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# SIMPLE Toolchain: Coupling GAMA simulation with VR universe

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## Keywords

Virtual reality, Agent-based simulation, Unity, GAMA

## Abstract

Agent-based simulation is increasingly used in an interactive context to define computer-based serious games and concertation tools. At the same time, video games have undergone extremely important developments, reaching impressive levels of complexity and sophistication, and proposing new ways of exploring virtual universes, for example through virtual reality (VR). There is therefore a clear interest in coupling these two approaches, with agent-based simulation enabling models to be built on a scientific basis, and video game engines enabling these simulations to be explored and interacted with in an immersive way. In this context, we present the tool developed for the European SIMPLE project, aimed at developing digital tools to raise awareness of environmental issues. This tool links GAMA to Unity, a widely-used game engine. In particular, it enables fluid data exchange, real-time visualization and user interaction in VR environments, enabling researchers to exploit the strengths of ABM and VR to produce more attractive and impactful simulations. One of the key features offered by this tool is the ability to transform using Wizards any GAMA model into a virtual universe that can be explored and interacted by one or more players through VR. For example, GAMA can be used to send the position and geometry of agents directly into the virtual universe in real time, to update terrains/grids or to control object animations. Similarly, the position of players in virtual universes is sent directly to GAMA, which can then display them and take into account their actions in the simulated world, i.e. GAMA can be used to synchronize the different actions of the players. This tool is fully documented and offers a set of example models to illustrate the various features included. A tutorial for transforming a GAMA model into an interactive virtual universe is also provided. Finally, tools for statically exporting geometries from GAMA or Unity are also provided. Complementing this tool, a web-based middleware interface has been developed to streamline gaming sessions for users and ensure a stable network environment between the GAMA simulation and connected virtual reality devices. This middleware supports the simultaneous connection of multiple devices to GAMA, facilitating multi-user interactions such as multiplayer gaming. Finally, it offers a set of functionalities enabling non-IT users to easily launch and control game sessions.

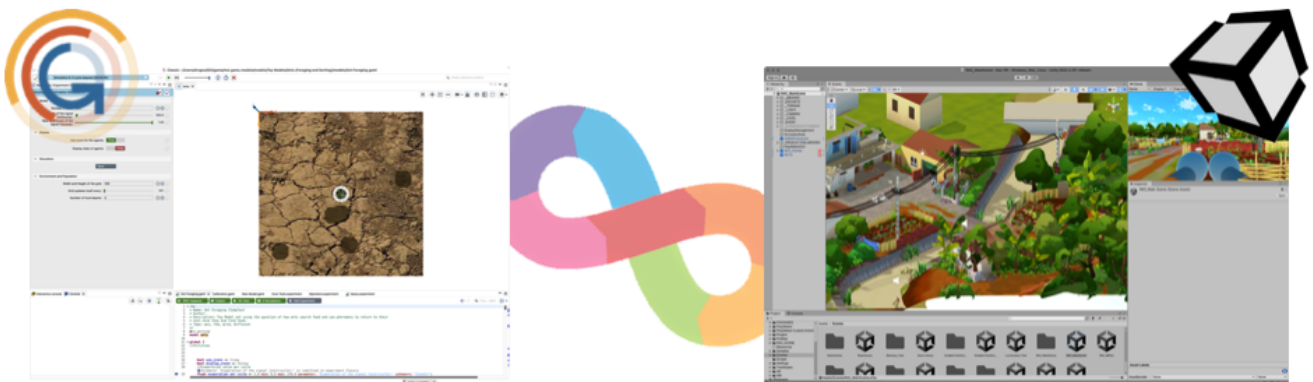


Figure 1: Coupling GAMA simulation with VR universe

## Additional material

The source code of the toolchain can be found here: <https://github.com/project-SIMPLE/simple.toolchain>, and the source code of the web application can be found here: <https://github.com/project-SIMPLE/simple.toolchain>