HOW TO ASSIST DESIGNERS IN THE URBAN DESIGN PROCESS

DAVOOD CHITCHIAN\textsuperscript{1,2} AND JAN HEELING\textsuperscript{1}
\textsuperscript{1}Delft University of Technology
The Netherlands
\textsuperscript{2}Iran University of Science and Technology
Iran

Abstract. A lot of CAAD programs and design applications exist to assist designers. They hardly support the whole urban design process. Although those programs are useful for the architectural design process but are not suitable for urbanistic design. We have been working on the Urban-CAD application to assist designers with urbanistic design activities.

1. Introduction

There exist many design applications to assist designers. Although those applications are useful means to be utilized in design tasks, but they are not suitable tools for supporting the whole design process. The most CAD programs are based on the architectural design process and therefore not suitable for urbanistic design. Also there exists no feedback into the design process at all.

Due to the limitations of the existing CAD programs and the inadequacy of those programs to assist designers in urbanistic design activities, we have been working on a research project to develop a CAD program to overcome those limitations and also suit the needs of the urbanistic design process. The project has been started in our group (Heeling and et al., 1997). The basic goal is the development of a computer application in order to make the urbanistic design-process by computer easier, quicker and more effective. Our Urban-Cad has been developed using an advanced CAD tool, MicroStation SE from Bentley Systems.

Two points were our main concerns in the development of Urban-Cad. First, the separation of the design elements and the information associated with those elements. Second, considering different scales or abstraction levels that designers want to work in the different design stages.
2. The Urban-CAD Components

Three components currently form the basis of the Urban-CAD software.

- MicroStation SE Cad tool is a general-purpose computer-aided design and drafting package for 2D and 3D modeling and representation.
- Database management system is a general-purpose database used for storing and organizing spatial information.

These three systems provide the basic capabilities needed to plan and design an urban space. The user interface of the Urban-CAD system is the same user interface of the MicroStation SE, but not as it is, rather we have added extra functions and utilities to it to support the urban design process.

2.1. THE STRUCTURE

The overall structure of the Urban-CAD system is depicted in figure 1.

![Figure 1. The structure of the Urban-CAD system](image)

The Urban-CAD supports a graphical environment for the users. This environment based on the graphical environment of the already existing Cad program, MicroStation SE from Bentley Systems. To support the urban design process, facilities like Topography, Centerline, Area, Junction, and Urban-Tool are added to the menu items of the user interface.

2.2. MAJOR FEATURES

The important and useful features among the others are: the information storing and retrieving mechanism, the scaling method, displaying and viewing of the objects. These features in the system provide an environment for the urban designers to help in their design tasks.
The urban environment is composed of many small, medium and large objects. These individual objects are related to each other. The main objects in the system are:

- **Street**, it may contain other objects such as trees, lightings, bus or train stops, and so on,
- **Junction or intersection**, and
- **Area**, it may include different parts such as green area, public area, residential and industrial area), building.

Note that the main objects of the system usually consist of several other things or parts. For instance, a street is not a single element rather it consists of other parts, i.e. a pedestrian part, a part for bike, a green part probably in the middle of the car part, and so on.

Three levels of abstraction, so called level of detail (LOD), for urban planning are applied both in presentation and in the design of the database (Liggett and Jepson, 1995). Whether an element of the design-file is displayed on the computer screen, depends on the scale the designer is working at. For example a street is shown as a single line when working on the scale of the whole city. On the scale of a neighborhood this same street will be shown as a strip with a certain width, containing different parts (i.e. car part, bike paths and sidewalks). Six different scales of observation have been considered, they are: 1:10000, 1:3000, 1:1000, 1:300, 1:100, and 1:30 (De Jong, 1995).

### 3. The Urban-CAD User Interface

Suppose an urban space is specified or drawn as depicted in figure 2. The figure also represents the user interface of the system. The lines and shapes, such as rectangle or triangle, denote the heartlines (of the streets) and the areas respectively. To define the heartline of a street or an area the menu items centerline and area help to do the job. The centerline dialog box is for storing, retrieving, and manipulating the information of the street objects. A street may contain different parts, such as car, bike, green, pedestrian, tram/train, and water.

The space between three or more streets is seen as an area object, which in turn many consist of various sub-areas in different scales. In the design process there are some steps to be taken to develop the area objects and the future buildings within that area. The steps are: defining the areas, defining the FSI (Floor Space Index), defining the building-line, parceling the area, defining the building envelop, and defining the buildings. The main area and its sub-areas (as the result of drawing streets) can be identified using the provided functions in the area menu item of the Urban-CAD user interface.
3.1. MANIPULATING THE OBJECTS IN VARIOUS SCALES

Six different scales enable designers to focus only on any abstracted or detailed level of an urban space without being distracted by the related information in the above or below levels. Any street object must belong to one of the six scales ranging from 1:10000 to 1:30. Depending on the width of part of a street, if it is greater than a certain value, that part must be displayed. For instance, in scales 1:10000, 1:3000, or 1:1000 if the width of a part is greater than 50, 20, or 5 meter respectively so that part must be displayed in the corresponding scale.

The scaling dialog box, the top right picture in figure 3, allows displaying objects of an urban space in a certain scale. The ratio button allows choosing one of the six different scales. The elements button lets the user to select one of the three (single, fence, or file) modes for displaying. Four option buttons are provided in the bottom of this dialog box. They are: street, lighting, tree, and area. Checking of these options does certain thing. For instance, if the users want to see or view only the street or the area objects they must check the corresponding option. Also if users check the lighting or the tree option (or both) the Urban-CAD system displays those objects (if exist).

Any area object must belong to one of the four scales ranging from 1:10000 to 1:300. Also an area object does not consist of any parts unless it contains some smaller sub-areas. In this case, each sub-area must belong to a lower scale than the main area object belongs to. When the user views or displays objects in a certain scale, only the area objects that belong to this scale will be displayed. Some dialog boxes are illustrated in figure 3.
4. Conclusion

Due to the limitations of the existing CAD programs and the inadequacy of those programs in urbanistic design activities, we have been working to develop a CAD program to overcome those limitations and also suit the needs of the urbanistic design process. The basic goal is the development of a computer application in order to make the urbanistic design-process by computer easier, quicker and more effective. It is expected that students will start working with a prototype of Urban-CAD software in October 2001.

The scaling mechanism of the system is the outstanding feature that is missing almost in all the existing similar applications. This feature plus the others makes our system an advanced application that the urbanistic designers community needs. The Urban-CAD design tool, sustaining the aforementioned capabilities in the previous sections, provides the designers with comprehensive information and supports the urbanistic design process.

References