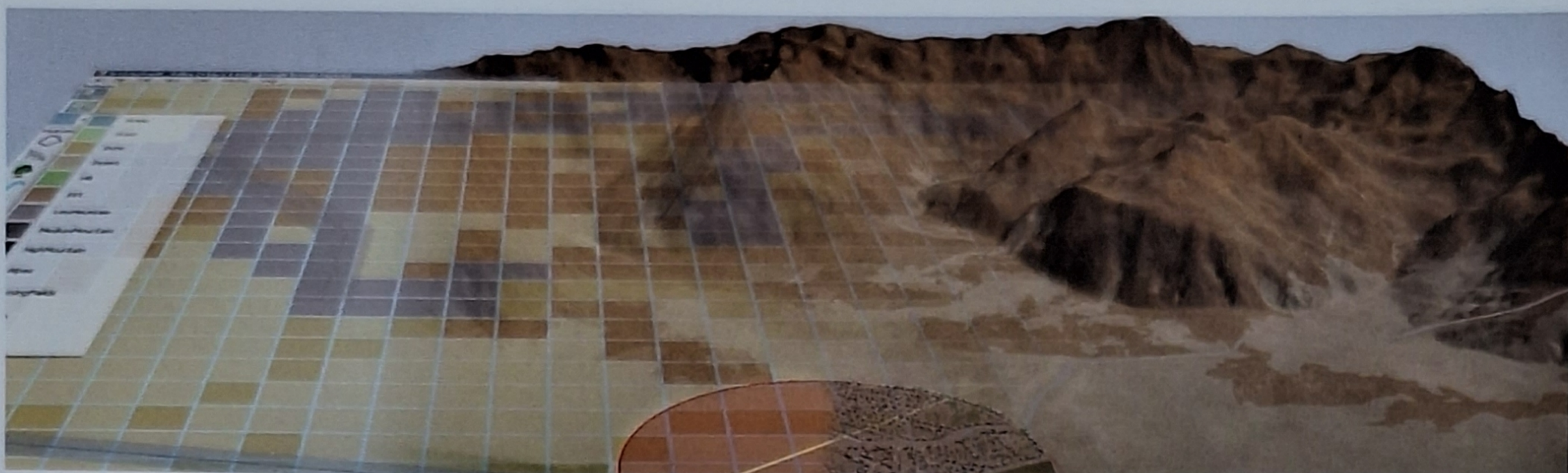




Game research  
for training and  
entertainment



### Semantic Virtual Worlds

The GATE project is developing visions on research that is necessary to maintain a leading role of the Netherlands in game research for training and education. One of the research directions with high impact is into semantic virtual worlds.

### Challenges

The GATE vision meetings have identified three main research challenges that lie ahead. (i) Find innovative methods and techniques that enable automatic matching of sensor data to semantically rich models. (ii) Find innovative methods and techniques that enable declarative generation of virtual worlds by capturing designer intent into semantically rich models. (iii) Find innovative methods and techniques that enable automatic transformation of virtual worlds into metaphor worlds to achieve a better (serious) gaming experience. Note the prominent role of the keyword semantics. The pivotal point of this research theme is the use of semantically rich models, which have not only physical characteristics, but also have meaning and behavior, and allow for proper interaction with other surrounding components in the world model. Reconstruction techniques and procedural modeling techniques meet on the pivotal point of semantics. When reconstruction techniques match and identify semantically rich model instances within an observed real world, they can be re-instantiated in a virtual world by using procedural generation techniques.

### Impact

Innovation into the above directions will lead to new functionality and services, such as the following. **Automatic geometric reconstruction.** 3D point clouds are currently the number one data source for geometric reconstruction. Point clouds are either obtained from laser range measurements or from photogrammetric analysis of imagery. Innovations are still required in the processing of point clouds, reaching for faster algorithms, more accurate data, and better segmentation and model fitting algorithms. **Automatic semantic analysis.** More than just a geo-

metric reconstruction, innovation should head for true semantic analysis of data. Instead of fitting just geometry to the data, algorithms should be invented that decompose the data into a coherent set of semantically defined objects. This analysis should not only hunt for objects in isolation, but consider the full scene context and the relationships among all objects in it.

**Seamless declarative modelling.** Game world design environments shall strive after a full integration of procedural generation techniques and interactive editing operations. The tools shall more effectively translate high-level designer intent into adequate world characteristics, leading to more accessible tools with improved productivity.

**Re-usable semantic object library.** A key innovation lies in the development of a re-usable semantic object library. Such a semantic library provides the game designer with a large variety of generic semantic objects, each of which knows how it looks, how it behaves, how it relates to other elements of the game world and in which ways it can serve the designer's intent.

**Metaphor worlds.** Experiments with serious gaming over the past years have learned that game worlds do not need to resemble the real world at all times. On the contrary, some games demand for a metaphorical representation of the world. These metaphor worlds shall be designed to emphasize a certain key concept of the world, while de-emphasizing irrelevant details. **Adaptive worlds.** The final field of innovation we identify for procedural generation of game worlds is in the field of **adaptive worlds.** As the methods for procedural world generation progress, opportunities open up to push these algorithms to the end of the pipeline: creating content at run-time. Game play and user customization can then steer the creation and fine-tuning of the virtual world, thus allowing adaptive worlds with endless possibilities.

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The government has appointed a number of Top Sectors in the Dutch industries, one of which is Creative Industries, <http://www.top-sectoren.nl/creatieveindustrie>. Part of this sector the gaming domain. The working group on gaming has proposed the Innovation Network GATHER - GAMES for SafeTy, Health,

Education, and IndustRy. Many representatives from industry, government, and knowledge institutes have contributed to this innovation plan. The GATHER document was edited by Jan Willem Huisman (IJsfontein), Mark Overmars and Remco Veltkamp (UU).t