Workshop Keynote Abstracts

SeCoGIS Keynote: Semantic modelling and vario-scale geo-information

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Date: Tuesday 14:00-15:30
Room: Louise 1b
Chair: Max Egenhofer (University of Maine, USA)

Peter van Oosterom obtained an MSc in Technical Computer Science in 1985 from Delft University of Technology, The Netherlands. In 1990 he received a PhD from Leiden University. From 1985 until 1995 he worked at the TNO-FEL laboratory in The Hague, The Netherlands as a computer scientist. From 1995 until 2000 he was senior information manager at the Dutch Cadastre, were he was involved in the renewal of the Cadastral (Geographic) database. Since 2000, he is professor at the Delft University of Technology (OTB institute) and head of the section "GIS Technology". He is the current chair of the FIG joint commission 3 and 7 working group on "3D-Cadastres" (2010-2014).

Abstract The Digital Landscape Model (DLM) contains the basic primary model of reality. DLMs at lower accuracies can be generated by the derivation of primary models at lower semantic and geometric resolution from the basic DLM. In generalization this is called "model generalization" and this is based on reclassification, selection and aggregation operations. The Digital Cartographic Model (DCM) is the result of applying "cartographic generalization", i.e. reduction, enlargement, and modification of the graphic symbols to the DLMs. It is well known that in order to automate generalization, the semantics plays a crucial role in the decisions. Although the separation between DLM and DCM is considered theoretically as the optimal way of maintaining data sets at multiple scales, in practice data producers, like national mapping agencies (NMA), wrestle with the question what to store explicitly in order to efficiently maintain their geographic databases and maps. A main disadvantage of explicit storage of both models, up to the data instance level, is that it leads to more redundancy in multi-scale data models and makes it more difficult to manage geographic databases. We can extend the line of thinking for the scales stored in the database: If certain features are present at multiple scales, then why store these representations redundantly? Variable-scale data structures have been proposed to provide an answer. Two advantages of variable-scale data structures are: 1) no, or at least very little, redundancy between scales and 2) also the possibility of "in-between scales" representations, not only the fixed, stored representations. Vario-scale structures have to apply both semantic and geometric techniques in order to obtain good representations. Most recently the true vario-scale structure for geographic information has been defined by the property: a delta in scale leads to a delta in the map (and smaller scale deltas lead to smaller map deltas until and including the infinitesimal small delta) for all scales. The structure is called smooth topological Generalized Area Partitioning (tGAP) and the solution is based on full integration of 2D space and 1D scale representation into a single 3D data structure: the space-scale cube (SSC). The 2D polygonal area objects are mapped to 3D polyhedral representations in the smooth tGAP structure. The polyhedral primitive is integrating all scale representations of a single 2D area object. Together all polyhedral primitives form a partition of the space-scale cube: no gaps and no overlaps (in space or scale). Obtaining a single scale map is computing an horizontal slice through the structure. The structure can be used to implement smooth zoom in an animation or morphing style. The structure can also be used for mixed-scale representation: more detail near to user/viewer, less detail further away by taking non-horizontal slices. For all derived representations, slices and smooth-zoom animations, the 2D maps are always perfect planar partitions (even mixed-scales objects fit together and form a planar partition).