21st Century Milan: using new image processing techniques to assess the environmental quality of the Milan Trade Fair masterplan

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21st Century Milan: using new image processing techniques to assess the environmental quality of the Milan Trade Fair masterplan

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ABSTRACT: The aim of this paper is to assess the environmental quality of different masterplans proposed for the redevelopment of the Milan Trade Fair, and in particular the winning scheme proposed by Zaha Hadid, Arata Isozaki, Daniel Libeskind and Pier Paolo Maggiora. The central subject of the study is to examine the relationship existing between environmental indicators and urban morphology / density, such as in the case study presented. As methodology we analyse simple raster images (Digital Elevation Models) and compare results obtained by several investigations on the projects.

Conference Topic: 2 Design strategies and tools
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1. RESEARCH CONTEXT

The Milan redevelopment represents one of the largest and most important brownfield redevelopments in Europe. An international competition was held in 2004 by the Fondazione Fiera Milano together with the Milan local government; it attracted leading architects from several countries, in an effort to rethink the relationship between urban sustainability and environmental quality.

The paper aims to better understand the relationship between urban morphology and environmental quality, highlighting the often-conflicting sustainability issues of compact urban development [1]. Also, it develops a library of functions that could be used as a support tool for architects and urban planners, while they design buildings or develop guidelines.

2. METHODOLOGY

The inputs of the analysis are very simple raster models of urban form: the so-called Digital Elevation Models (DEMs), which have proven to be a very powerful tool for environmental assessment in urban areas [5], [6]. Image processing algorithms, developed in the Matlab programming language, allow the quick calculation of the selected environmental indicators, which are then compared across the different design schemes. A large table is produced, synthetically ranking each design based on the selected environmental variables.

3. ANALYSES AND RESULTS

This paper compares the five finalist urban design schemes through indicators of compactness and environmental quality. In particular, urban density and morphology are correlated with environmental parameters, which are considered as formgivers of a more sustainable and adaptive architecture [2], [3], [4]. The environmental parameters include, among others, solar access (mean shadow density, solar gain through solar envelopes, sky view factors), energy consumption (surface-to-volume ratio and passive/non-passive zones), cross ventilation, wind porosity, urban canyon height-to-width [5], [6], [7], pedestrian accessibility and visual perception of the open spaces through isovist fields [8], [9].

The presented investigations on the masterplans show the very different characters and environmental behaviours of the projects.

The library of functions as a useful tool for urban planners seems particularly relevant today, as the winning scheme for the Milan Trade Fair site is undergoing severe environmental scrutiny and will require partial rethinking. An analogous vicissitude happened to the masterplan for a business district in Haifa, which was drastically reconsidered after an Environmental Impact Study based on similar analyses as the ones here presented [10]. Future work will better define which indicators are more meaningful, objective and easy to be interpreted by policy makers.
<table>
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**Figure 1**: Some results showing the environmental mapping on the DEMs for the masterplans.
Table I: The data resulting from the analysed environmental and density indicators for the five masterplans.

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**References**


