Zeitschrift: IABSE reports = Rapports AIPC = IVBH Berichte
Band: 72 (1995)

Artikel: An approach to the integration of the design process
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DOI: https://doi.org/10.5169/seals-54660

An Approach to the Integration of the Design Process

Une méthode pour l'intégration du processus du projet

Ein Ansatz zur Integration des Entwurfprozesses

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SUMMARY
A new approach to the integration of the design process is presented. The model considers not only tools that could be solved by means of the traditional computation science, but manifests the necessity to use other techniques useful in representing the knowledge of the experts.

RÉSUMÉ
L'article présente une nouvelle méthode pour l'intégration du processus du projet. Le modèle emploie des outils qui peuvent être traités par l'informatique traditionnelle. Il envisage aussi l'usage d'autres techniques qui sont très utiles pour la représentation de la connaissance.

ZUSAMMENFASSUNG
Es wird eine neue Möglichkeit vorgestellt, die Arbeit aller am Entwurfsprozess Beteiligten zu integrieren. Dieses Modell nützt nicht nur die Möglichkeiten der traditionellen Computerwissenschaft, sondern zeigt auch die Notwendigkeit auf, neuere Techniken zu verwenden, die sich besonders zur Verarbeitung von Expertenwissen eignen.

1. INTRODUCTION

Nowadays design process is developed in a very fragmented succession of activities and in spite of a lot of computer applications have been carried out to improve the work, due to the advances in hardware and software, these applications imitate this fragmented scheme. In other words, the philosophy has not changed: each area has better tools than before but there is no connection among them. Since the 80's a new philosophy has existed: the idea is to integrate the building process during design and later throughout the building's life cycle, giving the computer a more active role in the entire process of designing Gero[3], Eastman[2], Luiten et al.[4]. All these works have a common pourpose that is to obtain the integration of the design process, but the principal difference among them lies in the way in which this integration is reached.

From the analysis of these works the following points can be drawn out if the integration of the design process would be obtained:

- It is neccessary to define a *conceptual model* for structuring all data about a specific building, to be used in design, production and maintenance.
- It is neccessary to store the information contained in the conceptual model in one or more *databases*. Nevertheless, these databases are only able to store objects and their characteristics (shapes, sizes, physical properties, materials used, etc).
- It is neccessary to store the experience of the different partners that intervene in the process, by means of *knowledge bases*, in order to make the system able to take decisions and to adquire knowledge.

This paper describes the study of the different problems which arise as a result of the definition of a conceptual model for integrating the building design process.

2. DESIGN PROCESS MODELLING.

The construction process must be understood as a set of stages that must be executed to obtain the final result. For this reason the process and its stages must be perfectly defined. It will be necessary to take into account each stage of the process separately. In this way a structured organization of the data handled by each stage could be obtained. Once these sets of data exist they must be integrated in objects to the greatest possible extent.

Each object would have different views of the process. Thus the integration of all the data handled by the process will be possible in such a way that a change in one view will imply the change of the instance of the object as a whole.

The acquisition of knowledge precedes to the conceptualization stage. The general vision that we have of the problem depends in part on this stage. Once this stage is done we can pass to the following stage: the modelling, whose result will be the conceptual model, where the structured and integrated set of data handled by the process is represented. This conceptual model, all our knowledge of the problem will present.

The object oriented data bases would be a solution for implementing this conceptual model. In this way both the data structures and the functions of these data as soon as the inheritance properties could be integrated.

2.1. Analysis of the constructive process model

The design method that the architect uses could be emulated by means of an efficient structuring of the architectural process. An algorithmic process can be developed if this process is split into modules that define different stages. This algorithmic process could be solved by means of mathematical tools as the combining topology is. But on the other hand the process needs to have other information due to the set of objective as well as subjective requirements that will be stored in DKB that the process needs to use or modify depending on the stage it considers.

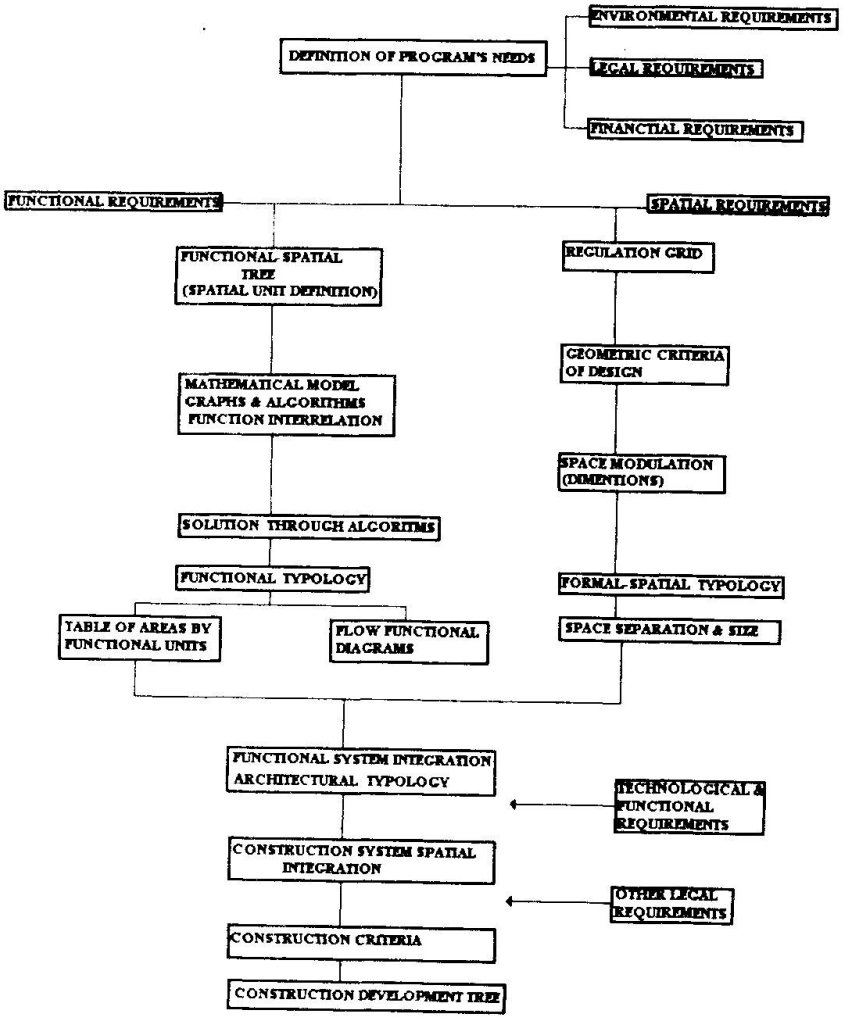

Fig.1 Structure of the Proposed Architectural process as well as the different modules.

In figure 1, the following modules can be distinguished: The module of definition of general program requirements. It is a function of the objective to reach (efficiency, functionality, comfort, etc) and the needs to settle. At this stage a kind of objective and quantitative requirements as can be the legal and environmental or physical ones, must be defined. These requirements could be stored in data bases. On the other hand, other kind of requirements, that have qualitative character must be considered. These last requirements cannot stored in a data base.

Once, the above mentioned stage has been developed, the second module can be developed. This second module, called the architectural design module can be split in two sub-stages Alvarez et al.[1]. In the first of them, the architectural spaces are generated taking functional requirements as

a base. In this way the structure of the building can be defined and, as a consequence, the functional typology can be obtained. At the other sub-stage the space is modulated and geometrically structured, taking into account the spatial requirements. In this way the dimentions can be given, and the spatial typology is defined.

With the integration of both sub-stages the architectural typologies are defined, in which the functions are spatially represented and the morphological image is generically outlined. With both of them an architectural typology file will be created that will be stored in a data base.

The following stage, called the spatial integration of the constructive process, will be developed taking as a base a constructive development tree previously defined. Taking into consideration the technological and functional requirements that has been previously defined and which will be stored in a data base, the constructive system can be choosen. Then the technical calculations will be made with adequate tools and following the legal requirements of the standards of constructive and technical aspects. As a conclusion at this stage, a new data base is generated in which all the elements and components are stored. Lastly, both the functional-spatial stage and the construction development stage must be treated in conjunction to obtain the formal image of the building.

3.CONCLUSIONS

It is very important to bear in mind that the process cannot be implemented as a succession of stages executed in a sequential order only. It seems to be clear that in the integration of the construction process the concepts of subjectivity, personalization and individuality of each design must be dealt with.

It is neccessary to have a system capable of holding the knowledge that the experts integrate within the construction process and which allows going through the graph until reaching the final integrated design.

The interactions between different stages in certain cases may produce feedback between these stages that will originate changes in the products or objects handled during the whole process allowing the control and check of the eventual errors of design.

REFERENCES

1. ALVAREZ M., RECUERO A., Propuesta de Modelo Conceptual de una Vivienda Unifamiliar, ARECDAO 93, 1993, Barcelona pgs. 151-162
2. EASTMAN CH., Modelling of buildings: evolution and concepts, Automation in Construction 1, 1992, Pgs. 99-109
3. GERO JS., AI and New Computational Models of Design, IABSE Colloquium, Beijing, 1993, pgs. 25-34.
4. LUITEN G., FROESE T., BJÖRK B.C., COOPER G., JUNGE R., KARSTILA K., OXMAN R., An Information Reference Model For Architecture, Engineering and Construction, Management of Information Technology for Construction, 1993, Singapore. pgs. 391-406.