Aims, application frame, and antecedents

This proposal develops a methodology applicable to the analysis of spatial texts. This is an adequate system to represent spaces, producing a certain kind of knowledge about them.

When speaking of space, we mean any representation of space. According to a semiotic perspective, we do not suppose that anything can be apprehended otherwise than through some kind of signs. For cognition nothing exists but these signs. Avoiding entering into the debate of the possibility of an ontic existence, we affirm that, for the human mind, a space is what the signs representing it make it to be. In this sense, a spatial text, a spatial grouping or settlement, can be a two-dimensional representation (for example, an architectural plan) or a three-dimensional model (for example, a maquette); even when we are in front of a real building, all we have of it is the interpretation of a certain image in our retinas, which is also a sign.

Therefore, the proposal presented here is a certain kind of representation, 'a formal scheme for describing shape or some aspects of shape' (Marr and Nishihara 1978: 270), working out from other representations.

We consider this methodology appropriate for the analysis of spatial configurations both two and three-dimensional. In this article we focus the analysis, for the sake of illustration, on a plan of an architectural work. This fact does not rule out the possibility of applying the system to any other object in a field other than architecture. Object must be understood as a textual construct (in our case a visual one) by which its utterer has organized the space cognitively.

This article is based mainly on two previous pieces of research. One of them, worked out by Juan A. Magariños de Morentin, is about the semiotic analysis of verbal discourse. In this sense, the present article intends to apply those developments to the semiotic analysis of spatial visual texts. To this application, we do not simply take the tools of the
verbal analysis trying to adjust them to the spatial visual analysis; instead, we develop the appropriate tools for our objective independently of the other research, taking just the general ideas from it.

The second of the alluded investigations is the theory of spatial delimitation, proposed by César Jannello (1983a, 1983b, 1984), as well as some developments of it, carried on under the research program directed by Claudio Guerrì (1985, 1987, 1988). We apply certain aspects of this theory without questioning for the moment its pertinence or suitability to represent any kind of spaces.

From the theory of spatial delimitation, here we take basically the system for the organization of figures, as well as the variables by which all these signs can be described or specified. This is presented here axiomatically, without aiming at a demonstration or justification of its validity.

Those figures and relations are used here as elements entering a net, which intends to represent the relationships present in a spatial text.

This net departs notably from the models appearing in the theory of spatial delimitation as tree structures (cf. Jannello 1983b; Guerrì 1988: 405, 407, 410; Gramón 1988). The conception of the net is closer to the semiotics of discourse (Magariños et al. 1991), in the sense it is an application of the first semiotic fundamental operation, i.e., syntactic attribution, which for a full production of signification is integrated with semantic substitution and pragmatic overcoming (Magariños 1986: 145).

Nets of spatial relations and configurations

The net allows a certain knowledge about a spatial text and constitutes the representation of that knowledge. Following Peirce (CP 2.228–231, 2.274, 4.536; 1966: 404) we can say that the net is composed of certain signs (figures, relations, configurations, formulas), which refer to other signs (spaces), which at that moment constitute their object, creating another series of more elaborate signs called interpretants.

The net intends to produce the representation (it has an iconic conception) of the possible cognitive operations used by the utterer of a text, representation which ultimately organizes, constructs, or projects (Jackendoff 1983: 23) the spatial relationships of the object.

As a system of signs, the net (second representation) has certain semantic relations with the objects it refers to (the spatial texts that constitute the first representation). Semantic relations are to be interpreted as the relations among the signs of the system used as substitute and the objects to which they refer, that is, the signs of the substituted system. The semantic relations show the capacity of those signs to substitute for or represent those objects in some aspect. In our case, we use graphic figures and configurations to represent spaces and articulations of spaces. Figures and configurations maintain some formal and metric similarities with the spatial text to which they refer; they work, therefore, as icons.

The net implies a more elevated rank in the knowledge of the object because it is not merely an iconic and structural representation of the spatial relationships of a complex text; it also represents a logic sequence or ordering of the productive or cognitive process of such text (Jackendoff 1987b: 37).

A semiotic net of relations, such as the one proposed here, aims at satisfying the initial conditions of what, echoing Langacker, can be termed a cognitive grammar of the spatial representation. Such a grammar is conceived as 'the most complete description possible of those aspects of cognitive processing which constitute the mental representation of a linguistic system' (Langacker 1991: 512), in our subject, of an architectural system.

Figures, relations, and configurations as signs of spaces

A net is composed of figures, relations among figures, and configurations.

Figures are considered as signs that represent spaces according to an iconic relation. This relation refers merely to the qualitative aspects of shape and proportion and to the quantitative aspect of size of the space. Reference to other formal aspects that may characterize a space — such as color, texture, or appearance of the constituting elements — are not included in this article. Moreover, figures do not give any indication of the constructive materiality, or of the uses and functions a space can lodge.

These aspects are not neglected; simply, they have not been considered on this occasion, which does not mean they will not be dealt with in future applications of this research. Thus, a net of tonal, textural, functional, or other relations could be developed along with the spatial net as well.

A space can be an empty delimitation, say a room, or a solid, say a wall mass. Contrary to the usage of some authors, for instance Preziosi (1979: 45–47), who define the solid delimitations as mass and only the empty ones as space, we prefer to use the term space in an broad sense. Thus, a space can be plane (two-dimensional) or volumetric (three-dimensional), the latter type being either solid (with mass) or empty (without mass).
The consideration of solid elements as spaces or not will depend on the text to be analyzed. In modern architecture, where walls are usually thin diaphragms, the thickness of these elements is not relevant as space. In other architectures, where the mass of solid elements is prominent or where they have a sculptural treatment, it could be relevant to consider the solid elements as spaces; we should remember, for instance, Michelangelo's plan for Saint Peter's in Rome.

Criteria for representation

The edges of figures represent the main limits of a space. Consequently, a room would be represented in two dimensions by a rectangle (if this figure corresponds to its shape), or in three dimensions by a rectangular prism. These figures leave out, at first, all the other minor elements that modalize or characterize the space, for example, shape and position of receding or salient parts, additions or dependent sub-spaces. Such sub-spaces are analyzed later, in regard to the main space they depend on. In order to describe any spatial configuration, no matter how complex it is, this procedure of hierarchical description is applied iteratively. On the notions of hierarchy and description of complexity, see Simon (1969: 1, 73, 107, 117), and Langacker (1986: 4).

The limits of figures can be traced in two different ways. If the solid elements (walls, columns, etc.) are too irrelevant to be considered spaces, then the delimitation of figures is traced on the axis of those elements. This criterion is the one followed in our analysis sample (see Fig. 3). If the solid elements are relevant enough to be regarded as spaces, then the delimitation of figures is traced on the borders of those elements. Those borders constitute the contact between solid spaces and empty spaces.

A figure is always defined as a convex delimitation. It does not admit concavities (Jannello 1984: 6). A concave space must be represented by the combination of two or more figures. This combination is called relation. A relation, as we will see later, can generate one or various configurations.

All figures are generated and explained by means of certain transformations produced starting from some particular figures which are taken as primitive or irreducible categories. These primary figures, which are not generated but are taken as provided by geometry, are: the infinite series of regular polygons from triangle to circle, the five regular polyhedrons, the sphere, and other polyhedrons (the 13 Archimedian polyhedrons, the regular prisms and antiprisms, the pyramids with polygonal base, and the cone), on condition that they be inscribable in a sphere and that they occupy the maximum volume possible. Starting from these figures, infinite series of spatial delimitations are derived through a procedure devised by Jannello (1983a: 3–8; 1984: 2, 8; also, Guerri et al. 1987: 4.3.14). These derived delimitations besides the primary types mentioned are the only delimitations called figures. A spatial delimitation that cannot be explained in this way is not considered to be a figure.

Figures are always drawn complete. If the space to be represented is concave or irregular, then it must be represented by a combination of two figures or through a series of combinations. The combination of two figures is called relation. If a space is equivalent to an incomplete figure, say a portion of a circle, the representing figure is to be traced complete, that is to say the whole circle. In order to account for the delimitation of the portion in question it is necessary to resort to the intersection of the complete figure with another one, therefore, a relation is necessary. The representation of spaces as they appear in the analyzed text (where they can be portions of figures) is accomplished in the configuration.

Modal space, modalized space, relation of modalization

Relations and simple configurations are the significant units of the analysis. Relations show the way in which two figures are combined. Simple configurations are the representation of such relations as they actually appear in the text. In a relation we can recognize: (a) the modalized figure (the one representing the main space), (b) the modal figure (the one representing the subsidiary space that affects the main one), and (c) the combinatorial relation proper that brings both figures together. Comparing this with the semiotics of discourse exposed by Magarínos et al. (1991), the modalized figure can be seen as equivalent to the first column, the modal figure to the third column, and the relation proper to the second column.

Analysis variables and their notation

The variables by which each of the two combined figures are analyzed and defined are: formatrix, size, and saturation (Jannello 1984: 2). Avoiding going into details, we will give a short explanation of these variables.

Formatrix (F) refers to the family or type to which a figure belongs. For any two-dimensional figure, its formatrix depends on the quantity of sides and on how it has been derived from a regular polygon having
the same quantity of sides (Jannello 1984: 2; Guerri 1988: 408). This concept can be clarified with Figure 1.1, which reproduces a sample of the procedure devised by Jannello to derive figures, a procedure which — simultaneously — gives origin to an order system or atlas of figures. In this sample, a family of squares and rectangles has been derived from a square in normal position (by convention, at 0°). It is said that all of them have the same formatrix (form-matrix). If instead of positioning the square at 0° we set it at 45° (Fig. 1.2), another family (in this case rhombuses) is generated, and consequently this is another formatrix. The same happens if we begin with another polygon, for instance a triangle (Fig. 1.3). Summing up, the formatrix is defined by means of the original regular polygon and its angular position in regard to the axis of the graphic construction of the atlas. For the sake of notation, the formatrix is expressed by a number standing for the quantity of sides of the polygon, followed by another number indicating its angular position. In the case of Figure 1.1, the formatrix is $F=4/0°$; in Figure 1.2, $F=4/45°$; in Figure 1.3, $F=3/0°$. By convention, we consider 0° when the polygon is in such a position that, if a horizontal line is traced under it, one of the sides of the polygon rests on this line. Regarding the number of sides, the formatrix can vary between three (triangle) and infinite (circle). With respect to the angular position, the possibility of variation for each polygon is 360 degrees divided by its number of sides. For any three-dimensional figure, the formatrix depends on the type of polyhedrons from which it has been derived by means of Jannello’s procedure.

Size ($S_2$) refers to the area of a figure (for two-dimensional figures) or to its volume (for three-dimensional ones) (Jannello 1984: 2). For notation purposes, the size can be expressed, in absolute terms, in any unit of area or volume, or, in relative terms, by defining a certain area or volume as the unity.

Saturation ($S_1$) refers to the proportionality of a figure. For rectangular two-dimensional figures, the saturation is directly obtained dividing length by width. For any other class of figures this is no longer valid. Thus, the general procedure consists in: (a) positioning the figure into the atlas with the aid of the corresponding graphic device (Jannello 1984: 2, 8; also, Guerri et al. 1987: 4.3.2), (b) tracing a straight line from the point 0 of the atlas and making it pass through the centroid of the figure, (c) obtaining the slope of such a straight line (by dividing its vertical coordinate by its horizontal one). This slope represents the saturation of the figure under consideration (Fig. 2). Saturation may vary between 1, for regular polygons or saturated figures, and a very large value, for lines. The notation of saturation is made by these values. For three-dimensional figures, saturation is broken down into two: planar saturation and corporeal saturation. In the case of rectangular prisms, the planar saturation is obtained by dividing length by width, while the corporeal saturation, by dividing length by thickness.

Once both figures of the relation are defined through the mentioned variables, it is necessary to describe the relation by which they are combined. This relation is defined by considering the variables of separation and attitude between both figures (Caiano and Guerri 1986).

Separation refers to the distances between the centroids of the figures, measured according to their projection onto certain axes. For the relations between two-dimensional figures, separation is broken down into two because it is measured on the $x$ and $y$ axes. For the relations between three-dimensional figures, separation is broken down into three because it is measured on the $x$, $y$, and $z$ axes. The abbreviations for the different separations are $xS$, $yS$, and $zS$. All separations can be expressed in a notation either by means of absolute or relative values. In the first case any metric linear unit can be used (millimeter, centimeter, meter, etc.). In the second case it is necessary to take a fixed separation as unit, and refer all separations to this one.
Attitude (A) refers to the angular position of figures in the combinatorial relation, that is to say, the degree of rotation of one figure in regard to the other. The attitude is expressed by means of the angle which shows the difference in degrees in the position of both figures. By convention, the vertical is considered 0°, and the rotation is measured counterclockwise. We remark that attitude is not the absolute position of an isolated figure but its difference in rotation degree with regard to another figure. Hence, for example, if two rectangles are lying the attitude is 0° because, while each rectangle has rotated 90° with regard to the vertical, the difference between both rotations is zero. Let us suppose, in another example, two isosceles triangles lying, but one of them pointing to the right and the other to the left. The attitude is 180° because the first one has rotated 270° (three right angles) from the vertical and the second one has rotated 90° (one right angle), the difference being 180° (two right angles). In the case of relations between three-dimensional figures, the attitude is broken down into three because the rotation can occur on the x, y, and z planes individually or jointly.

Guidelines for the construction of nets

A difference of this net of spatial images with the net of a verbal text comes from the fact that in verbal texts we have a temporal linearity and successiveness while the image is presented as a simultaneity of elements. Furthermore, in verbal texts there exists a typification of terms: subject, modalizer, verb, adverb, etc., which are expressions already codified by linguistics whose syntactical function responds to a system of grammatical categories. Therefore, we know the function each term accomplishes, and which term works as modalizer of another. In graphic texts there exists no previously established grammar whose rules indicate the function of the different figures; one of the aims of this article consists precisely in establishing some of these rules.

Hierarchies of spaces

Among the signs of the net, certain syntactic rules are established.

The simple configuration, which corresponds to the statement in Magarianos et al. (1991), is always a figure connected with another figure by means of some relation. One of these figures is considered as the modalized one and the other one as the modalizer of the former.

In order to consider that a space modalizes another space some contact between both must be verified to exist. Through this contact, the modal space produces either an addition or a subtraction to the modalized space. If the modal space is completely interior to the modalized space, then it effects a subtractive operation; if it is partially or totally exterior, then it effects an additive operation with regard to the modalized space. The modalized space is the one that receives the effects of the addition or subtraction resulting from relating both figures. As a general rule, the modalized space is larger than the modal one.

The explanation of the system will be exemplified with the two-dimensional analysis net of the plan for Hagia Sophia in Constantinople (Fig. 3). This net can be read in various different ways.

Sector A, the net proper, constitutes an analytical tree structure, which has an obvious Chomskyan reminiscence (Chomsky 1957: 27; 1965) and certain similarities with Marr’s 3-D model of description (Marr and Nishihara 1978: 278–279). This tree structure shows how, starting from a base figure, the different modalizations are produced with the aggregation of new figures which, in turn, suffer ulterior modalizations. The nodes of the tree show the relations between spaces, represented by complete figures. The shading of figures shows, starting from such relations, the spatial configurations as actually verified in the analyzed architectural plan. A relation can be the origin or explanation of various configurations. Thus, for example, the relation expressed in 131 can potentially give origin to six different configurations (Fig. 4). Of all these possibilities, the one which actually appears in the plan is the one having the square with the half-circle juxtaposed (the number 2 in Fig. 4). This is shown with the shading in sector A, and in this same way the configurations appear in sectors B, C, D, and E.

Sector B is a column with a series of configurations. Each one accumulates the configurations of the corresponding level, and the complete series shows the different grades of specialization in the construction of the total configuration. This column makes the summation of the configurations in each level, in our case, levels I, II, III, and IV. Since each level represents an increment in the grade of specialization of design, this series of partial configurations shows a sequence from the most general (the space synthesizing the whole church) to the most particular (the smallest apses which affect a certain part).

Sector C is a row with a series of configurations accumulating the configurations of each derivation branch of the tree. All configurations in the series are equioriginal (that is to say, accumulated, starting from an equivalent origin), and each configuration bears its own ranges of modalizations. This row makes the summation of configurations for each
branch, in our case, the branches derived from nodes 11, 12, 13, and 14. The resulting configurations show the right aisle, the left aisle, the nave, and the portico — all equir original parts — with the range of modalizations that each one possesses.

The total configuration results from the summation of column B or row C, and is placed in sector D. This total configuration shows the result of all the operations integrated, and can be contrasted directly with the plan of the church because it represents the spatial structure of that plan.

Another possible reading is given in column E, where each configuration of the series, besides accumulating the configurations of the corresponding level, adds the ones of the previous levels. This column goes also from the general to the particular, but including in each step the previous grades. This column E shows the generative qualities of the system and is comparable to the levels of specificity mentioned by Langacker (1986: 8), where each configuration ‘can be regarded as schematic for the one that follows, which elaborates its specifications’ and defines the modalizations effectively present among all the possible ones. The total configuration (identical to the one in sector D) appears here directly at the end of the column. Consequently, this column shows a linear synthesis of the design process.

Let us see now the formation of the net. There is a figure which constitutes the main space of the analyzed text. This base figure is the one which all the remaining figures directly or indirectly modalize. This figure is placed in the first level of the tree. In our example, the base figure (1) is the rectangle broadly representing the whole interior space of the basilica (excluding portico, narthex, and interior apse).

The second level (or grade of specialization II) consists of a series of four relations and their corresponding simple configurations, which show all the modalizations the base figure suffers, taken in their most general level. In the example, the base figure is modalized mainly by four figures:
a rectangle (11) representing the right aisle, a rectangle (12) representing the left aisle, a square (13) representing the central space under the dome, and a juxtaposed rectangle (14) representing the narthex. As can be seen, each simple configuration is made up of the base figure plus a minor figure which modalizes it, either as an interior partition cut out from the space of the base figure or as an external addition.

Each subsequent node consists also of a relation which generates a simple configuration. One of the figures comes from the previous node, while the other one is a new figure which modalizes the former. Thus, in the third level (or grade of specialization III) we see the rectangle from node 11 receiving the modulation of another rectangular space (111), which is shorter than the former and interior to it. The same happens in node 121 with the rectangle coming from node 12. The square coming from node 13 suffers three modalizations: at 131 and 133 it becomes expanded along its longitudinal axis by means of two semicircular exedrae with half domes, while at 132 it receives the modulation of the circular space of the central dome. At 141, another rectangle, representing the exterior loggia or exonarthex, is added to the rectangle coming from node 14.

At the fourth and last level (grade of specialization IV), only relations and configurations coming from nodes 131 and 133 are developed. The rest of the nodes remain as terminals at level III. The circle representing the half dome of the rear is modalized at 131.1 by the octagon introducing the apse. This half dome is also modalized at 131.2 and 131.3 by two minor circles, representing the lateral exedrae, which expand it. Similar exedrae, represented at 133.1 and 133.2, expand toward both sides the half dome near the entrance, which is also modalized by the rectangular space (133.3) making up the transition with the narthex.

The net presents various features and details which we proceed to analyze.

The numbering of nodes is done according to a decimal system. Each added digit implies a more specific relation. The base figure bears number 1. Each of the remaining relations bears the number coming from the upper branch plus a new decimal which differentiates it from its neighbors. This system has two significant qualities: on one hand, each numerical designation reflects the genealogy or lineage of the relation (that is, allows us to know which branch it comes from); on the other hand, the quantity of digits coincides with the level number at which the relation is located (relations at level II bear two digits, at level III, three digits, etc.). Hence, even if we see an isolated relation, by paying attention to its numerical designation we can know in which level it must be placed and what its genesis is. In order to facilitate the reading, after each group of three digits (counting from left to right) the numerical designation is detached by a point.

Levels are indicated by roman numerals.

In the nodes of the tree, figures are marked with thick lines when they work as modalizers, and with thin lines when they work as modalized figures. As has been said, the shading indicates the part of a figure taken in the configuration. In configurations, either in the columns — where they aggregate the levels of the tree — or in the row — where they sum the main branches of the tree —, all figures are marked with the same fine thickness.

**Notation formulas and their counterpart with graphics**

The specification of figures and their combinatorial relations in the tree (sector A) can be performed in two ways: drawing the configurations directly, as has been done in Figure 3, or by means of notation formulas (Fig. 5). These formulas specify both the pair of figures and the relation by which they are combined.

Formulas constitute a notation system which can substitute for the drawing of the relations, though with a different semantic efficacy. Complementarily, formulas enrich the interpretation of the analysis.

Thus, in our example, the base figure holds as notation: \( F \) (formatrix) = 4/0°, \( Sz \) (size) = 5396 m², \( St \) (saturation) = 1.07. At node 11, this figure

![Figure 5. Specification of figures and their combinatorial relations by means of notation formulas. The tree from Figure 3 is expressed here in this symbolic language.](image-url)
appears in a relation with a rectangle whose notation is \( F = 4/0^\circ, \, S_z = 648 \, \text{m}^2, \, S_t = 2 \). The relation between both figures is expressed by: \( xS \) (x separation) = 0, \( yS \) (y separation) = 26.5 \, \text{m}, \( A \) (attitude) = 0°.

In the tree, separations in each relation are measured from a pair of orthogonal axes crossing at the centroid of the modaled figure (the one coming from the upper node). The measured distance, then, is the separation of the modal figure (taking its centroid too) with respect to the modalized one. For \( x \) separation, values are positive if separation is produced to the right, and negative if separation is produced to the left. For \( y \) separation, values are positive if separation is produced upwards, and negative if separation is produced downwards.

The notation formulas of figures are placed in the node where such figures work as modalizers (the formula refers, in each node, to the new figure, the one marked with thick lines). The notation formulas of the relations between figures are placed along the lines connecting a node (in one level) with its derivatives (in the inferior level).

The relations between spaces can be described in the net in two different levels of language, the iconic one (graphic), which represents spaces and their relations by means of a certain kind of similarity, and the symbolic one (notation formulas), which represents spaces by means of an established code. The use of one language or the other, or the addition of formulas to the drawing of the relations, will depend on the degree of precision in the information intended to be conveyed. Evidently, formulas are more exact than simple visual estimation of the graphics.

In our case, the analysis could be semiotically performed solely by images. But, even admitting the hypothesis that in the cognitive process of the organization of space man concedes preference to the iconic aspect, at a certain instance, the symbolic semantization (the attribution of names that make the spatial organization specific) can be required in order to have a univocal translation. When analyzing spatial relations, we are working on visual relations; now, for them not to be ambiguous or with multifold interpretations, we can adopt formulas to give them a specific meaning.

On the other hand, as we have said, the notation formulas make it possible, if desired, to skip the graphic representation of figures and relations, because such formulas are completely univocal and allow for the exact reconstruction of any figure or relation. By this, the tree of figures and relations (with an iconic character with respect to the architectural plan) can be reduced to a tree of formulas (with a symbolic character). Furthermore, the numeric language proves to be more appropriate for the interaction with a computer. Formulas serve as entry and processing data for the information concerning spaces and their involved relations. However, we cannot neglect the direct representative character of figures, because a net of pure formulas would finally require, for the comprehension of the spatial relations being represented, a process of translations into images. Even when this process is mentally performed, the iconic aspect already appears.

We see, therefore, that the language of images can be used alone, but that the addition of formulas also plays an important role. Formulas constitute a system of signs, parallel to the drawing of figures and relations, whose concern is the accurate metrical interpretation of what figures or spaces are to visual intuition. Thus, introducing a trivial example, we can quickly visually appraise a figure as a square (such could be the case of node 1 in our sample), but the value of its saturation will tell us if it is an exact square or a rectangle coming close to the square.

Applications and possibilities

The net gives us a possible description of a spatial representation. By comparing the nets of a collection of spatial texts we can infer some conclusions regarding that collection. For instance, we can observe recurrences and constants that identify styles, codes, or corpus belonging to a period or author. By contrasting nets belonging to different styles we can see where the differences and similarities reside, which enables us to deduce, consequently, the peculiar features of each style. Let us exemplify with a particular case. In speaking of hierarchies and modalization of spaces, we have affirmed that the modal figure can result in an additive or subtractive operation to the modaled figure. The fact that a net encompasses a predominance of additive operations or a predominance of subtractive operations is an important factor of the style; in the first case this implies a building designed by an outwards process, while in the second case, a building designed by an inwards process.

Looking towards another kind of possible application, we can furnish the operation of spatial modalization with semantic character, so as to use this logic system in the design of objects and in problems related to packaging, industrial design, etc. For instance, bringing up the issue of the manipulation of objects, the different ways of grasping something can be accomplished either by a handle, haft, or protuberance (an addition), by a depression, hollow, or concavity (a subtraction), or simply by making the size of the object suitable to the hand. The resolution of this functional problem — or of any other — can be thought of, in formal terms, as a modalization executed to the main body of the object.
Now, a spatial text does not come about in isolation but interrelated with other texts. The possibility exists of building hyper-nets, that is, groups of sequentially interrelated nets where both the spatial relations internal to each text and the way one text is spatially related to each other can be identified. Consecutive plans of the same building, a whole urban conjunct, or even historic sequences of groups of plans can be analyzed in this way. This is based on the proposals of sequential hyper-nets and contrastive hyper-nets by Magarriños et al. (1991: 36).

The construction of a big number of nets, and even their integration into a hyper-net, can be accelerated by means of a computer. A computer program incorporating the algorithms that refer to the spatial reading of certain representations (for instance, architectural plans) and their interpretation by means of figures or formulas, as well as the algorithms to guide the process in accordance to the syntactic rules for the construction of nets, could automatically draw the net corresponding to a certain spatial text, starting from a conventional representation of it.

Even with this kind of relatively simple diagrams we call nets, where many aspects that make up a space (color, texture, materials, decoration, etc.) are not present, differences already appear allowing the identification of cognitive operations and processes of the designer. This system, which brings us close to Foucault's notion of discourse formations (1969), would even allow a critical study of styles, typologies, or design schools, reviewing the way they have been conventionally proposed.

Notes

1. On texture, see Jannello (1963) and Caivano (1990).
2. This aspect is developed in Caivano (1991).
3. In any system, it is necessary to start from some primitive categories. We can mention examples going from the concepts of point, line, surface, etc. in Euclidean geometry (concepts which are defined but not demonstrated), to the basic domains mentioned by Langacker (1986: 5), and the primitive conceptual categories exposed by Jackendoff (1987a: 98) for the semantic analysis of language. Notwithstanding, we do not consider this from the point of view of a formal innatism in the Chomskyan fashion, but as a methodological matter.
4. The base figure is equivalent to the base statement in Magarriños et al. (1991).

References


Caivano, José Luis and Guerri, Claudio (1986). Arquitectura, diseño y teoría de la delimitación espacial. Paper delivered to the First Congress of the Argentine Association for Semiotics, La Plata, November.

Juan A. Magarriños de Morentin (b. 1935) is Professor at the Escuela de Periodismo y Comunicación Social of the Universidad Nacional de La Plata, Argentina, where he is also director of the Instituto de Investigación de la Comunicación Social. His principal research interests are semiotics foundations, cognitive semiotics, discourse analysis, and semiotics of marketing and culture. Among his publications are *El cuadro como texto* (1981), *El signo*
José Luis Caivano (b. 1958) teaches at the Facultad de Arquitectura, Diseño y Urbanismo of the Universidad de Buenos Aires, and carries out research as a fellow of the CONICET (Consejo Nacional de Investigaciones Científicas y Técnicas). His principal research interests are in the field of visual semiotics and semiotics of architecture. Among his publications are 'Para una teoría del diseño' (1988–89), 'Coincidencias en la sintaxis de diversos sistemas de signos' (1990), 'Visual texture as a semiotic system' (1990), 'Cesia: A system of visual signs complementing color' (1991), 'Sistemas de organización del color' (1991), 'El color como concepto psico-físico' (1992), and 'Symbolicity in elementary visual signs' (1992).