

**Urban form at the fringe of Metropolitan Santiago (Chile). A result of a normative or profitability plan?**

*Forma urbana en la periferia del área metropolitana de Santiago (Chile). ¿El resultado de un plan normativo o de rentabilidad?*

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**Abstract**

Metropolitan Santiago is one of the many Latin American cities which has been developed according to a spread model of urbanisation. This pattern has caused at least two types of consequences: economic and physical ones. The former is shown in the speculation of land value at the rural fringe of the metropolitan area which has low prices, these have suddenly increased after the normative changes in the land use, from rural to urban. The later shows location of massive low-income housing and commercial malls regardless connection to the urban fabric and spatial shaping of the existing city. This results in a chaotic urban form resembling a "patchwork". This paper reviews the scope of a Chilean policy instrument called "Plan Regulador" used to control physical urban growth, particularly sprawled on the fringe of the city. It is believed that as a consequence of this Plan, normative procedures are not good enough for achieving its objectives. Conversely, urban form appears to be a result of a profitability plan made by private developers. Given the weakness of this instrument, some recommendations related to spatial models are suggested to incorporate to or complement the "Plan Regulador".

**Key words**

"Communal Regulating Plan" in Chile, growth in size, a city of Santiago de Chile, the relationship between urban design and urban planning.

**Resumen**

*La metrópolis de Santiago es una de las muchas ciudades de América Latina que se ha desarrollado de acuerdo con un modelo de extensión de la urbanización. Este patrón ha causado al menos dos tipos de consecuencias: los económicos y físicos. El primero se muestra en la especulación del valor del suelo en la periferia rural de la zona metropolitana que tiene precios bajos, estos han aumentado repentinamente después*

*de los cambios normativos en el uso de la tierra, de zonas rurales a zonas urbanas. Allí, la ubicación de la vivienda masiva de bajos ingresos y centros comerciales se produce sin tener en cuenta la conexión con el tejido urbano y espacial de la ciudad existente. Esto se traduce en una forma caótica urbana se asemeja a un "mosaico". En este trabajo se examina el alcance de un instrumento de planificación chileno denominado "Plan Regulador", el que se utiliza para controlar el crecimiento físico urbano en la periferia de la ciudad. Se cree que, como consecuencia de este Plan, los procedimientos normativos no son suficientes para lograr sus objetivos. Por el contrario, la forma urbana parece ser el resultado de un plan de rentabilidad realizado por los promotores privados. Dada la debilidad de este instrumento, algunas recomendaciones relacionadas con modelos espaciales se proponen para incorporarlos o complementar el "Plan Regulador".*

**Palabras clave**

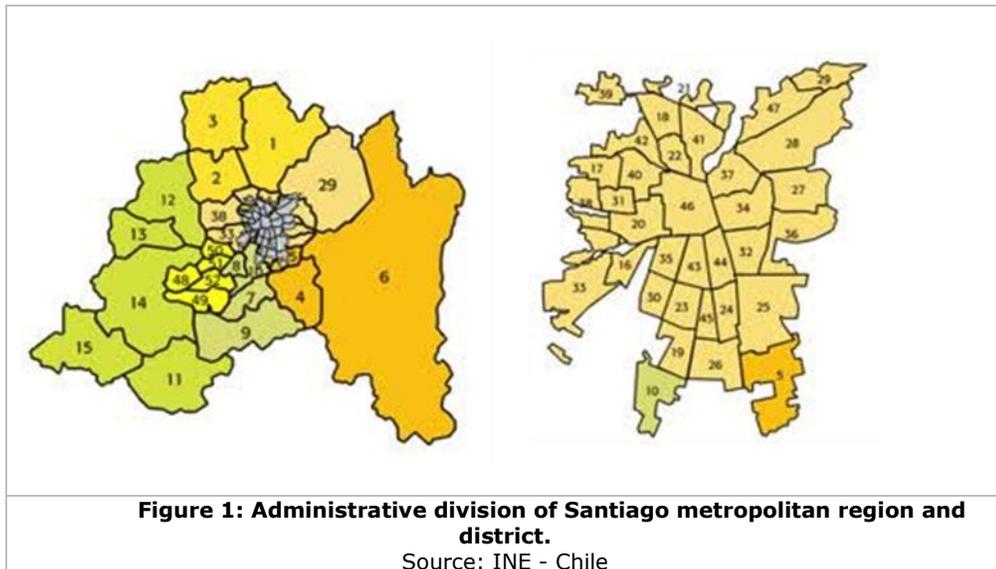
*"Plan Regulador Comunal" en Chile, crecimiento en extensión, metrópolis de Santiago de Chile, relación entre el diseño urbano y planificación urbana.*

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## Overview

Santiago's Metropolitan region is the smallest region in Chile. Of its 791,581 Has only 46,179 Has have been urbanised, leaving approximately 18,015 for future sprawl. Its 4,676,900 inhabitants represent almost 40% of the national population with a density of 101,3 (Hab./Hà.). Santiago is the capital of Chile and it has traditionally hosted industrial, commercial, financing, administrative, and cultural services. National GDP reaches 41,5 %. The Metropolitan area is composed by 34 districts from which 16 are located in the central area and the rest on the periphery (**Figure 1**).



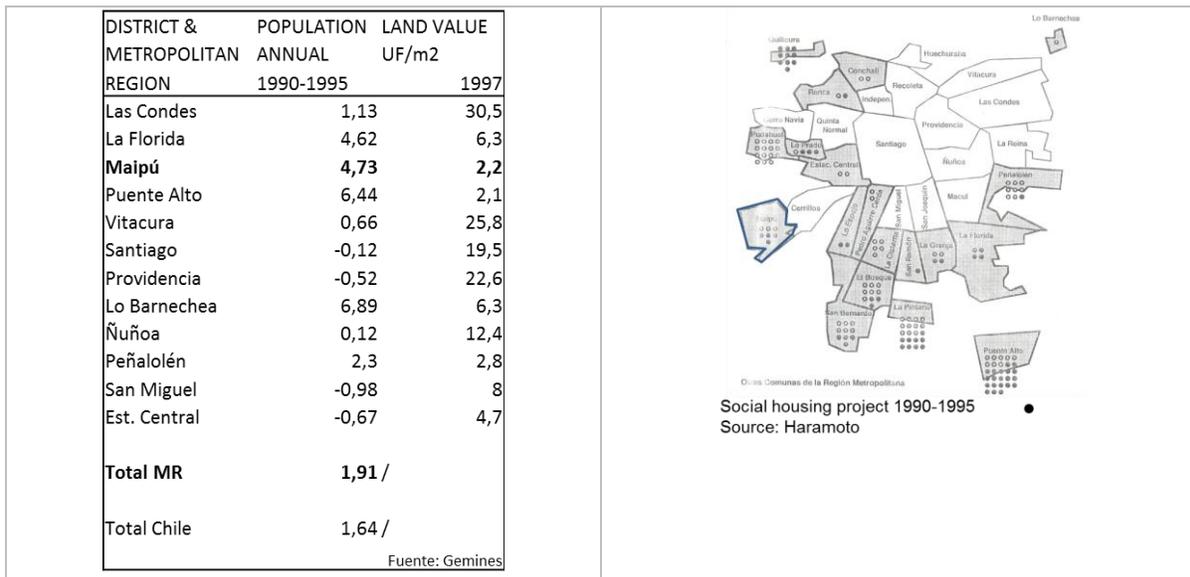
Santiago has been developed according to a spread model of urbanisation, which has had an enormous economic, social and physical impact on the city. Since the 1950's, the Metropolitan Area has shown a rapid physical growth using new land in the periphery (**Figure 2**). Particularly, since the 1980's when urban development policy was based on free market principles, which stated that land was an inexhaustible resource, private developers started to buy land and build large number of low income housing at the periphery. Such is the case of Maipú.

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**Figure 2: aerial view; suburban sprawl in the southwest of Santiago** Source: Aerophotogrametric service, Chilean Aerial Force.

**Figure 3** shows a comparison of Maipú district in relation to Santiago metropolitan region. It considers population, land value and social housing which register some maximum and minimum district value only.



**Figure 3: Comparison of land value, social housing and population in Maipú and district on Santiago Metropolitan Region**

## **Policy and Urban planning instruments in Chile**

To understand the context in which this research takes place, the policy and planning stages in Chile will be outlined briefly. Up to 1974 urban planning was strongly centralised by the state and the main concern was housing and land for the poor. It was the time of land invasion ("tomas de terreno") for housing purposes. From 1974 up to 1980 urban planning still being restrictive with regulatory framework but it starts a decentralisation process through "*regionalización*". Main concern was infrastructure - particularly transport - and housing, not only for the poor but also for middle income groups as well. In the 1990's as many Latin American cities, it is less centralised, more flexible and the state looks for partnership with private sector and community participation. Planning tends to focus on environmental issues and empowerment of the local level. "Real State Agencies are seen as catalytic agents of social change and structural development.

The last three Urban Development Policies (UDP) are quite different from each other in terms of principles and major concern, as follows: (MINVU, 1979) (MINVU, 1985).

-In 1979, "Política Nacional de Desarrollo Urbano" stated that land is an exhaustible resource, therefore there is no need to control land use and to set up limits to physical growth. (Urban Growth Boundaries).

-In 1984, "Política Nacional de Desarrollo Urbano" stated that land is a scarce resource, and thus land use must be planned to control urban growth for public good.

-In 1990, "Política Nacional de Asentamientos Humanos" states that poverty and environmental degradation are the main issues to be tackled by the state and society, hence land use should be controlled according to equity and against pollution.

Chilean town planning instruments are organised in order of a cascade, as follows: (MINVU, 1998)

Plan Regional de Desarrollo Urbano  
Plan Regulador Intercomunal  
Plan Regulador Comunal  
Plan Seccional

All of them differ in terms of the scale in which they are applied, from regional, to inter-district, to district, to neighbourhood. The variables used by instruments to control growth are zoning, facilities, width of road and street system, priority areas to be developed, boundaries, densities, land use, building standard, site division, etc.

## Town planning, Architectural codes and Urban form

Chilean town planning and architectural codes seem to have little or no effect at all in shaping the public space of suburban Santiago. This is quite obvious, if you see the poverty of the metropolitan periphery of Santiago, especially in low-income areas (**Figure 4**). However are those very codes intended to regulate the structure and morphology of the city? And, in doing so, are they not intended to shape the physical space of the communities? These are critical questions; nonetheless, they are not an issue in the written law.



**Figure 4: Spatial poverty of the metropolitan periphery of Santiago.**

Fuente: Mawromatis

For a better understanding of the suburban sprawl phenomena in present-day Santiago, it is necessary to identify the historical forces that triggered the unprecedented horizontal expansion of the metropolitan area. Throughout the last decade and a half, Chile experienced a dramatic restructure in its economic system. Historically, during most of the century, the Chilean State was destined to overtake the responsibility of public and social enterprises. The shift to an open market economy turned the lead of urban development to the private sector. Suburban growth developed as an attractive investment field.

Private developers have been benefiting since, through a very generous variance to the ordinance, called "*DFL-2 de construcción simultánea*", that overrides the municipal codes and the general ordinance of urbanism and constructions.

As a result, suburban development projects became increasingly standardised, uniformed and monotonous. Maximising profit and minimising risks has been the motto shaping the suburban landscape of middle and low-income communities.

The central issue regarding the ineffectiveness of Chilean Ordinances in conforming a community, is based on two main points:

Firstly, the municipal codes, as well as the general ordinance of urbanism and constructions have been conceived as written law. The urban form as a central issue in the structure of a city, is not considered. Zoning is the basis in the shaping of suburban development. The urban space, as a result, is non-existent in terms of form and identity. Second, the codes and regulations are structured as a restrictive instrument, which has proven to fail in achieving a good urban form.

The American experience regarding the effects of suburban sprawl allows anticipating the potential destruction of vernacular urban culture through zoning criteria in urban policies. Economic growth and access to a higher standard of living in Chile may accelerate the predominance of the car in urban planning, favouring therefore, and the American suburban model. Collector highways, closed developments and even more restrictive regulations for a mixed used environment can be the consequence.

Mixed-use, hierarchy, urban and architectural typology, is clear and specific variables that are essential in conforming a neighbourhood, a town, and a community to identity. These variables can be incorporated in local codes that prescribe rather than restrict.

In that respect, the new American towns and the alternative codes that shape them, like the Traditional Neighbourhood Development TND (Duany and Zyberck, 1991), have proven to become a quite successful enterprise. Communities and businesses have benefited through a challenging and intelligent endeavour.

### **The Missing Point: The Urban Form**

Given this introduction, the Maipú district has been selected as a case study as it is located in the fringe of Metropolitan Santiago City and it has shown a great dynamism in the last 15 years. The instrument known as Plan Regulador Comunal (PRC) has been applied in Maipú since 1965 and urban fabric has been shaped by social, legal, political and economic factors in different decades. Remarkably, before the creation of PRC, there were legible physical structures in the old centre. After this instrument was applied, physical structure of the city started to blurr, though it appears certain significant elements that could shape urban form of Maipú in terms of spatial boundaries, connections and centrality. However, they hardly articulate an urban design project to develop the city (**Figure 5**).



**Figure 5: Disruption in scale of residential development around identity icon- Templo Votivo Maipú**

Fuente: Cárdenas

Since the 1980's sprawl of the metropolitan Santiago city was explosive and particularly Maipú district which cross far beyond legal boundaries of PRC and starts to form conurbation Santiago - Maipú. A critical issue was how to control spread without architectural codes and urbanism recommendations derived from PRC. Therefore others urban planning instruments were applied to land use such as *Plan Regulador Intercomunal*, (PRI) and *Plan Seccional*, (PS) as well as a legal regulations like Housing DFL-2 "*construcción simultánea*" and another one ironically called "*conjuntos armónicos*". (Harmonic project) However, none of them consider means to structure the urban fabric of Maipú as a whole, consequently urban form becomes chaotic and disconnected to the old city square. At the end, building the city in Maipú district is a process to add one by one but regardless of the functional and composition principles.

On the other hand, these instruments considered variables to control physical growth of buildings, sites, land and streets but it still not good enough for shaping the urban form. This is due to architectural codes such as building height, constructibility parameters, as well as urban regulation like land use, land occupancy percentage, size of site, densities, distance from neighbourhood site, etc. are applied to regulate space within private property. While normative to control streets, water-sewage pumping, communications network, etc. - all elements located on the public space - are applied to protect right function of the single service but not to regulate public space as a property of the community and users. Therefore, at the end of the day the design of public space is not a conscious but a residual task.

To illustrate, there is a technical manual to control street size according to safety and geometric principles in order to guarantee that vehicles can easily move on it. The design concept of the street is platform for mobility instead of space for pedestrian and vehicles whether staying or moving. Moreover, to link such public space to architecture and activity within it. For example, a concert hall building would likely need more public space for staying and waiting people in a safety manner, so design of the street might be different than standard street size.

In this case, the question would be how to link activities, architecture and street (public space)

In an ordinance in which matches all different requirements?

In others words, to conceive public property as a space for living people rather than a platform to provide services only such as cars traffic or water supply. In this sense, it seems that a new normative which considers other elements and dimensions to shape urban form in the cities is required.

### **Blending Spacial Models**

Going back to the origins of spatial analysis methods, it can be found that the first attempt to work with such a graphic methods took place in the sixties. In fact, the Scottish architect and city planner Mc Harg set up the basis for ecological planning to protect natural environment from urbanisation projects. In doing so, the author proposed a method for environmental impact analysis which support EPA (Environmental Policy Act) in the USA (McHarg, 1967). Moreover some authors have stated that concepts behind Geographical Information System GIS started with Mc Harg method of environmental planning method (Sainz, 1992) (Martin, 1996). However, the first technical example was the Canadian Geographical Information System applied to land use in 1964 (Bosque, 1992).

In addition to that, technology began to develop, i.e. in 1962, Sutherland developed the first software package for drawing in Massachusetts Institute of Technology (MIT) which is considered as the basis for Computer Aided Design CAD. (Sainz, op. cit.). However, since then, many graphics software have been created for spatial analysis and they can be classified under an umbrella term known as Computer-assisted Cartography which is composed by CAD and CAM Computer -aided Map. CAD is widely used in architectural and engineering design environments which when applied to map is known as CAM (Martin, 1996).

After the creation of IBM's Personal Computer PC, in the nineties a wide variety of graphic software have been launched to the market. While CAM was developed, GIS emerged as a mayor tool for spatial analysis. Nowadays, GIS is considered both a

technology and a spatial analysis method for modelling (Birkin, 1996). Broadly speaking, GIS is a device for turning data into information for decision making (Hearnshaw, 1996) But it also involves a process that consists of at least four stages: collection and input data; storage and retrieval; manipulation and analysis; and finally output a digital map and reporting (Martin, op. cit.). Geographical Information System, whether technology or process, is widely used for regional and urban planning purposes and recently for spatial decisions support system (SDSS) (Birkin, op. cit.).

In the meantime, CAD developed a three-dimension (3D) software which emerged as a step toward modelling architecture and public space, in other words, to support urban design. This device is a cornerstone for architects and city planners to work with architectural and urbanism concepts that traditional means such as CAD or even GIS cannot convey to the users or decision-makers. This is due mainly to the fact that both packages are applied in two dimensions (2D) of reality. In this sense, it is important to distinguish both capability surfaces modelling and volume modelling to enable research on the interaction of different shapes in the realm of public space (GisEurope, 1997) (MicroStation, 1997).

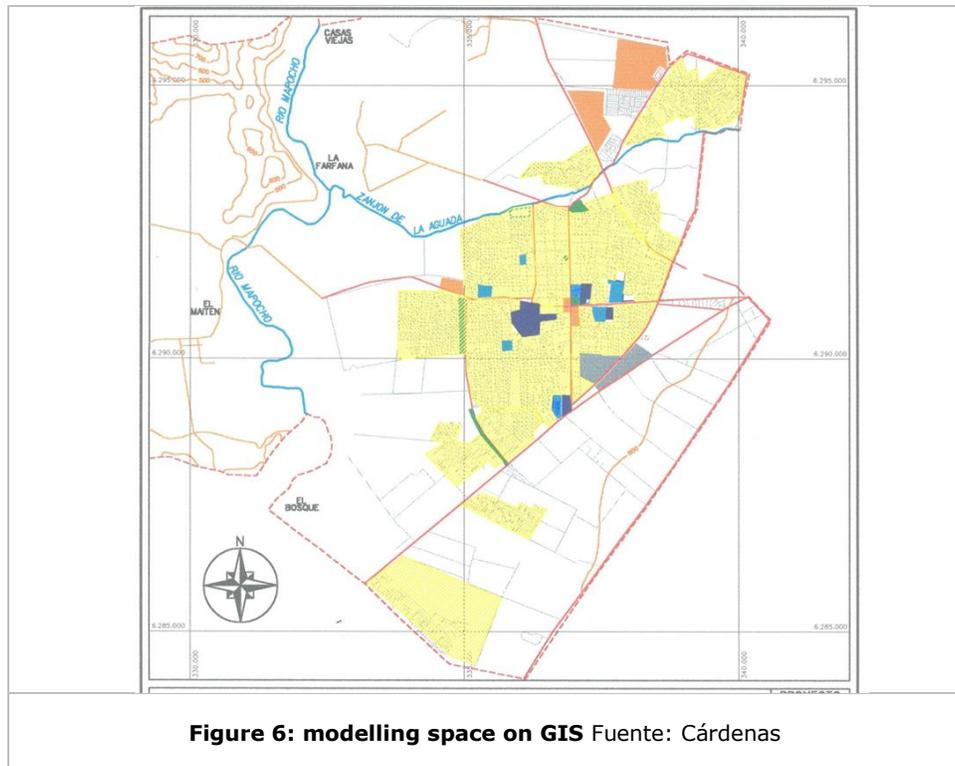
In the nineties, Virtual Reality VR emerges in the zenith of computer graphic technique and urban modelling concept, because it becomes a way of developing a virtual urban environment for planning and design purposes (Batty, 1997). In fact, on web sites it is possible to find "virtual cities" in different ways such as online guides; or "flat" which use 2D maps of cities and buildings; or 3D which use virtual reality technology to model the built form of cities; or "true" virtual cities which are an effective digital equivalent of real cities. For example, a realistic built form, a diversity of services, functions and information, is able to support social interaction with other users (Dodge et al., 1997). The most popular approach to create virtual cities is the Virtual Reality Modelling Language, VRML which provides a flexible, powerful, platform-independent tool to model the urban form of virtual cities.

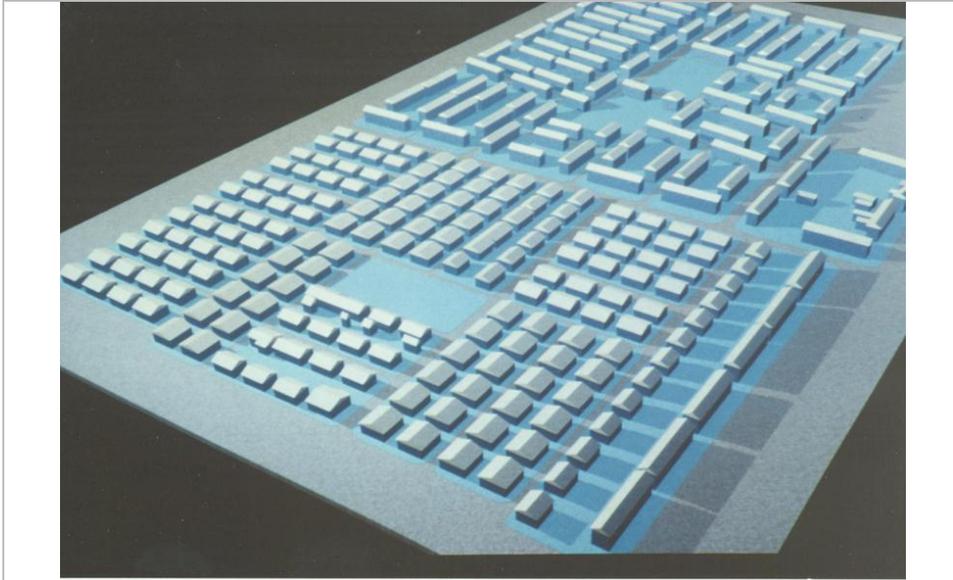
Given the "state of the art" in spatial modelling, this paper intend to propose an integration of method to be included as a regulatory framework in Chilean planning process in order to guide decision makers in controlling urban form. It is believed that through visualisation technique private developers, users and decision makers can more effectively communicate and achieve an understanding of the spatial impact of its interventions on the built environment.

According to requirements of disciplines is the method to be applied on; a case in point is the use of GIS traditionally has been applied to environmental planning, land use planning, regional planning, etc. While CAD, 3D and recently VR has been applied to architecture, urban design and urbanism. In the latter, it should be mention a couple of remarkable examples: the famous architects Duany and Zyberck in USA (Katz, 1994) with "the new urbanism" and Batty in UK (Batty, op. cit.) with "the virtual cities" on the nineties.

To implement these experiences in Chilean planning, it is imperative to provide the local municipal authorities, the private developers, and the common citizen, with a clear and tangible view of how investing in better projects can ultimately benefit everyone. Thus it would be possible to anticipate and to improve the understanding of the impact and potentials of urban interventions in the city.

As stated previously, the missing point in Chilean town planning is the urban form, this paper intends to explore the ways to bridge the gap between 2D and 3D visualization as a concept to be applied to planning instruments. It would therefore be possible to display information of planned and unplanned changes on the urban environment (Bishop, 1994). An integration of both methods is thus proposed: a "cartographic model" based on GIS and a 3D visualisation, both of them working in an interactive way as shown in **Figure 6** and **Figure 7**.





**Figure 7.- Housing visualization 3D**

Source: Cárdenas

As shown, the cartographic model works with 2D based on base map that overlap to create a new map with new information in a type of flow chart. The final result is then contrasted with alternatives of urban design to assess and evaluate spatial changes. Prescriptive rather than restrictive codes are suggested in order to support town-planning instrument for shaping an urban form.

Prescriptive codes are easier to formulate, if they go together with clear, simple spatial and volumetric rules. The urban form, as structure and as public space, is physically defined by the relation between buildings and the open space. This can be replicated using 3-D software. 3-D modelling allows experimenting in urban space through trial and error at a low cost.

Urban Planning and Architecture in the metropolitan area and even in at a neighbourhood scale may result very abstract for the common citizen. Nevertheless, a community may participate and become involved with its environment through computer generated simulations. Involvement creates commitment. Commitment creates identity, which result in better communities.

## References

BIRKIN, M. et al. (1996). *Intelligent GIS. Location decisions and strategic planning*. GeoInformation International. Cambridge.

BISHOP, I. (1994). The role of visual realism in communicating and understanding spatial change and process. In *Visualisation in Geographical Information System*. John Wiley & Sons. Chichester.

BOSQUE, J. (1992). *Sistemas de Información Geográfica*. Ed. Rialp. Madrid.

DUANY, A. and E. Plater-Zyberck (1991). *Towns and Townmaking Principles*. Harvard University Graduate School of Design. Rizzoli. New York.

GISEUROPE (1997). *Spotlight on 3D GIS*. Issue 10, October. GeoInformation International. Cambridge.

HEARNSHAW, H. & D. Unwin (Ed.) (1994). *Visualisation in Geographical Information System*. John Wiley & Sons. Chichester.

KATZ, P. (1994). *The New Urbanism*. Mc Graw Hill. New York.

MCHARG I.L.(1967). *Design with nature*. John Wiley & Sons. New York.

MARTIN, D. (1996). *Geographical Information Systems*. Routledge. London.

MICROSTATION WORLD (1997). *Designed to Last*. Third Quarter. Bentley Systems Inc. Pennsylvania.

MINVU (1979). *Política Nacional de Desarrollo Urbano*. MINVU. Santiago.

(1985) *Política Nacional de Desarrollo Urbano*. MINVU. Santiago.

(1998) *Ley y Ordenanza General de Urbanismo y Construcciones*. Ed. Publiley. Santiago.

SAINZ, J. and F. Valderrama (1992). *Infografía y Arquitectura: dibujo y proyecto asistido por ordenador*. Ed. Nerea. Madrid.