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Expanding Boundaries:
Systems Thinking for the Built Environment

Urban SOLar Visual Explorer (UrbanSOLve) – A solar performance-based decision support for the early-design of neighborhood projects

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Workshop Proposal

At the early-design phase of neighbourhood projects, design decisions are being made, among others, on the building typology, massing, and layout, which affect the heat losses and solar gains and thus influence the future energy performance of the design. Despite recent development in the field of decision-support instruments, limitations remain, particularly regarding seamless integration into the design process, computational cost of urban-scale simulations, and user-guidance features.

As an attempt to overcome these limitations, we propose a multi-criteria decision-support workflow that estimates the passive, active, and daylight performance of neighbourhood variants automatically generated from a set of urban design parameters provided by the user. This prototype tool is developed to provide practitioners with early-stage design alternatives in an interactive and iterative sequence, guiding them towards a design with improved solar and energy potential. The core of the workflow is coded and packaged as a Grasshopper plug-in for Rhino, with a customized interface for gathering the user-inputs.

We propose to explore the effectiveness, relevance, and usability of the prototype through a workshop during which participants will learn about the assessed performance criteria and how they are affected by specific design parameters, through a realistic design problem adapted from a masterplan. The targeted audience is a group of up to 25 architects and/or urban designers with some level of practical experience, particularly in the early-design phase of neighbourhood projects. No prior knowledge of the tools (Rhino, Grasshopper, etc.) is required.

The tentative schedule (subject to change) of the workshop is as follows:

1. Initial questionnaire to gather information on the participants' level of experience and knowledge regarding tools and methods (if possible prior to event)
2. Overview of the prototype to be tested and the performance criteria it addresses
3. Initial ranking phase, of design alternatives provided to the participants, with respect to each performance criterion
4. Presentation of the design problem, including the constraints (e.g. targeted density) and design variables (e.g. choice of building typology)

5. Testing of the tool by the participants
6. Second ranking phase
7. Final questionnaire to gather feedback from participants on their experience with the prototype and to identify further development avenues

The full duration of the workshop should be of about 3-3.5 hours. It will take place in a computer lab where all required programs will have been previously installed. Participants do not need to bring any material.

Note: The prototype to be tested is a beta version in its early development stage, stemming from a PhD thesis conducted at the EPFL.

Illustrations

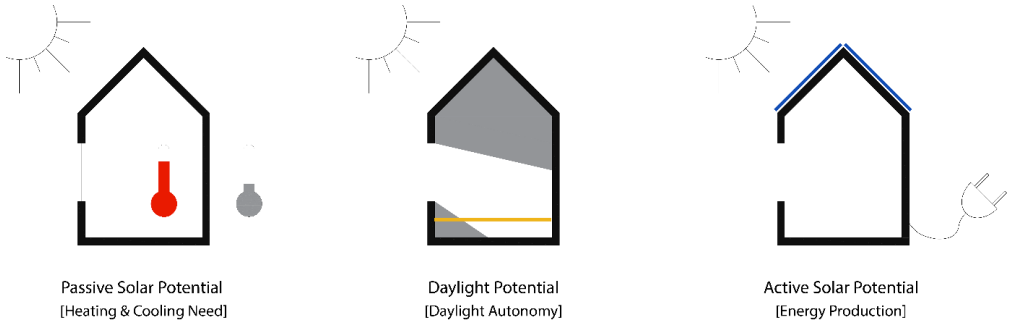

Figure 1 – Performance criteria assessed by the tool

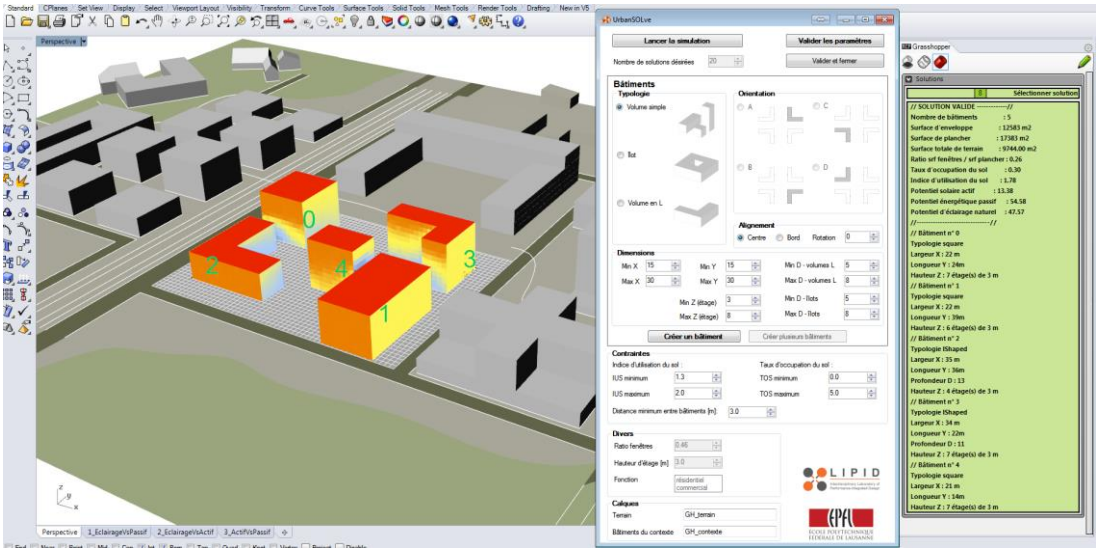

Figure 2 – Screen capture of the Rhino and UrbanSOLve interface, with the irradiation map of a variant generated from the user-inputs