



General overview of the Language

Preamble

This document provides an overview of the project, including key objectives, methodologies, and anticipated outcomes.

Chapter 1

Context of MetaScript

Let us imagine a scenario where the creation of graphical interfaces, video games, virtual or augmented reality experiences and even virtual simulations are not limited by conventional tools.

By Conventional tools, we mean technologies, frameworks or programming language usen nowadays. (ex : Three.js pour du JavaScript, Unity pour du C#), all of them have some limitations, whether in terms of complexity, rigidity, or performance, which can hamper the creativity of developers and designers. MetaScript is there to turn this vision into reality.

It's not simply a new item for the UI developments. It's a new way of paradigm changement, created to redefine the standards of interactive and immersive design. this programming language allows you to push the boundaries of what is possible. whether creating intuitive interfaces, breathtaking games, or virtual and augmented reality environments of unprecedented depth, MetaScript is the ally that offers you speed of execution without compromising on quality.

1.1 Virtual Simulation, What is it

1.1.1 Meta-World

Theorem 1. A meta world W_0 is characterized by these properties:

- W_0 is made up of elements with which we can physically interact by touching, seeing, listening, tasting or smelling
- W_0 is made up of elements to which we have attributed a meaning. These elements are designated by $w_{0,i}$ with $i \in N$
- The $w_{0,i}$ are splitted into 2 categories : the liven ones and the static ones

Theorem 2. The world where human beings are living is a Meta-World. It is called by convention the real World and it is designated by ΩW and in this world, humans are an example on liven element.

Theorem 3. $meta(W)$ is the set which gather all the meta-worlds

Theorem 4. Let us considerate 2 meta-worlds W_1 and W_2 . Simulation is a set of finite functions $\{ f_1 f_2, ..., f_n \}$ which assure that $\forall w_1 \in W_1 \exists f_i, \exists w_2 \in W_2, f_i(w_1) = w_2, i \in \{1,2,...,n\}$

All functions which define a Simulation must be finite, meaning that they are either clearly stated either it exists some rationnal expressions to check if a function is defined into that simulation.

1.1.2 Meta-World Component

Theorem 5. Let us take a Meta-World W_0 . Everything which are defined in this meta-world is its meta-world component. $w_0 \in W_0$ means that w_0 is a meta-world component of W_0

- w_0 is made up of elements with which we can physically interact by touching, seeing, listening, tasting or smelling
- a meta-world component is a set of differents characteristics. $w_0 = \{ 'attr1', 'attr2', ... 'attrn' \}$.
For example a meta-world component can have a name, a size, a colour, a position ans so many others possibilities

- all meta-world component has at least one attribute, this attribute tell either or not the component is alive or not
- all meta-world component can have so many finite attributes as possibles, even another one meta-world component. However all the attributes of a meta-world component must be defined in the same meta-world as its.

1.1.3 Meta-World Phenomenon

Theorem 6. A Meta-World Phenomenon is some event that occurs into a meta-world which affect one or more of its components. we represent a phenomenon defined in a meta-World W_0 by this term f_{W_0} .

- a phenomenon can affect a component either it is alive or not.
- a phenomenon just happens to components defined in the meta-eorld where it is defined
- a phenomenon is declenched by something, it can be a component, another phenomenon or the meta-world itself where they are contained
 - if a phenomenon f_{W_0} . is launched by a component w_0 , this function is written $w_0 f_{W_0}$.
 - if a phenomenon f_{W_0} . is launched by a meta-world itself, this function is just written f_{W_0} .
 - if a phenomenon f_{W_0} . is launched by another phenomenon g_{W_0} , this function is written $\frac{\Delta f_{W_0}}{\Delta g_{W_0}} = g' f_{W_0}$.

1.1.4 Virtual Simulation

Theorem 7. ΔW is the Meta-World which have been created by an human. By Convention, it is called the virtual World ΔW . ΔW is the only Meta-World which respect this property : $\forall w_1 \in \Omega W, \exists w_2 \in \Delta W, f_i(w_1) = w_2$

Theorem 8. Virtualisation means to pass from a meta-world $W_a \subseteq \Omega W$ to a meta-world $W_b \subseteq \Delta W$

Theorem 9. Virtual Creation means to pass from a meta-world $W_a \subseteq \Delta W$ to another meta-world $W_b \subseteq \Delta W$

Theorem 10. If $W_b \subseteq \Delta W$ is defined by virtualisation from another meta-world $W_a \subseteq \Omega W$. We call the real-world experimentation, thes simulation which means to pass from W_b to W_a .

1.1.5 Some Examples of Simulations

1.2 Types of Virtual Simulations made by Computer

Theorem 11. we call *Simulating Setup* all the set of components which in charge to make a simulation

There are many kinds of simulations, every process where we are corresponding some World elements to another one can be considered as a simulation.

Imagination for example is a meta-world, that is its formal definition.

- starting meta-world : some scene that a people has already lived
- simulating setup : human mind
- ending meta-world : a mind-created world where static items are represented as the setup's memory and events occurs as the setup remembered them or wanted them to happens.

In our case, we still focus in Virtual Simulations where the setup is a computer

1.2.1 2D-World Simulation

2D Simulation is one of the lowest exigence capacities in simulations a 2D world is a word where the space has just 2 axis, one for the width and one another for the height. (An example is a paper sheet)

1.2.2 3D-World Simulation

3D Simulation is a 3D World is

1.2.3 Mathematical Models Simulation

This simulation is kinda different of others virtuals ones. It returns mainly

1.2.4 The Case of Simulation made by IA

This simulation is kinda different of others virtuals ones. It returns mainly

1.3 Problems solved with Virtual Simulations

Virtual environments, such as immersive simulations and 3D virtual worlds, offer a multitude of solutions for various problems in several fields. Virtual simulations are powerful tools used across diverse domains to solve problems related to training, design, testing, risk assessment, decision-making, and optimization. By providing a safe, cost-effective, and flexible platform, they enable innovation, enhance safety, reduce costs, and improve efficiency in various industries and fields.:

1.3.1 HealthCare and Medicine

Applications

- **Surgical Training:** Surgeons can practice complex procedures in a virtual environment, reducing the risk of errors during actual surgeries.
- **Medical Diagnosis and Treatment:** Simulations can help doctors understand the effects of diseases on the body and predict outcomes of different treatments.
- **Healthcare Planning:** Simulations can model patient flow in hospitals to optimize resource allocation and improve patient care.

Problems Solved

- Reducing risks associated with medical training.
- Improving diagnosis and treatment planning.
- Enhancing patient safety and operational efficiency

1.3.2 Aerospace and Aviation

Applications

- **Flight Training:** Pilots use flight simulators to practice maneuvers, emergency procedures, and instrument navigation without real-world risks.
- **Aircraft Design and Testing:** Simulations are used to test aerodynamics, structural integrity, and system performance of new aircraft designs.
- **Air Traffic Management:** Simulations help in designing and optimizing air traffic control systems for safer and more efficient air travel.

Problems Solved

- Reducing costs and risks associated with pilot training.
- Improving aircraft safety and performance.
- Enhancing air traffic management and reducing congestion.

1.3.3 Military and Defense

Applications

- **Combat Training:** Virtual simulations provide a realistic environment for soldiers to practice combat scenarios, tactics, and strategy without real-world risks.
- **Mission Planning:** Simulations help in planning military operations by modeling potential outcomes and assessing risks.
- **Equipment Testing:** Air Traffic Management: Simulations are used to test new weapons, vehicles, and technologies in various combat scenarios.

Problems Solved

- Improving training effectiveness and readiness.
- Enhancing mission planning and execution.
- Reducing costs and risks associated with real-world testing.

1.3.4 Automotive Industry

Applications

- **Vehicle Design and Testing:** Simulations help engineers test vehicle performance, safety features, and aerodynamics without the need for physical prototypes.
- **Driver Training:** Virtual simulators are used to train drivers in safe driving techniques and to prepare them for various road conditions..
- **Autonomous Vehicle Development:** Simulations are crucial for testing and refining algorithms for self-driving cars.

Problems Solved

- Reducing costs and time associated with vehicle prototyping and testing.
- Improving driver safety and training.
- Accelerating the development of autonomous vehicles.

1.3.5 Engineering and Manufacturing

Applications

- **Product Development:** Virtual simulations allow for rapid prototyping, testing, and optimization of new products, reducing time-to-market.
- **Process Optimization:** Simulations help optimize manufacturing processes, improve efficiency, and reduce waste.
- **Failure Analysis:** Simulations are used to analyze potential failure points in products and processes, enhancing quality and reliability.

Problems Solved

- Reducing costs and time in product development.
- Improving manufacturing efficiency and reducing waste.
- Enhancing product quality and reliability.

1.3.6 Education and Training

Applications

- Students can conduct experiments in a virtual environment, enhancing understanding without the need for physical resources.
- Distance Learning: Simulations provide interactive, immersive learning experiences for remote learners.
- Professional Training: Professionals in fields like engineering, healthcare, and emergency response use simulations for hands-on training.

Problems Solved

- Enhancing learning experiences and engagement.
- Providing access to practical training without physical constraints.
- Reducing costs associated with physical labs and training facilities.

1.3.7 Urban Planning and Architecture

Applications

- City Planning: Simulations model traffic flow, population growth, and infrastructure needs to optimize urban development.
- Building Design: Virtual simulations help architects visualize and optimize building designs for aesthetics, functionality, and energy efficiency.
- Disaster Preparedness: Simulations model the impact of natural disasters on urban areas to improve emergency response and resilience.

Problems Solved

- Improving urban planning and infrastructure development.
- Enhancing building design and sustainability.
- Increasing preparedness for natural disasters and emergencies.

1.3.8 Entertainment and Gaming

Applications

- Game Development: Simulations create realistic environments and physics in video games, enhancing player experience.
- Virtual Reality (VR) and Augmented Reality (AR): Simulations are used to create immersive experiences for entertainment, education, and training.

Problems Solved

- Enhancing user engagement and experience in gaming.
- Providing new forms of interactive and immersive entertainment.
- Expanding the possibilities for storytelling and experiential learning.

1.3.9 Environmental Science and Climate Modeling

Applications

- Climate Modeling: Simulations predict the impact of various factors on climate change, helping in policy-making and environmental protection.
- Ecosystem Management: Simulations model the impact of human activities on ecosystems to develop sustainable management practices.
- Natural Resource Management: Virtual models help in managing resources like water, forests, and fisheries by predicting future scenarios.

Problems Solved

- Predicting and mitigating the impact of climate change.
- Promoting sustainable practices in ecosystem and resource management.
- Enhancing decision-making for environmental policies.

1.3.10 Finance and Economics

Applications

- Climate Modeling: Simulations predict the impact of various factors on climate change, helping in policy-making and environmental protection.
- Ecosystem Management: Simulations model the impact of human activities on ecosystems to develop sustainable management practices.
- Natural Resource Management: Virtual models help in managing resources like water, forests, and fisheries by predicting future scenarios.

Problems Solved

- Predicting and mitigating the impact of climate change.
- Promoting sustainable practices in ecosystem and resource management.
- Enhancing decision-making for environmental policies.

1.3.11 Telecommunications and Network Management

Applications

- Climate Modeling: Simulations predict the impact of various factors on climate change, helping in policy-making and environmental protection.
- Ecosystem Management: Simulations model the impact of human activities on ecosystems to develop sustainable management practices.
- Natural Resource Management: Virtual models help in managing resources like water, forests, and fisheries by predicting future scenarios.

Problems Solved

- Predicting and mitigating the impact of climate change.
- Promoting sustainable practices in ecosystem and resource management.
- Enhancing decision-making for environmental policies.

1.3.12 Construction and Civil Engineering

Applications

- Structural Analysis: Simulations assess the stability and durability of buildings, bridges, and other infrastructure under various conditions.
- Project Planning: Simulations optimize construction processes and resource allocation.
- Safety Training: Virtual environments provide construction workers with training on safety protocols and equipment handling.

Problems Solved

- Reducing risks and improving safety in construction.
- Enhancing project planning and efficiency.
- Improving structural integrity and durability of infrastructure.

1.4 Some of the actual Virtualizing tools

1.4.1 Game Engine

1.4.2 Dedicated Simulation Softwares

1.4.3 3D Modeling Tools

1.4.4 Virtual Reality and Augmented Reality Softwares

1.4.5 Educational Simulation and Training Tools

1.4.6 Cloud System Simulations

1.5 MetaScript, the Virtual Simulations Language

1.5.1 Actual Limitations

1.5.2 MetaScript, the new proposal in simulations technologies

Chapter 2

Presentation of the Langage

- 2.1 MetaScript Philosophy
- 2.2 MetaScript Softwares Architecture
- 2.3 Characteristics of MetaScript
- 2.4 Graphical Scene Tools
- 2.5 Comparison with Programming Languages
- 2.6 Briefings about MetaScript Syntaxes

Chapter 3

MetaScript Algebra

3.1 Basic Fundamentals

- Linear Algebra
- Differential Equations
- Numerical Methods
- Geometry and Trigonometry
- Graph Theory
- Lagrangian and Hamiltonian Mechanics
- Fourier Analysis

3.2 Rules of MetaScript Algebra

Chapter 4

Formal Grammar of Language

Chapter 5

MetaCore : Graphical Integrator

Chapter 6

Memory Management

Chapter 7

MSCP : MetaScript Compiler

Chapter 8

Hardware Management with MetaScript

Chapter 9

The New Paradigm : Visual Oriented Programming

Chapter 10

Vision and Scope of Language

Bibliography