Serious Games in Cultural Heritage (SeGaCH)  
*MATEUS & QUEIROZ, 2008 - Serious-Games for Cultural Heritage – a theoretic-practical  
multidisciplinary approach: 4. Paradigms in games and territory sciences*

*Serious-Games for Cultural Heritage  
a theoretic-practical multidisciplinary  
approach*

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1. *Ancient territory spatial data acquisition and Heritage-Game Resources*
2. *Virtual architecture and mobile heritage*
3. *Organic protagonists of Ancient Territories*
4. ***Paradigms in videogames and territory (heritage) sciences: From trans-disciplinary scientific data and synthesis to game resources and immersive gaming experiences***



**Post-(modern/positivist) symptoms for the need of a  
new paradigm of hybrid creation through the via of Information Technologies:**

1. The growing **complexity of the multi-thematic and disciplinary integration** in the scope of the Sciences of the Past, of the Territory (Landscape), of the Environment and Heritage – in full contradiction with the growing of sub-disciplinary specialization and fragmentation and the prevalence of the reductionist-dictatorial “problem-solving” constraining strategy: This claims for the new reconsideration of open holistic entities.
2. The growing role of the **scientific contextualization in the movies** industry, such as historical, scientific and characterologic fictions, today dominant.
3. The growing need for a **Science Culture** and of a **Cultural Science**, more directly actuant in the social quotidian realm.
4. The growing **prevalence of the Information Systems** at all levels, not only as support for the research (ex: GIS), but also as objective in itself as global-access platforms to knowledge
5. The use of **computer simulations** in more and more domains of knowledge. To explain and Understand through the exploratory quantitative simulation, without aprioristic thoughts...
6. The prevalence of the **Statistics, Numerical Analysis, Probabilities Analysis** (descriptive mathematics) in all the domains of creativity and communication
7. The **digital option** as an integrative and alternative milieu of all the creative disciplines (Sciences and **Arts**)
8. The proliferation of the **Centres of Living Science** (“**Ciência Viva**”) – Science as a Scenic Spectacle - or the inscenated museums and their multimedia and multi-language apparatus.
9. The integration (post-(modern/positivist) of the “**knowing subject**” and its historic-cultural dimension as an active part of the representation, explanation, and the intelligibility of the real. The dependence of the observation-context, the prevalence of the multiple-truth. The need of a new paradigm of plurality in the visions and exploration designs.
10. The **Anthropic element** considered in the realms of Natural Sciences. The ecological in all domains of Human Sciences, unifying Culture and Nature.



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**Serious-Games for the Territory, Heritage and Arts**  
are a new *form of creation* born from the *post-(modern-positivist)* fusion between the

the **Landscape and Heritage Sciences**

(Earth Sciences, Biology, Geography, Ecology, Environmental Engineering, Agronomy, Architecture, Urbanism, Archaeology, Ethnology, Regional History, History of Arts)

**Performance and Plastic Arts**

(Theatre, Music, Dance, Declamation... Painting, Sculpture, Photography, ...),

and the **Computer Sciences** (Computer Graphics, Artificial Intelligence, Dynamic-Physics Simulation)



*We prefer to speak of*

## *Virtual Recreative Scenics*

An hybrid cultural creation in interactive digital support where a real universe of interest (in this case Territorial – Patrimonial) is scientifically recreated but approached under a **scenic paradigm** (from the Latin *scena* ou *sceane*, derived form the Greek *skEnE*) in its diversity of senses and ingredients.

It integrates a **scenery** (stage) considering a particular topography (from an Outside and an Inside) with passive or active scenographic elements where a set of actions, performed by **protagonists** in interaction with the milieu and between each other, take place in a **contextual conformity** with an integrative atmosphere of diverse nature (dramatic, historical, psychic, territorial, circumstantial...) -



## **Virtual Recreative Scenics** (*inscenation*)

### **Explaining the meaning:**

**VIRTUAL** – not a material but a computer infologic object

**SCENICS** (in Portuguese: *Encenação*) - A culturally constrained representation including a scenario (stage), a group of actors (protagonists), a drama.

**CREATION** – A new production of Science & Arts

**RE-CREATION** – A medium to recreate and simulate with epistemic distance (reconstruction)

**ACTIVE** – Involving actively the *listener / observer / spectator* as a **player**, himself a protagonist.

**REACTIVE** – Involving a scenario and a set of reactive protagonists as virtual items capable of responsive simulated pattern when played.



The **Virtual Recreative Scenics** is a reconstruction of the real in a series of approaches (stages) of conceptual appropriation and finally of reproduction

(These are common issues to all forms of science and arts creativity)

Reality

Perception

Exploration

Data acquisition, treatment and analysis

Data (digital) Processing

Reconceptualization (deformation, schematization, modellization)

Reconstruction

Restitution (Rendering)

*(disciplinary “Problem-solving” reductionism dismissed)*



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## REALITY

We privilege concrete universes referring a specific TIME & SPACE.  
Historic-territorial realist worlds with a referential in eco-territorial ecosystem  
(Mateus, 1990, 2004) or cultural landscape including mosaic-like and centripetal  
arrangements of wild, rural, sub-urban, urban, and domestic zones.



## PERCEPTION

*Distinct Perception Designs:*

SCIENCE

Restrict scientific discipline vision

Enlarged transdisciplinary scientific vision

Cultural (scientific-artistic) Hybrid vision (Science & Art)

(our privileged vision)

Integrated Arts vision

Restrict artistic discipline vision

ARTS



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## CONVENTIONAL EXPLORATION & REGISTRATION

The object of interest is considered through the  
traditional creative disciplines



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## DIGITAL DATA ACQUISITION AND TREATMENT

Compiled data is converted into digital format

(as illustrated previous presentations)



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## RECONCEPTUALIZATION

Spatial-Temporal framing (Structure & Function) – ecological paradigm



## Heritage Serious-GAMES as Virtual Scenic Eco-system of the PAST

### *The ecological game.*

To **play the past** means to engage ourselves into a virtual exploration of a “complete past world” capable of response, being it schematic or complex.

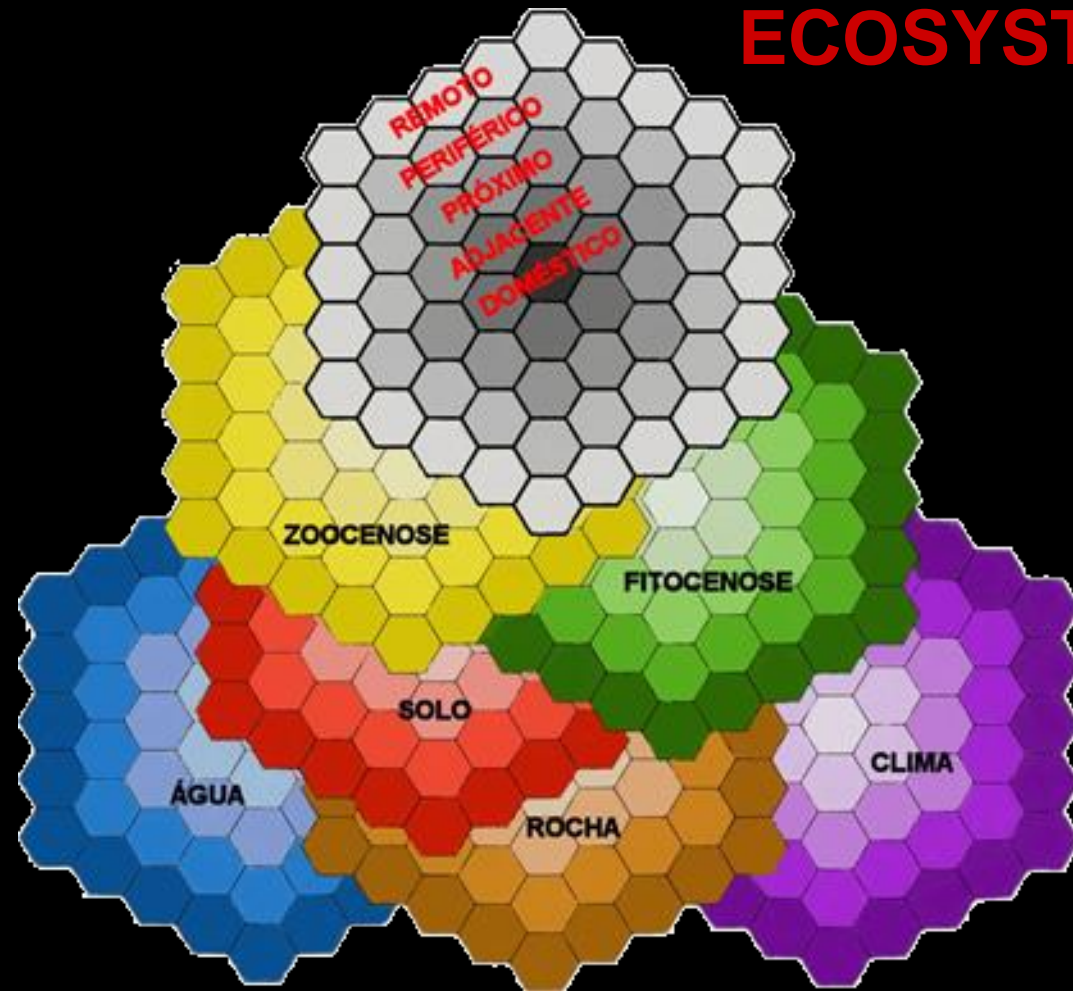
*The **positivist view** is fragmentation, focus, and reductionist problem-solving filtering.*

*The **game post-(modrernist/positivist) holistic view** implies the reconstruction of connective webs to make the virtual universe playable.*

In essence this is a pure **ecological paradigm** in the sense that ecology is the science of inter-relationships between abiotic and living components inside a particular biotope. We assume Natural / Cultural Heritage Games as Virtual Scenic Eco-system.

human impact in  
discrete centripetal  
zones of diminishing  
intensity and eco-  
artefactualisation

## THE TERRITORIAL ECOSYSTEM



The ecological hierarchy of sub-systems



## **Virtual Recreative Scenic – from heritage multimedia to heritage games**

These can evolve from the simple to the complex virtual:

1. **Portraits** – Emphasis on the physiognomy (geometry and texture)
2. **Reconstitutions** – Physiognomy + recurrent dynamics
3. **Simulations** – Virtual processes driven by scientifically parameterized mechanistic rules and algorithms
4. **Narratives** – Emphasis on the simple series of events
5. **Chronics** – Emphasis on the historical series of singular relevant events
6. **Dramas** – Emphasis on the circumstantial web of relations between personages emotively expressive
7. **Games** - Emphasis on the multi-linear exploration of the potential responses of a reactive virtual universe



## ***Hierarchical partition of space and other meaningful hierarchical webs.***

Games consider universes populated by **webs of relationship between components / inhabitants**. Games introduce for the sake of pragmatic efficiency the concept of **hierarchical partition of space**, using collection of nodes (which are just points in space defined by a single vectors or a matrix) interconnected by parent-child-sibling relationships. Each node is the *centroid* of a bounding volume (ex: a box, a sphere, an ellipsoid). Any “element” of the 3D game is at least a node, thus any inhabitant is roughly referred (in its administrative assumption) as a point and schematic volume.

These organisational webs (traditionally needed for occlusion filtering and collision detection) can be extended and reused for expressing other universes of relationship between objects.



***Natural objects (entities) – scientific concepts which are  
essentially hierarchies***

1. Species – taxonomy (abstract scope)
2. Types – typology
3. Specimens – ontology (concrete)

## “differential levels of detail” (LOD)



## LEVELS OF REALISM (LOR)

- *Levels of physiognomic detailed (LPD)*
- *Levels of access detail (LOA)*
- *Levels of manipulation (LOM)*
- *Levels of inherent scientific information (LOI)*
- *Levels of connection (LOC)*
- *Levels of expression (LOE)*
- *Levels of taxonomic realism (LTR)*

Increase of LOR can increase its PUL (Processor Unit Load), but it is not always true



**3D Replicas** are usually obtained by *sampling* with automatic quantitative morphometric data acquisition equipment at the level of surface points (i.e. 3D scanning or stereophotogrammetric apparatus).

**3D Models** are in general obtained by digital 3D reconstruction of the geometry (*composition*) through the use of (deformed) 2D & 3D primitives, “cage” of splines, (patch grids, NURBS surfaces) or editable (poly) meshes in a progressive approach to mimic the referenced reality. These have the advantage of implying a conceptual exercise in the act of modelling. **3D models** can be very different in detail, from crude (dummy or iconographic) to very detailed (quasi-replicas)



## ***Levels of access detailed (LOA)***

Natural and artefactual objects can be considered as **single indivisible volumetric units** or as a **cluster (linked hierarchical system)** of structural components arranged as a more or less complex organization (organismic paradigm)  
These composite objects are potential candidates for a **hierarchical access** to their intimate structure.

- **Single indivisible volumetric units**
- **Organized system of recurrent components**



## ***Levels of subjacent scientific information (LOI)***

Objects (elements of the abiotic natural and artificial layers of the territorial ecosystem) in serious-games are not mere props but **nodes of information** accessible to payers / visitants

This “submerged information” potentially driven by the interaction is mostly of non-vectorial form - **text, audio, photos, drawings, graphs, tables of diverse alpha-numeric data** – and may constitute important elements in terms of playability



## ***Levels of Manipulation (LOM)***

Immobile and mobile built entities can be **passive** or **responsive** to interactive manipulation

game-resources can exhibit invisible **reference manipulation hot points** and **bone systems** to act as interactive point-of-contact to players and active figurants

## Levels of connection (LOC)

**Artefactual Objects can be isolated in the Virtual 3D world or share common parents and siblings in different hierarchical networks. These parent-child-sibling hierarchies permit the travelling through their dendritic net of nodes.**

<b>Structural:</b>	node-trees – from object to component (structure) to subcomponent to element.
<b>Functional:</b>	(causal) node-trees: Action – reaction - result
<b>Technological:</b>	(constructive): – Artisan – technological design - tools – products – sub-products
<b>Chronological:</b>	(stratigraphical): – sequential layers of deposition from ancient to recent with a similar geo-genesis (including facies variants (siblings))
<b>Symbolic:</b>	webs of parental / genetic relationships between meanings
<b>Historical:</b>	sequential cause-effect events involving the objects (conception, creation, use, discard, transformation...)
<b>Other...</b>	



## ***Levels of Expression (LOE)***

3D Artefactual objects can show **different degrees of approximation (credibility)** in visual aspect in relation to their real references

Plastic arts items (sculpture, painting, drawing, etching, tapestry, jewellery...) constitute a special type of artefact in the context of 3D game-heritage scenery



## ***SPECIAL TYPE OF ARTEFACTS***

Apart from architecture, plastic arts items such as **sculpture, painting, drawing, etching, tapestry, jewellery...** constitute a special type of artefact in the context of 3D game-heritage scenery. Its reproduction and re-inclusion in the spatial, cultural, historical and personal context of its original creation and usufruct can provide us (scientist-game-developers and cyber-explorers) with **new conditions for evaluating and understanding** the original expressive and symbolic senses of these particular pieces of art.



Finally, **humans**, from **figurant-character** to fully active protagonists (**players**), passing through expressive virtual **actors** of historic-cultural specificity will be discussed in terms of Heritage Serious-Games. Again, the unique historical personages accessed via **historical** iconographic and biographic documentation **will co-inhabit with typological** characters. It is the privileged milieu for considering the complexity of ancient systems of behaviour and cognition.-



Artefactual Scenery will thus be populated with:

- **Biological entities** (plants, animals (inc. humans))
- **Performers** (actors)
- **Players**



***Organic protagonism brings other meaning to dynamics: animation (life)***

**Time-flow** (frames per second, update/render cycle, runtime)

**Animation dynamics** (Movement, Development, Evolution)

Movement = Time-flow + spatial change (translation, rotation, scaling)

Development = Time-flow + essence change in cyclic recurrent patterns

Evolution = Time-flow + shared essence change in irreversible patterns-



***As we did with Scenic Space Partition on a nested hierarchical way, we consider now Scenic-Time Hierarchical Partition from short to long time-span***

### Time partition (Natural Dynamics)

<b>Movement</b>	primary dynamic entity
<b>Gesture</b>	patternized sequence of movements
<b>Action</b>	patternized sequence of gestures
<b>Attitude</b>	patternized sequence of actions
<b>Behaviour</b>	patternized sequence of attitudes
<b>Process</b>	patternized set of behaviours
<b>Development</b>	a auto-driven set of processes
<b>Evolution</b>	an irreversible set of developments



**A protagonist is a piece of scenery which is capable to ACT or REACT in the context of the “scenic eco-system”**

**All the dynamic aspects of game-play involve protagonists in INTERACTION**

What are the rules of this interaction. These are obviously very diverse according to the typology and thematics of the VIRTUAL INSCENATIONS, but their essence lays in the distinct **Node Connection Hierarchies** (from Levels of Connection - LOC) as introduced in the former presentation.



## **Organic** *Levels of Connection (web-nodes)*

<b>Organismic</b> (structural):	object - component (organ) - subcomponent to element.
<b>Genetic</b> (parental):	biological relationships
<b>Trophic:</b>	related to food webs and chains
<b>Controlic:</b>	Predator – pray; King – vassal – subject
<b>Economic:</b>	Boss / subemployed
<b>Social:</b>	Dominant – dominated (social hierarchical status)
<b>Infological:</b>	Design (parental notion) – enformed resultant – variant (sibling / corollary) – derivative



## **Human protagonism at Creative, Conceptive, Emotive, Consumptive levels is a fundamental “complement” to “material culture”...**

*Introducing humans in the HSGs opens the virtual universe to **vivencial meaningful phenomena**  
which in this (theatrical) sense can be referred as*

### **VIVENCIAL PERFORMANCE**

*Described in plural:*

#### **Ecosystemic:**

Usage performance (in node-connection to tools)

Consumption performance (in node-connection to food-resources)

#### **Historical:**

Historical performance (acting historical “acts”)

Discursive performance (spoken textual documentation)

Wearing performance (the exposing of symbolic ornaments and badges)

#### **Artistic / expressive**

Poetical declamation performance

Singing

Mimics (expression of emotions via facial / corporal “morphs”)

Playing instruments

#### **Other performance**



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## **(VIRTUAL) HISTORIC-VIVENCIAL PERFORMANCE**

means to recreate new MATERIALITIES in the context of Heritage

Past (ephemeral) cultural phenomena not incorporated into stone-clay-bone-wood tetralogy brought again to live via Heritage Serious-Games.



## **Three Distinct Virtual Human Protagonists: Figurants, Actors, and Players**

From the point of view of scenic role or behaviour, we consider:

**Passive figurants** with no meaningful performance

**Active figurants** with eco-systemic performance (“nature vivante” Time)

**Historical personalities (actors)** with historical behaviour (narrative)

**Historical-fictional personalities (actors)** with historic-dramatic behaviour

**Reactive figurants** (Figurant Players - NPCs) - capable of response patterns  
against play contact.

**“Historiographed” players** with dramatic behaviour (historically informed)

**Universal players** without (past) historical-cultural constrain



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## Humans as more or less active figurants

Characters exhibiting non-historical (universal) behaviours  
(secondary elements in Heritage Serious Games).



## **Humans as historic-cultural virtual actors**

expose a **culturally-constrained outer physiognomy**, with:

hair / beard configuration,

Cloth, boots and occasionally armours

votive / symbolic / aesthetic ornaments (badges, crosses, rings, collars...)

They own and **use a contextual tool-set**:

Arms, kitchen & table implements, musical instruments, books, etc

*The re-introduction of these “tools” in the historic-archaeological sceneries where these have been originally used, and under the control of contextualized virtual actors can constitute new experimental designs capable of expanding our understanding of these tool-sets.*

**3D expressive actors:**

**speak:** assume a virtual verbosity partly derived from historical textual documents;

**mimics:** assume facial and corporal expression with historically informed gestures and attitudes

**represent (act) historical roles** (interconnected behaviours reconstructing events);

**sing; dance; declam; play instruments** (historical artistic expression)



*From the above schematic ideas, we derive a informal typology of  
**Scenic Times (dynamics):***

**Untemporal Scenic Experience** (no eco-systemic dynamics)

Scenic **“Nature vivante”** dynamics

Scenic **Narrative** dynamics

Scenic **Chronic** dynamics

Scenic **Drama** dynamics

Scenic **Game** dynamics

## 3D players

*As dramatic actors and players virtual, protagonists should patent  
a set of specific “characteristics”:-*

A basic **physiognomy** (form, height)

A **physiology** (metabolic status)

A **psychological** / characterologic constitution

A **psycho-somatic history**

A **historically-constrained lexicum of performance**

A resultant **operational “ability”** (Quoting Dungeons & Dragons Rule Book (Cook et al., s.d).

**Strength** – measures the characters muscles and physical power

**Dexterity** – hand-eye coordination, agility, reflex, and balance

**Constitution** – Character’s health and stamina

**Intelligence** – How well the character learns and reasons

**Wisdom** – The character’s willpower, common sense, perception and intuition

**Charisma** – Force of personality, persuasiveness, personal magnetism, ability

to lead and

physical attractiveness



## HERITAGE SERIOUS GAMES

Open projects with bidirectional creative links from Science to Gaming; from Gaming to Science

Holistic views under the Virtual Scenic Ecosystem of the PAST

With a renewed view of LODs: Levels of Realism (LOR) involving parallel (multi-thematic) hierarchies and partition-like dynamic approaches

A game scenario - not a collection of isolated “items” but a system of meaningful hierarchies of nodes of distinct nature

A world with virtual figurants, actors, and players

Vivential performance at ecosystemic, historical, and artistic levels

Players as a creative force to test the sustainability and realism of our PAST reconstructions



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Let us play with our ancestors in their own terrain with their  
own rules and our imagination