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OpenAlea 2.0: Architecture of an integrated modeling environment on the web

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Highlights: Plant modeling is based on the use of a diverse set of design paradigms (L-systems, visual programming, imperative languages or sketch-based interfaces). In this poster, the architecture of a new multi-paradigm and integrated modeling environment is presented. This desktop application will become a distributed web application, allowing to run simulations on a cloud computing system and share virtual experiments on the web. The modeling environment will run on a web browser using HTML5 and WebGL technologies.

Keywords: Scientific workflow, Integrated modeling environment, Web 2.0, WebGL

The development of a model of plant or cellular tissue requires the use of a modeling paradigm: (i) imperative using a script or a compiled language, (ii) declarative to define a set of rewriting rules like in L-systems, (iii) interactive using a sketch-based interface for creating 3D models of plants, or (iv) visual programming to combine existing components. All these modeling paradigms have been developed in different software platforms in the plant modeling community, but, as of today, none of them provides all the modeling paradigms in an integrated software environment: vlab/LStudio (Prusinkiewicz et al. 2007), GroIMP (Hemmerling et al. 2008) and L-Py (Boudon et al. 2012) focus on L-systems; TreeSketch (Longay et al., 2012) focuses on sketch-based modeling of tree; and OpenAlea (Pradal et al., 2008) focuses on visual programming. However, the need to develop more complex and integrated models, often assembling many sub-models, leads us to consider a modeling environment capable of supporting multiple design paradigms and models, and make them interoperable.

In this poster, we will present the architecture of a new integrated modeling environment, based on OpenAlea, able to use different paradigms for plant modeling (e.g. L-systems and visual programming). The user will be able to construct virtual scenes and environmental models, and to simulate them using either of the preceding paradigms or a combination of them. It is possible to integrate different model applications in this environment and to share data between these applications via well-defined communication protocols. The first prototype takes the form of a desktop application, but will become a distributed web application, based on HTML5 and WebGL technologies.

LITERATURE CITED

Boudon F, Pradal C, Cokelaer T, Prusinkiewicz P. and Godin C. 2012 L-Py: an L-System simulation framework for modeling plant development based on a dynamic language. *Frontiers in technical advances in plant science*, vol. 3, Art. 76.

Hemmerling R, Kniemeyer O, Lanwert D, Kurth W, Buck-Sorlin G. 2008 The rule-based language XL and the modeling environment GroIMP illustrated with simulated tree competition. *Functional Plant Biology* **35**:739–750.

Longay S, Runions A, Boudon F, Prusinkiewicz P. 2012 Treesketch: interactive procedural modeling of trees on a tablet. In *Proceedings of the international symposium on sketch-based interfaces and modeling*. Eurographics Association 107-120

Pradal C, Dufour-Kowalski S, Boudon F, Fournier C and Godin C. 2008 OpenAlea: a visual programming and component-based software platform for plant modelling. *Functional Plant Biology* **35**:751-760.

Prusinkiewicz, P, Karwowski, R and Lane, B. 2007. The L+C plant modelling language. In Functional-Structural Plant Modelling in Crop Production, J. Vos et al. (eds.), Springer.