INTEGRATED PLANNING SUPPORT SYSTEM FOR LOW-INCOME HOUSING

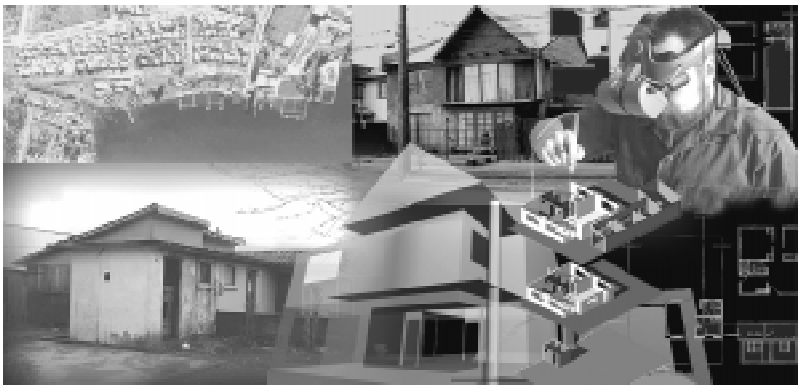

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Imagen sintesis:
Integrated planning support system for low-income housing (fig 1)

Abstract
This article describes our current research focused at the development of an integrated planning support system for the low-income housing production, using as exploration field the participative-planning strategies, particularly implemented by the progressive housing program *in Concepción, Chile. Setting our sights on the implementation of modern IT (Information Technology) into architectural field to support the entire planning process, it will be exposed the general deficiencies, diverse IT-tools, their combination possibilities and their practical contribution in order to prove the feasibility of a computer-aided system within a new concept of housing planning.*

Low-income housing

The housing construction for the homeless groups represents 80% of the total housing construction in underdeveloped countries. In latin america and the caribbean the household number growth rate is about twice as higher as that of the world's developing countries' average. Increments to the number of households indicate the housing demand. The projection shows approximately 85.8 million households will be increased in the first quarter of the next century.

The design of massive housing is confined to the multiplication of a same reduced conventional model that should complete the requested quantities quickly. [GARCíA, 93] In fact, the resources shortage derives in the production of repetitive small houses with low architectural effect, based on prototypical solutions, where the dweller's participation is completely excluded, resulting in: (1) the lack of the dweller's identification with its home and environment; (2) loss of individuality, and (3) socio-cultural dysfunctions due to the lack of democracy and the marginalization, which this production pattern produces.

Low-income dwelling projects present: (1) lack of modern technologies; (2) low quality construction, in which dwellings deteriorate quickly; (3) monotony; (4) deficient urban insertion, marginalization and insufficient infrastructure; (5) low quality of urban space, and (6) deficient functionality of urban areas, as seen in residual spaces and random distributions.

Particularly remarkable is the innovative strategy of *progressive housing* (since 1990), which comes from the "operación tiza" program (1964-70) and the studies of MacDonald (followed by others), which rather than planning super-small and low cost dwelling solutions, it pretends to be a shared efforts policy, growth in process and diversity. It consists of a minimal serviced dwelling unit: (1) a plot (water and sewage installation + services of electricity); (2) a sanitary unit (bathroom and/or kitchen); and eventually (3) an attached enclosure of multiple use (depending on the project and construction costs).

The progressive housing program operates by supposing that having that basis, people should be able to complete over time, an appropriate house to their specific necessities, depending on its own will and economic possibilities.

The foundations for such implementation already exist in many districts of the country, at different advance levels correspondingly; its upgrade might be feasible. This advance moves in a range that goes from the digitalization of analog cadastral documentation, up to the utilization of GIS applications (Geographic Information System),

integrating census information to the city's CAD-made planimetric information. Likewise, the use of CAD applications instead of drawing-boards, in most official agencies of housing- and city-planning is increasing at such degree, that the digitally formatted delivery of bid projects is becoming a standard exigency.

This development portrays a significant renovation of the instrument, also a reorganization of all correspondent information, however regarding a systemization of the processes, exists an insufficient coordination between parts, due mainly to the lack of a documentation standardization and a computer-aided integrative tool to embrace all stages of the process. (fig.1)

The Current deficiencies between processes and tools

With respect to the planning process: (1) the design, planning and construction are shaped of small, single, and isolated activities, which are very dissimilar to align them together; (2) big part of the information within the planning and construction process is fuzzy, vague, and mostly with diverse appearance; (3) norms, laws, guidelines and similar affect in each case, only very small sections within the construction process, and with different interpretations.

With respect to all computer systems available: (1) they are based on the support of single and isolated processes. (2) are based on, own functionalities, user-interfaces, data formats and particular requirements; (3) overwhelm more, than what they support, as seen within the totality of their requirements (material, technical, logistical, staff) till a comparable result is available; (4) have no knowledge or even experience, still responding to fixed (inflexible) procedures; (5) most data and (inter-) results are invisible, unable to be experienced, or to understand. Without any correlation, (similarly as they are within the classic planning processes); (6) every integration of (separate) current computer systems fails. In the best case, it remains just the juxtaposition of systems with a risky transfer of information; (7) the informal components are ignored.

IT tools and methodology

The use of different computer tools and software systems are possible to integrate into such an application field like described above. The possibilities range from simple planning tools to high equipped specialization tasks for such a complex process with many partners and clients, which are involved there. Regarding our current research tasks, the embedding of following issues are focused at this project, which will be in collaboration with Prof. Rodrigo García of the Universidad del Bio Bio.

VR systems: since 1994, when the multidisciplinary project *atelier virtual* was founded, two VRAD systems (Virtual Reality Aided Design) have been developed, namely voxDesign and planeDesign. The voxDesign software environment specifically focuses at sketch oriented creation of spaces with voxels, whereas planeDesign is space oriented making use of planes. A third system is the VRAM (Virtual Reality Aided Modeler), a conceptual design tool supported by VR technology. VRAM was tested in the VDS98, as well as in the VeDS 2000 workshops. [DONATH, 01]

Digital measurement: for design and revitalization in existing built environments, a set of tools are being developed for the computer-aided architectural surveying of existent buildings to support the professional surveyor with a structured surveying method, the post-processing and the analysis of data. A combination and integration of non-reflective tachymetry and photogrammetry provides the most efficient approach to geometric surveying. Implemented in two prototypes: *SAM,* which is a structure generator for the creation of spatial and element data, and *Freak 2000* which is a sketch-based three-dimensional geometry generator. [DONATH, 01*] (fig.2)

AR-VR systems: as an extension of digital measuring, Augmented Reality and Virtual Reality combined techniques allow the superimposition of real and mapped images, synchronizing the virtual model with the real-world situation. Reducing the differences in degree of detail, topology and geometric values between how the building was found on site, and how it would be conventionally, geometrically represented. AR concept offers the possibility of combining several tasks in one (different measuring techniques, digitizing, mass and volume calculation and transfer to a facility management system) and to integrate separate organizational steps (survey, transfer to CAD, planning, structural calculation, etc). [DONATH, 01*]

Online user planning-tool: a three-year research is developing an online design tool for individual low-cost housing in Germany. It enables the dweller to chose among varied alternatives the most convenient spatial configurations and their costs. The goal must be, to manage differentiated offers for different objective- and demand-groups, to open the real estate market also for low-income groups. [DONATH, 00] (fig.3)

Activity-Space modelling: based on a tool called FunPlan (functional planning), which is one of three tools, namely InfPlan (authoring and retrieval of informal models extensions) and NetGen (generation of node positions from topological relations at the functional specification) implemented in an intelligent CAAD-system prototype called PrePlan, was developed to support the early phases of architectural design. It relates activity with space into one unit, based on function-objects, which represent graphically function requirements, which have to be carried out during the planning process by means of the shape- and constructive

design. [STEINMANN, 97] (fig.4)

The field explorations pursue to detect lacks and availabilities of the state-of-the-art Technology and the low-income housing production process in Chile. Cross comparison with the german field-tested experience, allows anticipation to possible outcomes, in order to perfect a specific evaluation- and application methodology.

The lab explorations of several computer-aided systems, tools and advanced techniques point out their qualities and specific requirements in order to perform their integrative combination within a system.

The system supports both indistinctly, the project partners by means of a computer-aided tools set and a standardized model of procedures and documentation formats, and the dwellers by means of their direct contribution in the completion of their specific documentation (user-activities, -organization, preferences, household composition, etc).

Due to the great extensions of Chile's territory, web-based VR systems will enable CSCW (Computer Supported Collaborative Work) between project partners and authorities, for faster and detailed evaluation of new tendering projects, introducing clarity and transparency into the process.

The VR-based simulation of evolution alternatives for low-income housing developments, will allow to take in advance proper control of: environment's conservation, resources saving, city's expansion, use of public space, etc.

Digital measuring for surveying existing contexts proposed for future projects, to obtain reliable information, directly referred to the planning-system and stored into a data base.

AR-VR techniques enable authorities to evaluate quality degree of built projects.

By means of space modules, easy to combine, assemble, and modify, the dweller will be able to customize its housing solution, visualize it and obtain previous cost calculation. The responsiveness of spatial configurations to user's organization data, solves its specific requirements. Furthermore, the user's online-made design will automatically update official cadasters, complementing a reliable data base.

Activity-space modelling concept improves efficiency of the design-review loop, and by integrating diverse information (user activity model description, technical specifications, etc), provides faster evaluation of greater variety of design alternatives.

Come together

Based on our experiences with the state-of-the-art computer technologies, and looking at the constraints of the application field, namely low-income housing, we are sure that the integration of modern technologies, within a realistic, alive and critical situation is not the only one way to solve it.

As much in the process of architectural design as in the final product, an appropriate relationships structure between the parts becomes fundamental. The adaptation of existent and forthcoming parts, according to its mutual influence is what we could properly call interactivity, and its incorporation into the CAD-systems remains not done, at least not the way it has been incorporated in other fields of the ICT (Information and Communication Technology). A interface between the production of abstract forms and its adaptation to the specific requirements of the project becomes indispensable. This means a standardization of some linguistic and formal terms, and a general agreement regarding to a class of interpretable models. We should maximize the exploitation of ICT (Information and Communication Technology) in the field of architectural design.

There is a significant lack of integrated systems providing a general support for the designer during the whole design process. [SARIYILDIZ, 97]

In reason of that, we should look at the following propossals:

The planning process can be divided into small steps, experiencing effective support and leading to developing modular computer systems. It would be enough for a first step, to store side by side the produced information, clearly described. (The human being is capable to recognize complex contexts and to take conclusions out of it.) In a second step, processes as well as information gathering has to be put into one unit, where the correlation becomes the most obvious, necessary and meaningful issue. (A wall as "drawing", a wall as "specifications", etc.)

Prerequisite for the second step is that this should happen internally and not in separate systems. (i.e. the immediate description of construction activities within the CAD System, producing the specifications into it instead of any coupling.)

A main focus is the management of complex information correlations. The emphasis lies on the "correlations". e.g.:

-Between existing data, planning data, construction data, and result data.

-Planning data as existent real situation (context: location, construction law, requirements)

-Planning data as temporary solution's suggestion (the new), which in the sum defines the context-related result and construction.

-Planning data as client's requirements / - wishes.

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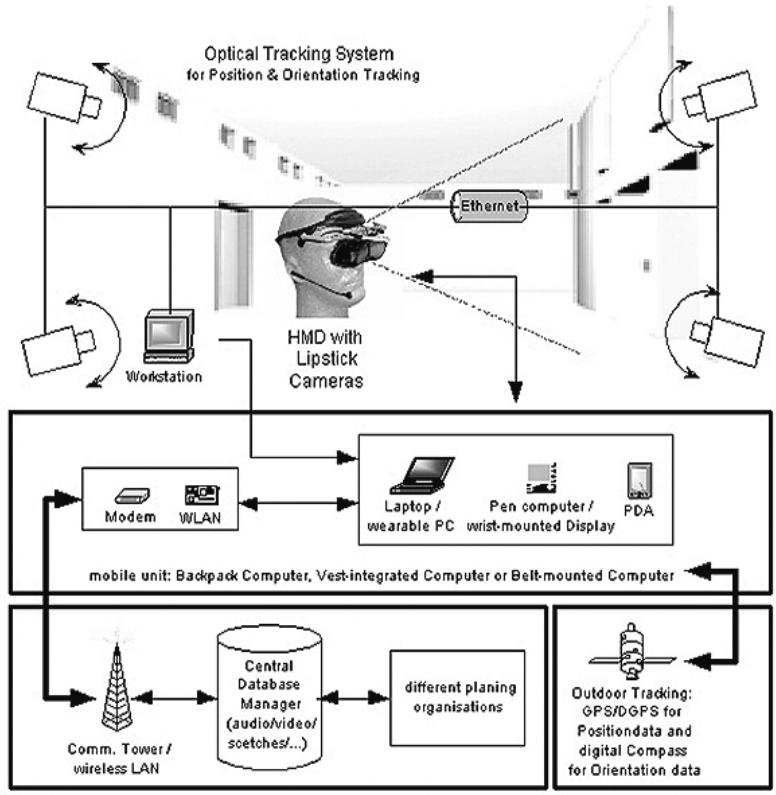
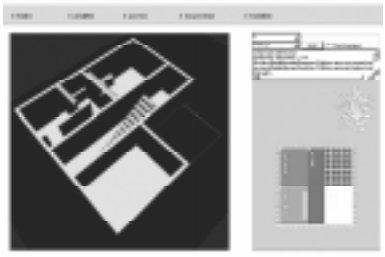
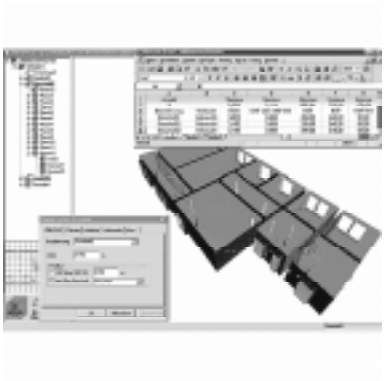


Digital measurement systems (fig.2)



Online planning tool (fig.3)



Functional planning tool (fig.4)