

## Procedural Roadway Generation - project proposal

This project aims at the on-line (i.e. runtime) automatic procedural generation of roadways, i.e. the path lines, in 3D space, which define the trajectory of roads in virtual game worlds.

The procedural generation of road-related content is an active field within game technology and computer graphics research. Recent articles in many journals and conferences published promising results in the automatic creation of city street networks, the off-line generation of racing tracks, the sketch-based generation of roads or even the generation of road/street geometry. Within our own group we are already currently researching these last two topics.

In this project, students should implement a new procedural method whose expected output should be a curved path/line, located in a three-dimensional space. The format of this output is open for decision, but it is likely to be one of the following: 3D spline, 3D Bézier curve or a 3D NURBS curve/surface.

The input parameters for this new procedure will control the generation process. They are divided in two types:

- **Explicit**, i.e. geometric parameters which define the average degree of: **curvature**, **inclination**, **smoothness/sharpness** (of curvature), **bifurcation**, and others to be researched by students.
- **Implicit**, i.e. gameplay parameters, based on the explicit ones, which define the average degree of: **speed**, **visibility** and **entropy**, and others to be researched by students.

The novelty of this project lies in the use of all of these parameters to control the generation process. Additionally, this new method should be highly efficient, optimized for on-line performance. This offers rewarding challenges and opens up a pathway for further innovation.

Road geometry generation is not an expected result of this project. We aim to integrate the results of this project with the results of another (currently finishing) MSc project, on the procedural generation of road geometry. However, for demonstration purposes, we expect some simple geometry to be present in this method (e.g. extruded surface, simple texture, etc). Both open roads and closed tracks are desired results for this project.

Although games like *Civilization* have been using road specific rules in their map generation algorithms for ages, it's games like *Burnout Paradise* or *Driver San Francisco* and their highly, almost never-ending, complex cities which seem to request advanced road generation. Road generation can be an important aspect in the future of game development. Not only can game development be made more efficient, but also new forms of gameplay can emerge with it. In fact, we aim to incorporate this new procedure in our own research on linking gameplay with procedural methods, in adaptive game worlds. Gameplay concepts like fun, danger and others can be used to determine the values of the parameters mentioned above.

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