A TOOL FOR CONCEPTUAL DESIGN EVALUATION BASED ON COMPLIANCE WITH SITE-DEVELOPMENT BRIEFS AND RELATED PLANNING REGULATIONS

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Abstract:

The need has been established for a computer based decision support tool to use during the conceptual stages of architectural design. The main functions are to check design compliance with the requirements of local planning authorities; characteristics evaluated will include building size, height, plot ratios, circulation and accessibility, and the preservation of natural features on site.

This tool is being developed to operate under AutoCAD environment; the construction industry standard computer aided design software, following standard layering convention, integrated command lines, and pull-down menus. In addition to the common graphical output, i.e. plans, elevations and three dimensional models, it will generate textual analysis in report format to use as part of the Environmental Impact Analysis of proposed development.

The tool's functions will be based upon the result of two types of field studies.

First, interviews and questionnaires will be carried out with architects and planners of both private and public sectors. These will cover issues related to the performance of Computer Aided Architectural Design applications with regard to the evaluation of design schematics, and decision-making for the production of data for environmental statements. Second, field observation and participation will be carried out to observe decision-makers behaviour during assessment of building design proposals.

A prototype is currently under development and will be tested against the expectations of the tool designer, Ashraf lsmail, and a team of professionals to be involved in the field studies. A critical analysis of the prototype design methodology and the study findings will be documented in the research thesis to be presented in June 1995.

Introduction:

Computer Aided Architectural Design (CAAD) is currently used primarily as a documentation and presentation medium and not as a means for evaluating and testing alternative design proposals. This paper presents the current scenario of a research which aims to contribute to expand the role of CAAD software to include rigorous evaluation of design proposals as they are developed.

Information technology has under gone considerable development in recent years. Contemporary operating system environments provide an impressive graphical user interface

for ease of communication between the computer operating system and casual computer users. On the other hand, some applications are specifically designed to allow the veteran users to customize and re-programme the original software features, or generate a specific new attribute in a user friendly manner [1]. Some of these applications have become industry standards, such as Windows, AutoCAD, AEC [2]. Third party application developers have learned to exploit the opportunity to provide customization and improvements to the large user base of such applications.

The research programme calls for the re-examination of the role of design evaluation in CAAD. This should be a continuous process to match the development and change in information technology.

A Practical View of Evaluation:

To date, the effort that has been put into the research has focused on the automation of the evaluation of architectural conceptual design and schematics. It assumes that the appropriate evaluation should not be solely devoted to visual analysis. Initial stages of evaluation could be based upon the legislative and other physical measures already defined at the local planning scale and, in particular, design guides and site-development briefs [3].

The Architect is not only responsible to his or her clients, design proposals submitted by the Architect are scrutinised by the local planning authorities appointed to safeguard the community interest. Part of the planners analysis is to ensure compliance with rules and regulations. These are described or illustrated in statutory and non-statutory documents devised to inform and regulate the planners and the architects. The question of their suitability for design evaluation and their effectiveness as informative documents are being examined in the research. The process of building design can be a tedious task, particularly the process of obtaining planning permission or building approval. Even with an experienced Architect, the process of obtaining a planning permission can lasts several months. There is therefore a clear advantage in being able to ensure compliance with regulations before entering the full process for obtaining full planning permission.

This type of problem is not soluble within the narrow confines of one academic discipline. Hence, the approach to the research methodology involves a variety of theories and

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[1] **DATABOSS** by Kedwell Software; a tool claimed to be easy to use as a word processor to generate a complete and fully functional database software to run under Windows environment.
PRTOGEN+ by ProtoView Development; another tool for creating a user friendly database software with capabilities for data validation in 3D effects in addition to generation of standard program code.

[2] **Windows** by Microsoft Cooperation, AutoCAD by Autodesk Inc., and **AEC** Architectural Engineering Construction software an add-on package for AutoCAD.

[3] **Examples of design guides and development briefs:**

- County Council of Essex, A Design Guide for Residential Areas, 1973.
- Sheffield City Council, Planning Department, Cambridge Street Site Development Brief, 1986.
- Hampshire County Council, Planning Department, Designing for Disabled People - The External Environment, 1981.

methods ranging across the fields of Computer Aided Architectural Design, local planning practice, and information technology.

CAD and Evaluation:

Chappell, D. and Cecil, R. [1989] define clearly the problem found in the use of Computer Aided Architectural Design:

> *"One of the inherent problems with using computers for architectural applications is the fact that computers are naturally best suited to well-ordered repetitive operations. Architecture tends to be an idiosyncratic activity, the same problem seldom presenting itself twice, and no two architects adopting the same approach to identical problems. Thus the soft-ware has to be very flexible or purpose designed"*

This research will develop a prototype Tool which is intended to be both flexible and purpose designed. The prototype Tool will consist of a Tool Shell, Coding, and Flow Charts. The Tool will include CAD features and evaluative procedures.

The ability to exchange results and communicate effectively with other platforms or systems is one of the crucial elements determining the progress to design completion. Most of us, either casual or experienced users, have encountered the problem of information exchange or transfer from one system or application to another. The process probably proved to be time consuming and effort wasting. Architects or their assistants spend long hours to produce presentable schematics on a CAD system. When it comes to transfer them to another application for carrying out a particular type of testing such as energy analysis or sunlight access, they will usually find that the analysis application does not accept the CAD data as input. Consequently, resources will be wasted in describing, in a different format, the geometric data which is contained in the CAD file.

These problems ought to be taken into account from the outset in developing computerised evaluation software.

The Tool Shell:

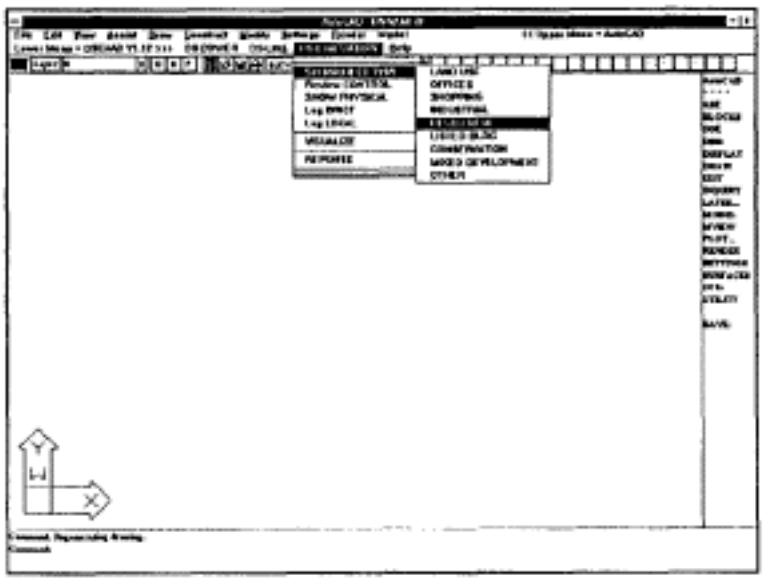
The Tool Shell is being developed using the common AutoCAD Release 12 interface for Windows 3.1 environment. The strength of AutoCAD in terms of editing in two and three dimensional space combined with Windows Graphical User Interface gives the required flexibility for manipulating the 'Tool Shell'. The Tool functions, i.e the evaluative procedures will be produced separately using AutoCAD Development System ADS. The aim is to carry out the evaluation while working on the design.

AutoCAD by Autodesk Inc., was selected for various reasons. Predominantly because it is the most popular software used in practice by Architects and their allied professionals. AutoCAD provides the flexibility that is required to change the shape of its original

software. Customization is one of the strong features that is implemented by AutoLISP [4]

(Figure 1: **The Evaluative Functions in the Tool Shell)**

The Tool Shell is part of the prototype which illustrates the features added to AutoCAD. To maintain the required performance of AutoCAD for editing and visualisation in two and three dimensional space, the Tool Shell will display AutoCAD functions alongside the new (figure 1). The menu bar consists of two lines; the second line unique to the Tool Shell. The commands in the second line are described in the following paragraph.



DSCAAD V1.12 is an acronym for Decision Support for Computer Aided Architectural Design - Version 1 for AutoCAD R12. The main three functions are POWER, LINK, and EVALUATION. The function POWER provides additional robust commands for two dimensional editing. LINK allows the user to activate particular software ie. AEC or LANDCADD [5] in addition to the tool database. An example of LINK in use is described later. EVALUATION is the most important feature and leads to the catalog of evaluative procedures. Its menu of commands are illustrated in figure 1.

The user would be asked to select from a cascaded sub-menu the project type for which evaluation will be required. This is to define the relevant types of evaluation and the parameters that are needed to carry out design testing. Appropriate information will be retrieved from the database and appended to the current working file.

One of the key requirements developed from an initial field study, is the need to generate ground levelling, to represent the topography of a particular site, in both two and three dimensional formats from a pure ASCII file. The Photogrammetry and GIS Units at the University of Portsmouth are using a technique to extract ground data in x,y,z format from aerial photography. An ASCII file containing space delimited point coordinates was

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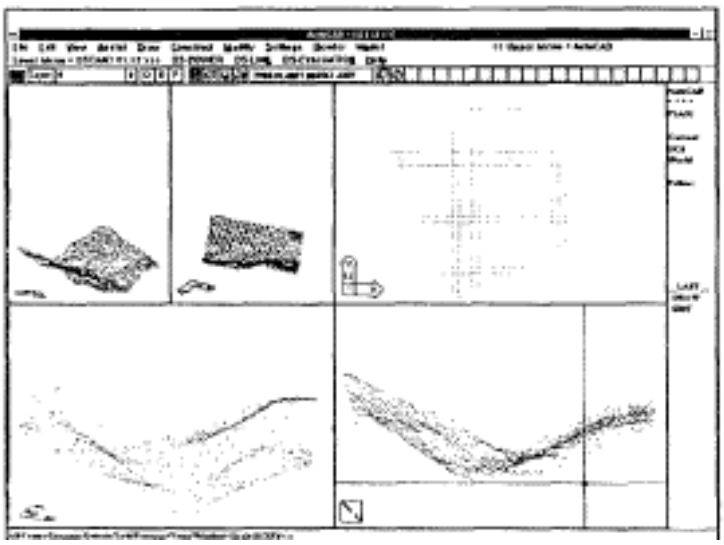
[4] **AutoLISP** by Autodesk Inc, a special implementation of LISP the programming language.

[5] **LANDCADD** by Landcadd International; a software for landscape design and ground modeling.

produced. This was then imported to the Tool, via a customized version of an AutoCAD *'Lisp Routine'* used under LINK sub-menu commands. It is then possible to view the variation in ground levels displayed by points for representation (figure 2). (At a later date this version of Lisp file will be amended to include the display of *'3D-Faces'* between every four points). This approach was used in order to utilise the facilities and resources available within the university departments.

Tool Output: (Figure 2 : **Output from the Photogrammetry Data File**)



In addition to the familiar graphical output of AutoCAD, it is envisaged that a report format will be generated from the tool to be included as part of the environmental planning assessment of the design. The analysis will be concerned with the local planning terms such as volume, density, plot ratios and accessibility to the site. At the same time these will be part of the design constraints imposed upon the user while drawing the conceptual schematics. The work of McCartney, K. [1985] presents evidence for the existence of a relationship between the usefulness of design information and the degree of iconicity in symbolization. He also suggested that there is a similar relationship between the configuration of design information and its usefulness. This research utilises these relationships as a basis for determining and selecting the output report format of the tool.

Summary:

The concept of architectural design evaluation is being presented based upon pre-defined measures found in design guides and site-development briefs as they are the input for continuous evaluation. The role of design briefs and their implications on the design is being considered as a major part for the general discussion and consequently for the production of the tool parameters. The intention is to address critically several issues regarding the use of CAAD in 3D-Modelling and their role as an evaluative tool in the practice of architecture.

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