A Tool for Typological Analysis

Giuseppe Alaimo, Giuseppe Pellitteri, Andrea Scianna*

** Dipartimento di Progetto e Costruzione Edilizia, Università di Palermo, Viale delle Scienze, 90128 Palermo, Italy*

Analysis and synthesis are the twin facets of the architect's activity.
Any design problem is faced drawing from the architect's knowledge, both case knowledge and general knowledge. One type of the latter is abstracted from a multiplicity of cases of which the common features are recognised in such a way as to single out a prototype representing in the best way a class of architectural objects. If applied to a set of residential buildings and to the flats in them, the analysis is typological and it is one of the fundamental ways of acquiring general knowledge to be used to face design problems. The tool we present is aimed at such a type of analysis and is based on the idea that it possible to acquire qualitative knowledge through the statistical analysis of measurable characteristics of the examined architectural objects. It has been tested by applying it to the typological analysis of a set of flats of illegal buildings in Sicily.
The procedure is organised in two main phases. The first one consists in a series of elaborations performed during the reading of architectural organism; the second one consists in a series of statistical analyses on the results (characteristic variables) of the first.

Phase 1

The plans of flats are acquired through a scanner or a digitizer and redrawn by AutoCad. Each rooms is defined through the coordinates of the vertices of its parameter. During the input procedure the dimensional characteristics of the flat (baryeentre, perimeter, area, volume) are calculated and stored in the data base. In the some time also the topological organisation of the flat (the adjacencies and the accessibilities between rooms) is acquired.
To each room , an attribute is given marking the fulfilled function (living, dining, dining-living, bed, kitchen and so on). The total information is stored in a list of the type:

(function_room*1*, function_room*2* .....,function_room*n*).

From this list and from the acquisition of the adjacency relationships between rooms, an adjacency graph is constructed and drawn. The correspond list is of the type.

(function_room*1* (function_room*j1*, function_room*J2*,.....), ...
..., function_room*i* (function_room*kl*, function_room*k2*,.....)).

A similar elaboration is constructed on information about accessibility drawn directly from the plan through the analysis of the door location. Also an accessibility graph can be drawn or altematively, the arches corresponding to accessibilities in the adjacency graph can be strengthened and given a bigger depth. The graph is represented by a list of the type:

(function_room*1* (connected_function_room*j1*, connected_function_room*j2*,....), ...
..., function_room*i* (connected_function_room*kl*, connected-function_room*k2*, ...))

Phase 2

After the acquisition of the data of all the flats, another phase begins, the statistical analysis. In the data base every flat is a record and each type of variables is field of each

variable distribution, average, mode or modes and variance are detected. The results of the statistical analysis allow the identification of possible recurrence of both dimensional and relational characteristics.
Consequently, types (prototypes) of flats can emerge, supplying in such a way just one of the kinds of general knowledge useful for facing design problems. The tool presented can be considered a general tool for typological analysis not only of flats but also of any kind of space distributions.
The variables, whose significance may be different in the various contexts, are substantially of two types: quantitative and qualitative variables. Whereas there is no problem in the statistical elaboration of the first ones, the presence of. the absence of the latter is checked and expressed by a code. In some cases complex variables can be taken into consideration, obtained by the combinations of primitive ones: i.e. external spatiality index (the ratio between the non residential area and the total area) or the non residential specialisation index (the ratio between the indoor non residential area and the total area).
In the case of the set of illegal buildings in Sciacca (Sicily) used as test of the method, the quantitative variables were: the flat area, the non residential area, the areas of various rooms, the percentage of room area with respect to total area, floor height, perimeter and volume.
The qualitative variables were: aggregation types, presence of a filter between night area and day area, kitchen as a specialised room (not also a dining room), entry separated from hall, facade type.
Besides the calculation of the aforesaid statistical variables, of in each distribution of the original variables one or more intervals about modal values are singled out.
The cases are grouped by number of variable aforesaid intervals, considered as having *modal* value. If many cases have many modal values, The set of cases can be looked on as rather homogeneous and a *typology* can be identified.
Another kind of statistical investigation is done through the cluster analysis. The *path* a case follows through the subsequent steps of the clustering gives useful information for detecting the existence of types and subtypes having a consistent degree of homogeneity.
The degree of heterogeneity of the elements included in each group, that is inversely proportional to the sub-set number of the phase, is expressed by the sum value of the internal deviance of that configuration.

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References

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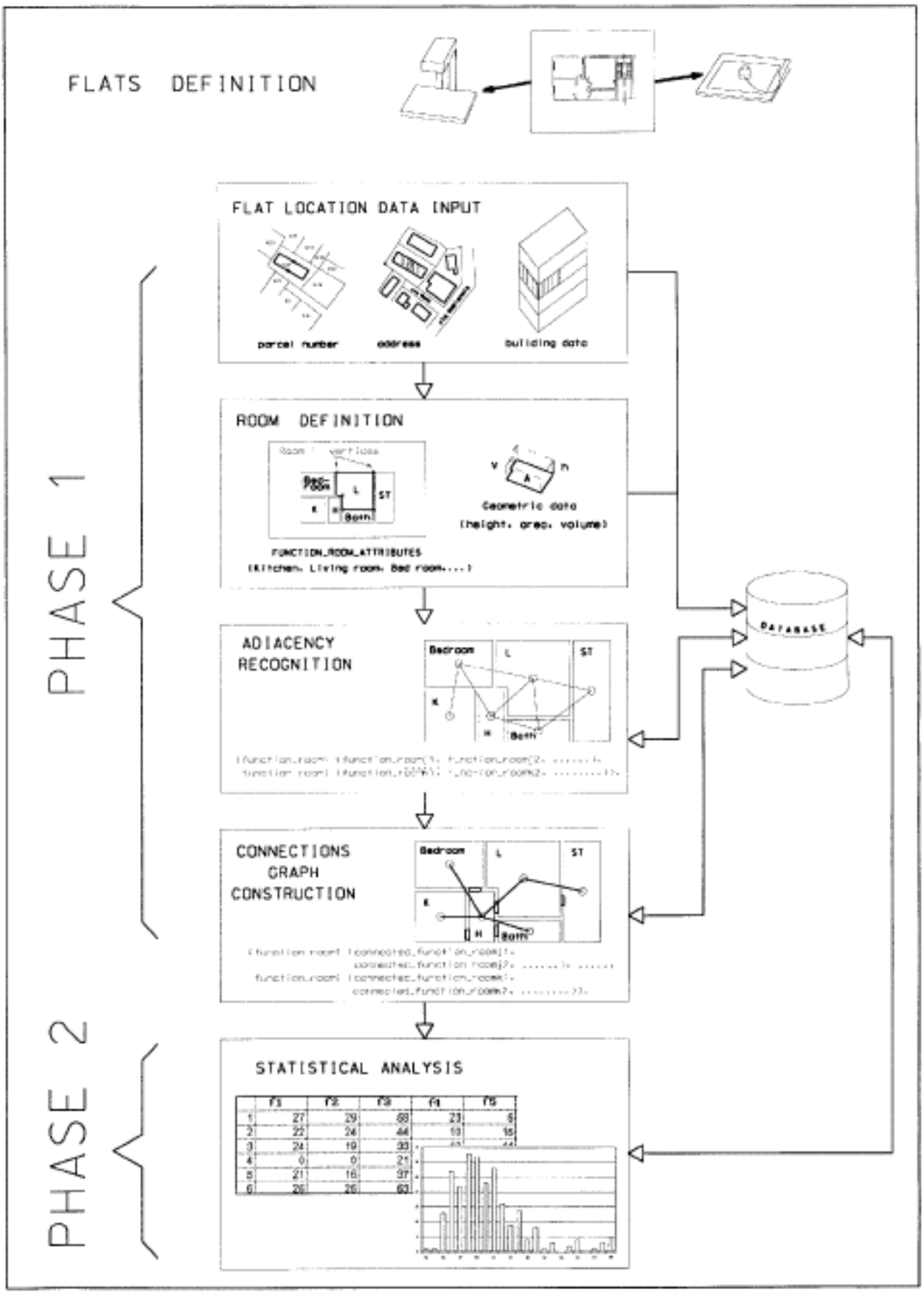
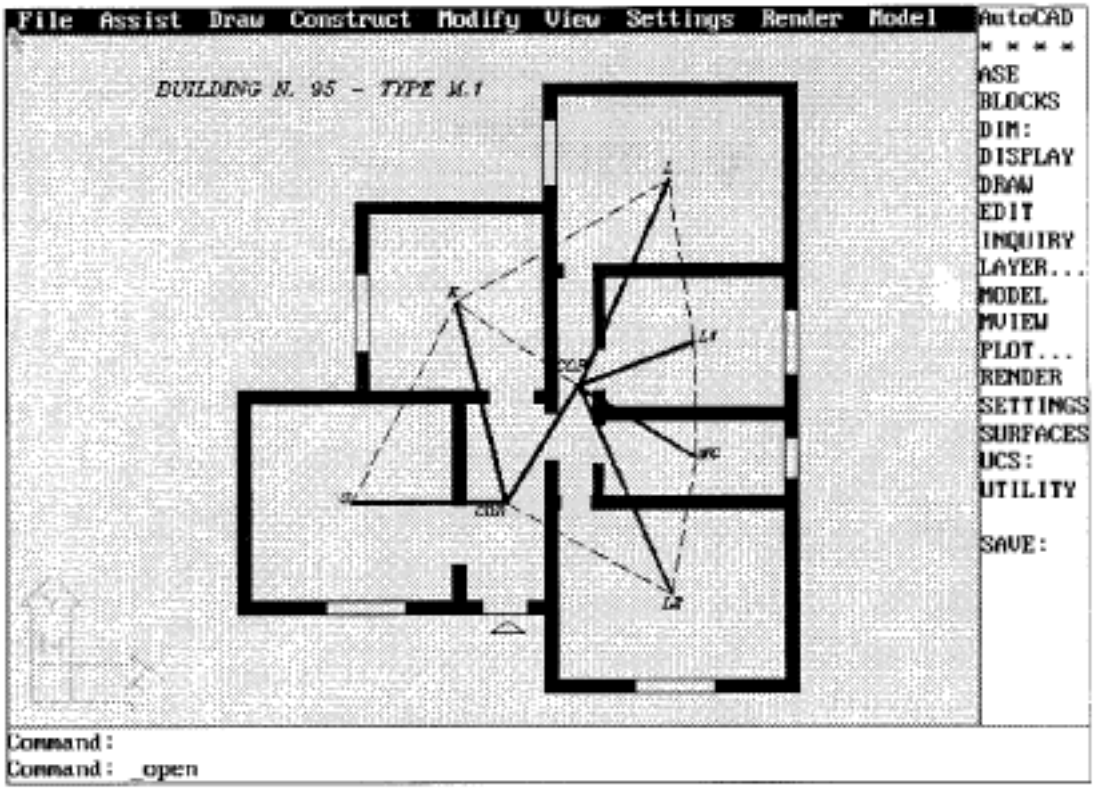
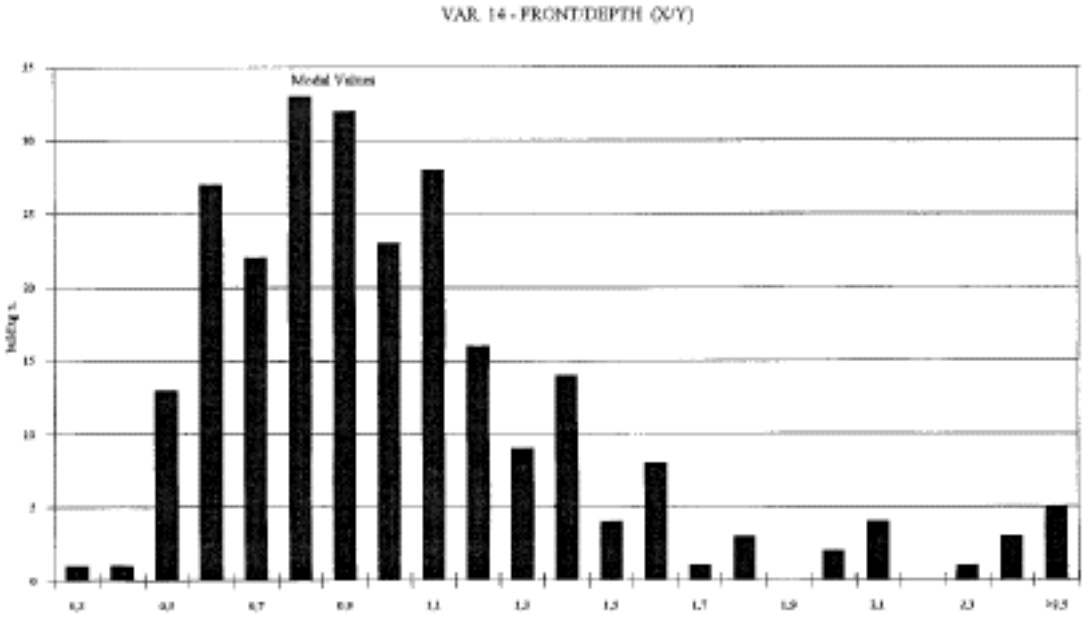

FLATS DEFINITION
FLAT LOCATION DATA INPUT
parcel number
address
building data
ROOM DEFINITION
Room 1 vertices
Bedroom
L
ST
K
H
Bath
FUNCTION_ROOM_ATTRIBUTES
(Kitchen, Living room, Bed room,...)
V
A
h
Geometric data
(height, area, volume)
ADJACENCY
RECOGNITION
Bedroom
L
ST
K
H
Bath
Database
CONNECTIONS
GRAPH
CONSTRUCTION
Bedroom
L
ST
K
H
Bath
STATISTICAL ANALYSIS
f1 f2 f3 f4 f5
1 27 29 68 23 5
2 22 24 44 19 15
3 24 19 33
4 0 0 21
5 21 16 37
6 26 26 63
PHASE 1
PHASE 2



The plan of an illegal building with the adjacency graph and the accessibility graph (bold lines).



An example oj'statistical analysis. The distribution qf two variables on a set of illegal buildings.