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**Building zero energy districts in tropical climates.
Development of design tools for
morphology/comfort/energy coupled optimization.**

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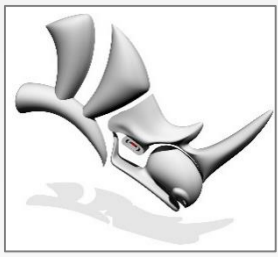
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Building zero energy districts in tropical climates. Development of design tools for morphology/comfort/energy coupled optimization.

Coupling multiple weather-based simulation models and tools via a Rhino-Grasshopper platform.

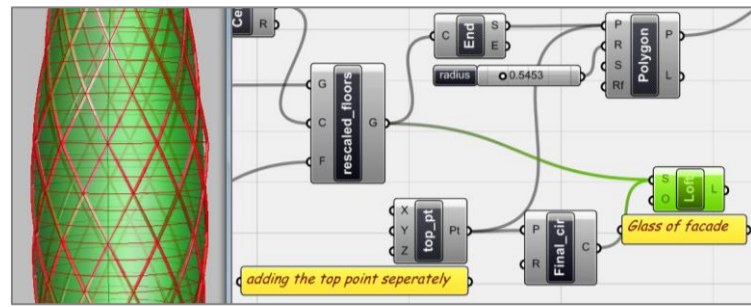
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APPROACH

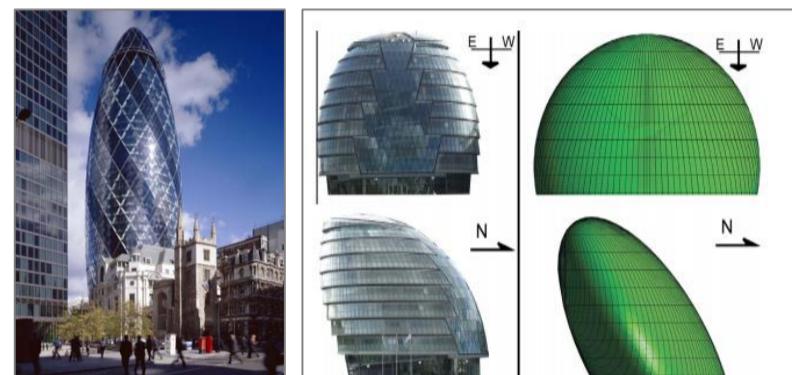
The couple Rhino-Grasshopper is a **parametric modelling** tool that is able to algorithmically control 3D models and geometrically optimize them to any defined criteria.

Grasshopper as a script-based Rhino plugin makes generating **complex geometries** easy. Architectural building designs belong to these complex geometries and are nowadays a reality.

Environmental sustainable building design requires the use of **multiple weather-based simulation tools** to assess the effect of the built environment on the local weather conditions.



Algorithmically generated and controlled building form in Rhino-Grasshopper
Khabazi_Algorithmic modeling with Grasshopper



Swiss Re HQ Building, London Foster and Partners
Greater London Authority Building 2013-Caruso, Optimal theoretical building form to minimize direct solar irradiation.

OBJECTIVES *How to design bioclimatic neighborhoods in dense tropical urban areas?*

Current design practice for buildings located in dense urban tropical areas imply multiple, independent and multi-scale models, tools and interfaces making continuity of the overall building environmental study (from mesoscale to microscale) impossible. This **modeling issue** makes the efficiency of passive design strategies adapted to tropical climates **uncertain**.

The **objectives** of the presented thesis are:

- To take into account both thermal and airflow transfers at the urban scale
- To improve currently available models ;
- To couple them ;
- To make them suitable for urban tropical microclimate simulation .
- To develop a unique, reactive and flexible environmental models coupling platform via Rhino-Grasshopper.

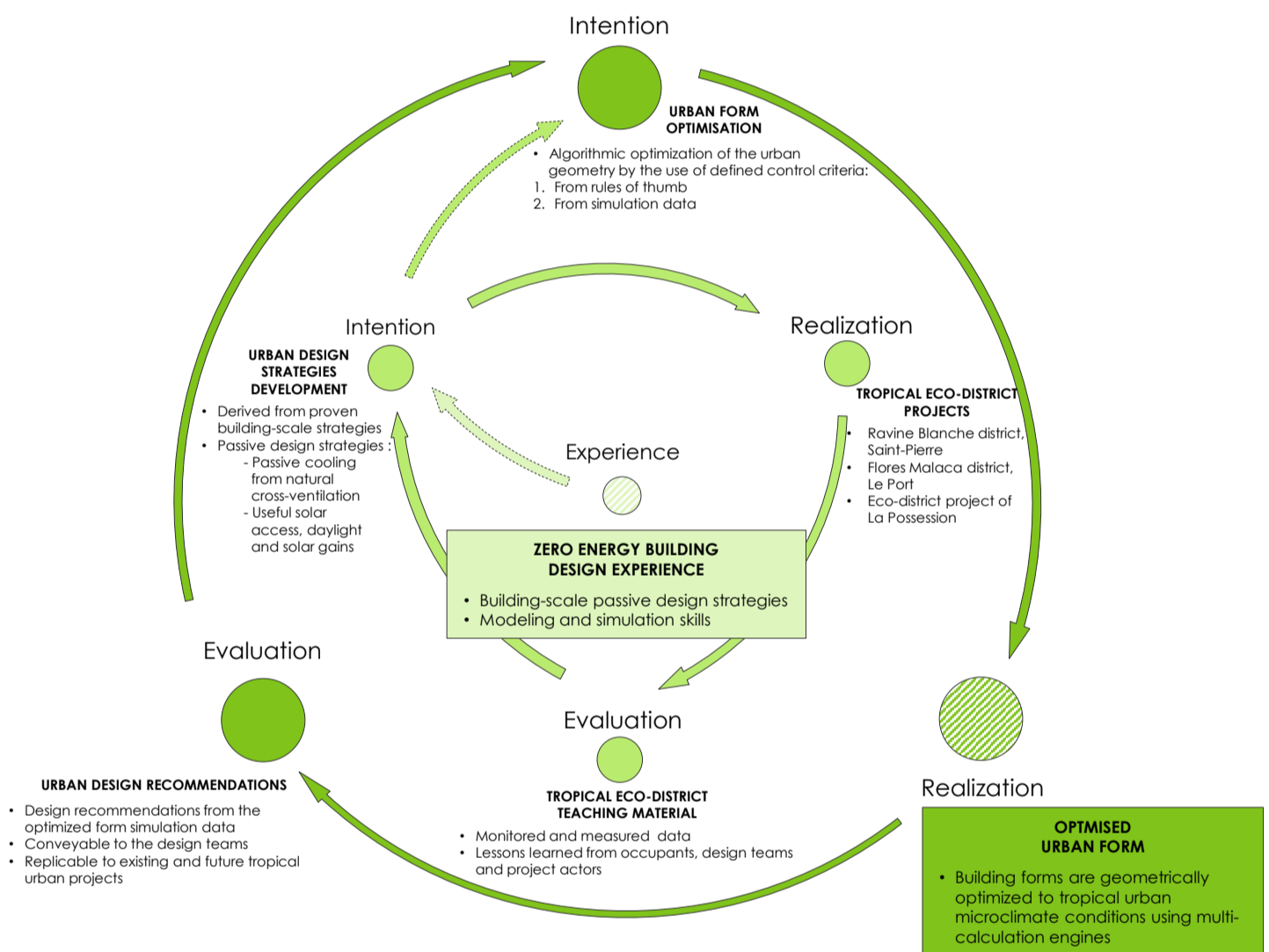
METHODOLOGY - DESIGN PROCESS

"Design is the process of realizing intentions."

Developing design tools for morphology/comfort/energy coupled optimization involves a development methodology following a **global design process**.

This thesis' methodology is built around selected design principles and **experiences** drawn from zero energy built and monitored projects in the **tropical climate of La Reunion**. The methodology can be illustrated by the following spiral.

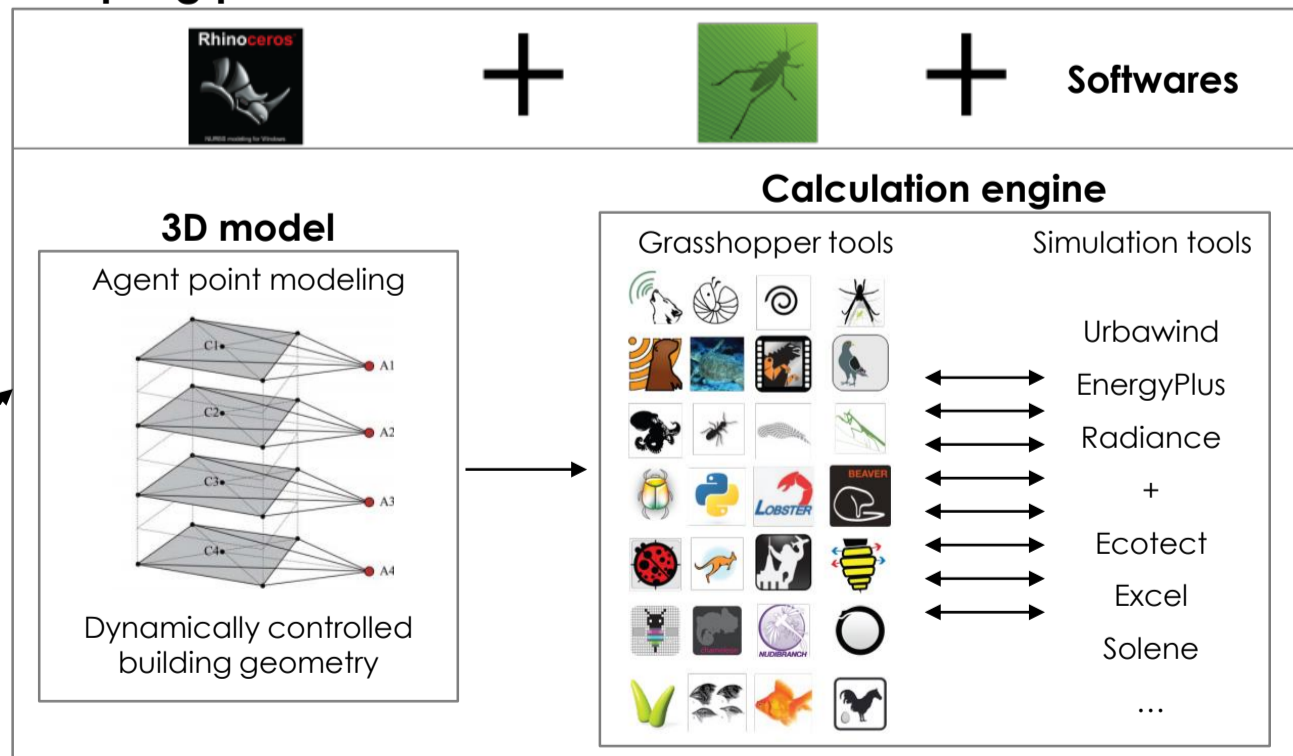
From zero energy building design experience to passively optimized urban form.



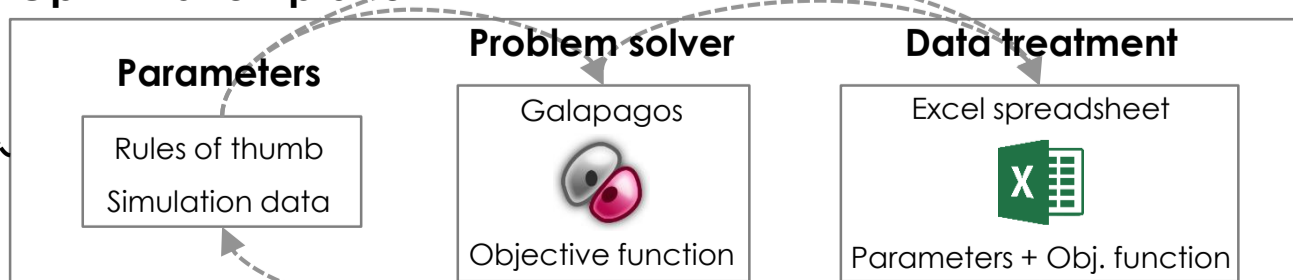
EXPECTED RESULTS

The expected achievement of this thesis is a **coupling platform**, solving continuity (temporal and spatial) issues of current **global environmental study** of buildings in tropical urban areas.

Coupling platform



Optimization platform



It will use the great range of weather-based simulation tools to assess the impact of the urban microclimate on buildings, occupants and pedestrians' comfort and ultimately **optimize the urban form to passive design strategies**.

Global environmental study and optimized building form

