Towards the Reconstruction of Historical Gardens and Parks Using the Techniques of FSPM

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Motivation and Introduction

The need for a reconstruction of parks or gardens using FSPM techniques can have different contexts. The motivation can be to virtually preserve a part of our cultural heritage or important historical places, which may not exist anymore, and make them accessible to the general public (possibly also with historical development over time), or to predict their development and impact of management decisions (e.g. pruning).

The objective of this poster is to present our test model of the park belonging to the castle Budatín in Slovakia and discuss how the techniques of functional-structural plant/tree modelling can be used to create a realistic 3D reconstruction of historical gardens and parks with the possibility of predicting their future development.

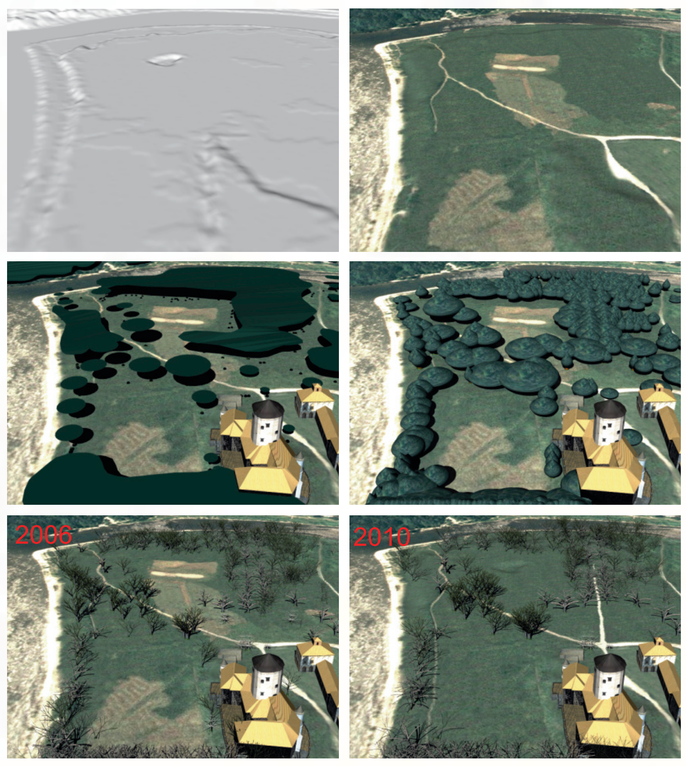
Pairs of pictures (left - taken in 2006, right - taken in 2010) show the changes that were made to the park as part of an EU-funded project to revive and revitalize the park (running from May 2009 till March 2011).

Reconstruction Process

The process of the reconstruction in GroIMP starts with generating a terrain from a heightmap. The orthophoto of the park is edited by deleting trees and used as a texture on the terrain. Then the model of the castle is imported and tree data from the database are used to place trees and to create envelopes. The height of trees is based on tree coverage data and own measurements.

In the following step, tree growth is simulated. Selected branches or trees can be, between simulation steps, pruned interactively or automatically.

For rendering, lights are added to the scene.



Reconstruction of the park step-by-step as described in the text. Last two pictures show simulation results based on available data from years 2006 and 2010.

Park Model

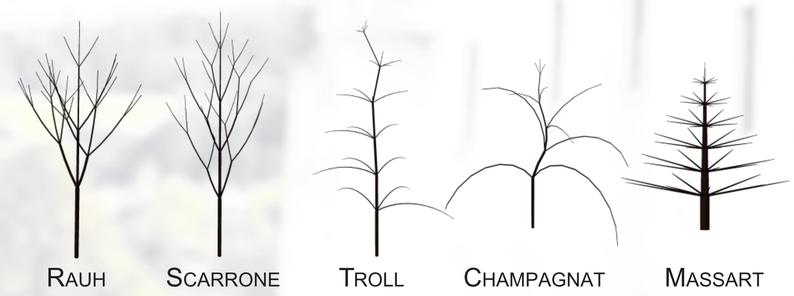
Three different approaches / software applications were used to create a 3D park model:

- *geographic information systems / ArcGIS* (ArcGIS 2010)
- *Virtual Reality Modeling Language (VRML)* (VRML 2010)
- *eXtended L-systems language (XL) / GroIMP* (Kniemeyer et al. 2010)

Data processed by ArcGIS (terrain, water, tree coverage, surrounding buildings, positions of trees based on a tree position map) and a VRML model of the Budatín castle with textures (created by J. Lacko, Comenius University in Bratislava, Slovakia) were imported into GroIMP and further edited. Diffuse and direct light (sky and sun) were also included into the scene. Then tree models were created using XL syntax.

Tree Model

First, measured data for trees (trunk diameter at BH, crown diameter, tree height), read from an accessible database, were used to create tree envelopes. To create more detailed structure, the architectural tree models described by Hallé, Oldeman and Tomlinson (1978) were implemented in XL. Tree structures grow within tree envelopes. To improve the plausibility of tree models, species-specific parameters are used and read from the database. To enhance realism, textures for bark (see below) and leaves (not shown here) for specific tree species were used.



Architectural models used to model trees growing in the park.

Future Work

To improve the value of the model, and to plausibly simulate structural development of trees over time, we would like to include some techniques of FSPM to the model. To improve the structure of tree models, e.g. a growth unit approach could be used. We plan to include climate data and the GroIMP radiation model to simulate competition for light and to provide input data for a simple photosynthesis model to simulate carbon gain as an input for growth.

Acknowledgement

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