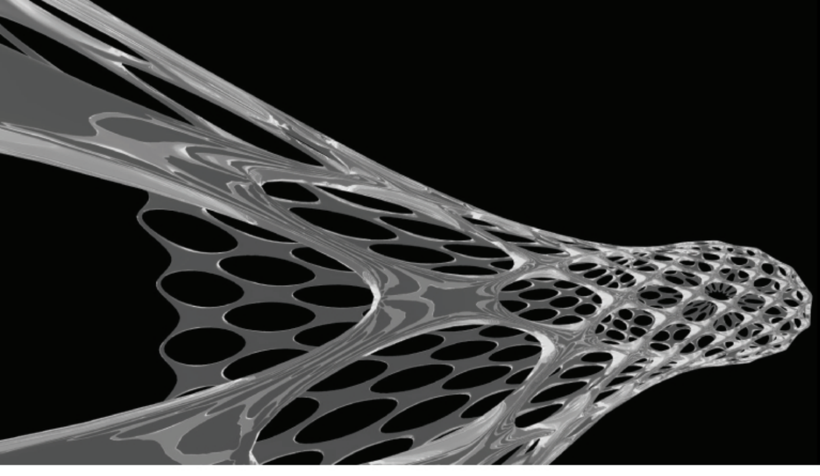


Digital Architectonics
University of Bath

Zack Xuereb Conti
[z.xuereb.conti@bath.ac.uk]

SOLAR INSOLATION MAPPING AND SHADOW RAY TRACING

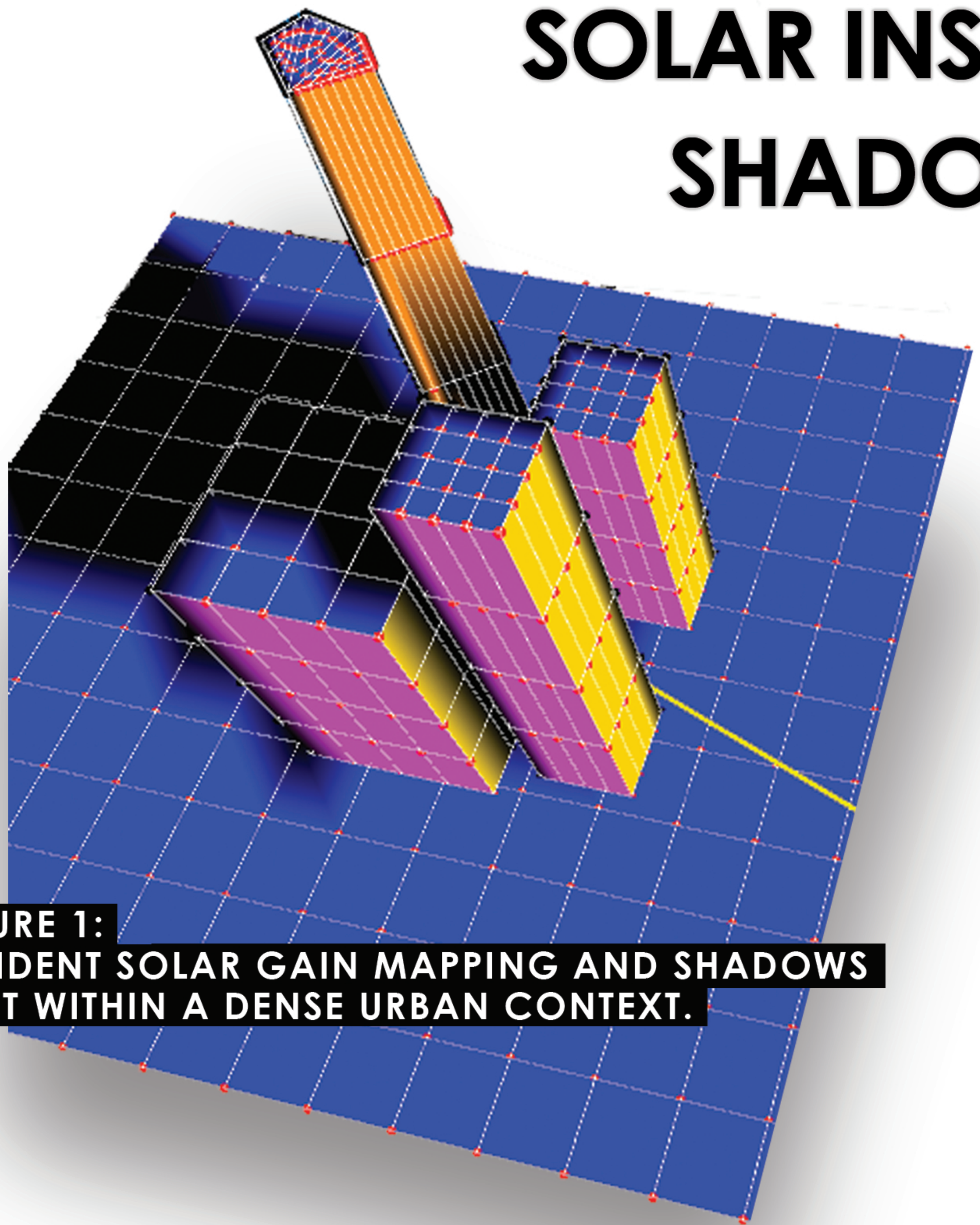


FIGURE 1:
INCIDENT SOLAR GAIN MAPPING AND SHADOWS CAST WITHIN A DENSE URBAN CONTEXT.

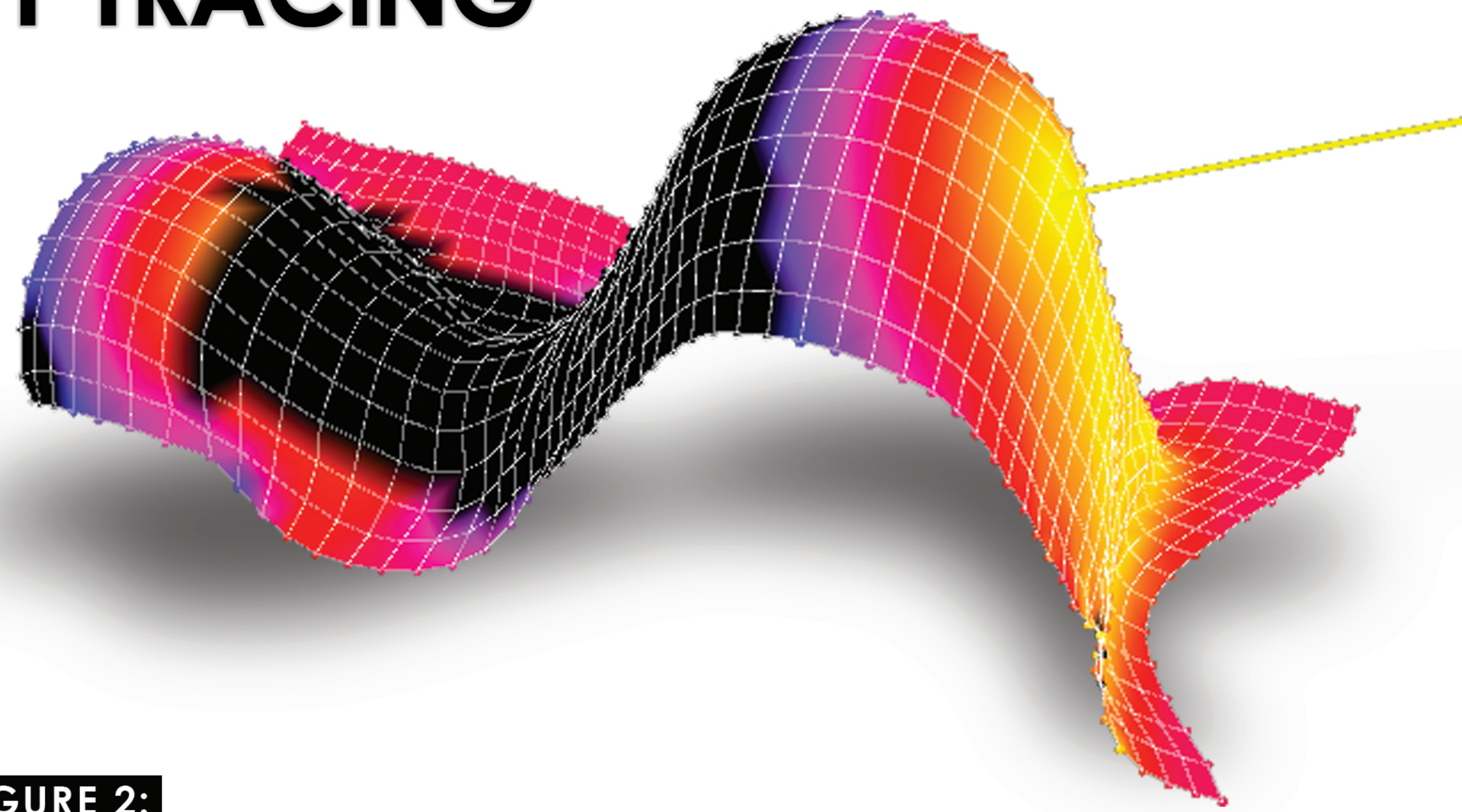


FIGURE 2:
SELF-CAST SHADOWS OF A DOUBLE CURVED SURFACE. THE SURFACE IS A RESULT OF A DRAPED MESH OVER TWO SPHERES.

Each face on the mesh knows of the incident solar gain based on the surface normal and the direction of the sun. The surface normals directed away from the sun indicates that the face is shaded. However, double curved sufaces such as the draped mesh in Figure 2, may cast shadows on themselves. It is therefore required to 'shoot' rays from different faces of the surface and test for the intersection of the rays with itself in order to determine whether a face is in shadow or not.

MULTI-OBJECTIVE FORM FINDING TO MINIMISE COOLING LOAD AND OPTIMISE VIEWS

(ON-GOING RESEARCH)

The simulations for solar gain and cooling load are processed within the same environment rather than running external applications, thus ensuring real-time calculations.

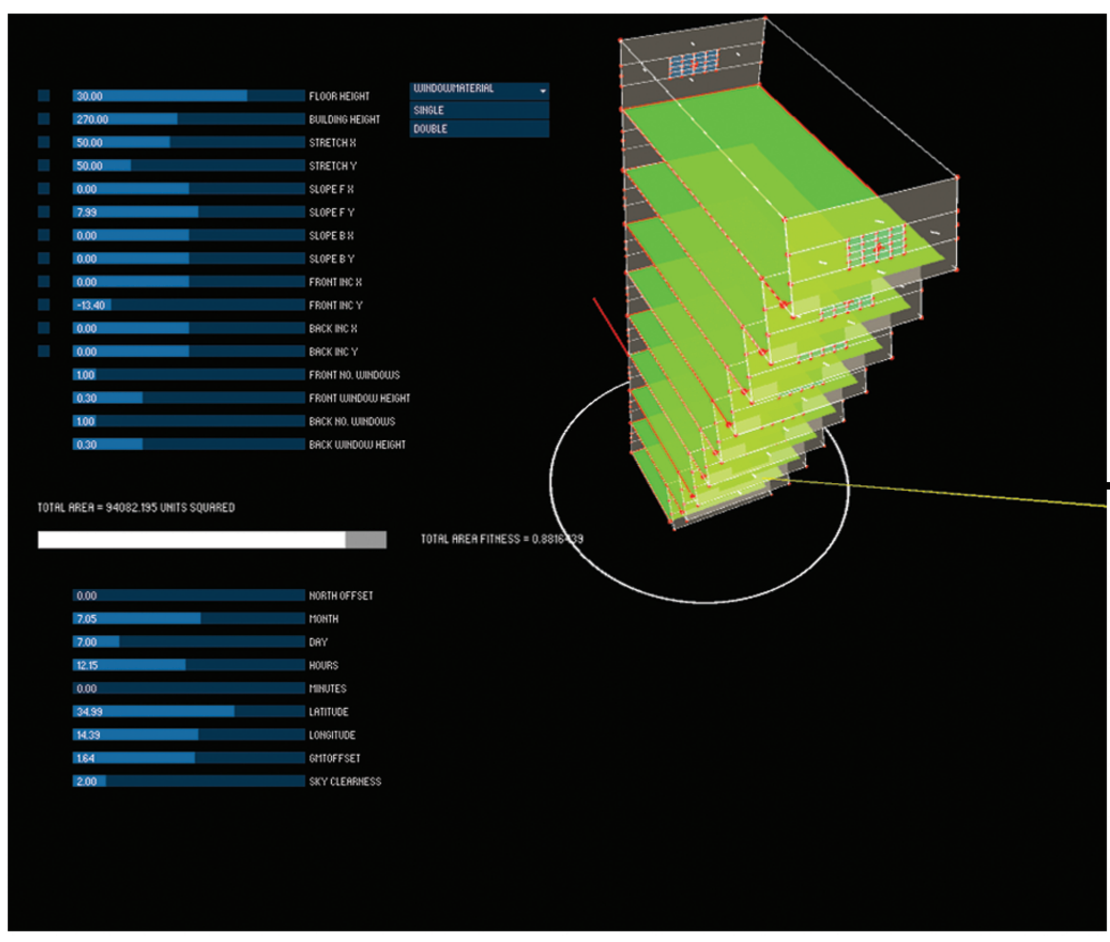
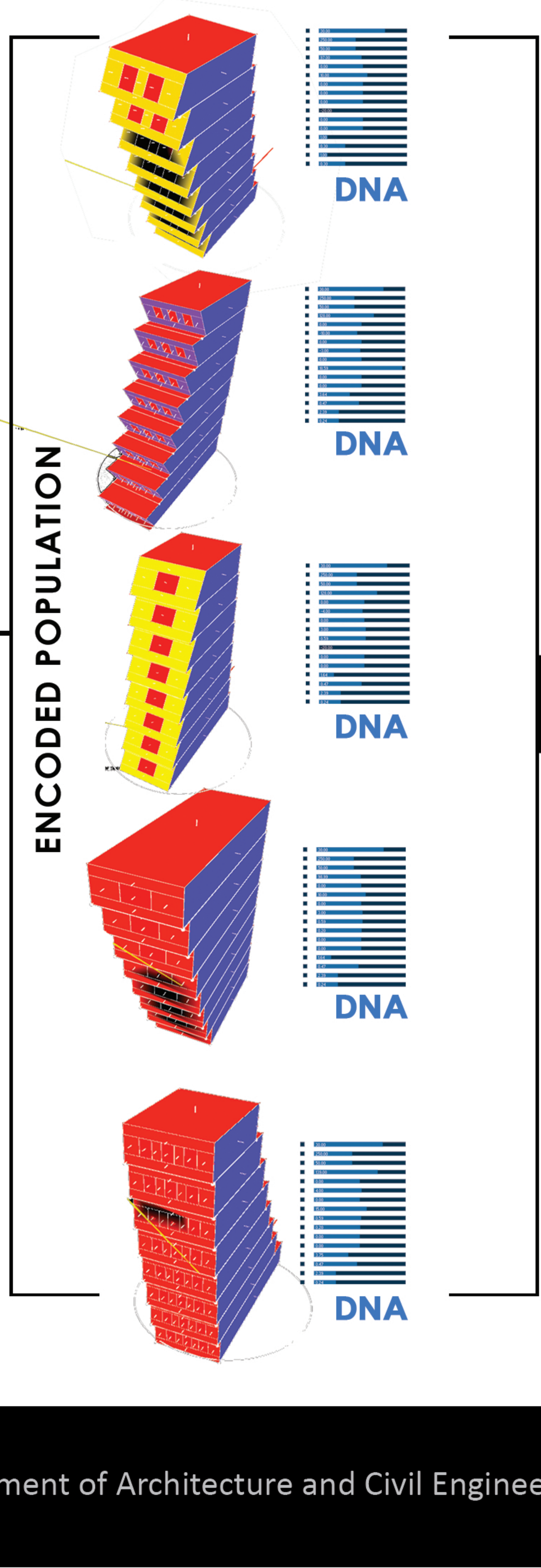


FIGURE 3:
THE FIRST POPULATION IS ENCODED BY MEANS OF THE USER INTERFACE.
THIS POPULATION IS THEN FED TO THE OPTIMISER WHICH WILL TRADE-OFF THE OBJECTIVES IN ORDER TO FIND OPTIMAL COMBINATIONS OF MINIMISED COOLING LOAD AND MAXIMISED VIEWS.



This software tool aims at generating high-performance building geometry based on optimal solar radiation values and maximised views from each apartment to yield maximised rentable-value. This tool will provide the traditional architect and/or small architectural firm with primitive massing guidelines within which the optimised levels of solar performance of the building are ensured.

The 'view' objective is unit-less and not directly comparable to the cooling load, therefore the cost was introduced as a common variable by which the fitness rating of the conflicting objectives may be measured and compared to.