



Morphological analysis of Londrina: application of Munizaga's patterns

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ABSTRACT. There are several approaches to city analysis. Urban Morphology focuses on the form of urban elements considering temporal issues. Current research employs the Structural Elements defined by Munizaga's methodology (1993) and analyzes maps published in 1932, 1934, 1935, 1938, 1949 and 1951 of the first town planned by the Paraná Plantations (CTNP). Compositions with regard to Types and Configuration Patterns were verified. Transformations occurred as from the original plan, with the maintenance of the former structure and the main axes. Initial imprints preserving the primary stratum of the city may be identified. By employing Munizaga's Urban Structures, the analyses of the maps revealed the beginning of disarticulation of the planned city, back in 1938. These transformations were more evident in 1949. Current research contributes towards the understanding of the genesis, permanence and transformations of Londrina's landscape.

Keywords: urban morphology, structural elements, Londrina, new town, cartographic analysis.

Análise morfológica de Londrina: aplicação dos padrões de Munizaga

RESUMO. São várias as vertentes de análise das cidades. A Morfologia Urbana foca a forma dos elementos urbanos vinculados à questão da temporalidade. Esta pesquisa utiliza a estratégia metodológica dos Elementos Estruturais definidos por Munizaga (1993) e analisa os mapas publicados de 1932, 1934, 1935, 1938, 1949 e 1951 da primeira cidade nova implantada pela CTNP - Companhia de Terras Norte do Paraná - a cidade de Londrina, Estado do Paraná. Pela análise é possível verificar as composições em relação aos Tipos e Padrões de Configuração. Observa-se que as transformações ocorrem a partir da malha existente, sob novos territórios mantendo-se a estrutura inicial e os eixos principais. Com a leitura identificam-se os elementos como as marcas iniciais que permanecem como estrato primário da cidade. Por meio da análise dos mapas, utilizando as Estruturas Urbanas de Munizaga, é possível observar, em 1938, o início da desarticulação da cidade idealizada. Em 1949, essas transformações são evidenciadas. A pesquisa contribui para o entendimento da gênese, permanências e transformações do processo de construção da paisagem londrinense.

Palavras-chave: morfologia urbana, elementos estruturais, Londrina, cidade nova, análise cartográfica.

Introduction

According to Moudon (1997), Urban Morphology's disciplinary field comprises city development from its initial marks and subsequent transformations, coupled to the identification and dissection of its several components. Consequently, the three main components of morphological analysis are form, resolution and time.

Within the context of new towns and cities, analytic strategy may reveal the concept of their projects and subsequent modifications. According to Gallantay (1977), new towns, deliberate planned communities established as responses for clearly placed aims, develop from an initial idealized plan of the city. More recent studies by Ficher and Trevisan

(2010) bring forth more reaching terms such as, the desire of public authorities or private initiative for specific actions that would attend to at least one of the following functions: administration, colonization, railway, replacements and others. The above authors insist that towns and cities are implanted on previously chosen sites foregrounded on the concept of an urban project within a determined time limit. The contemporary city of Londrina in the northern region of the state of Paraná, Brazil, is a new town built within the colonization process organized by the Paraná Plantations Company (CTNP) and within an entrepreneurship context on an area of more than one million, two hundred thousand hectares in the early 1930s (REGO, 2009).

The above process has already been discussed in several research works. Tomazi (2000) analyzed CTNP procedures and underscored the profit-making aspect of the entrepreneurship in the northern region of the state of Paraná. Rego and Meneguetti (2008) stated that the new towns might be differentiated from others characterized by colonization in Brazil. They related them to British colonization models as transmutations of the city-garden concept. Rego (2009) analyzed the land occupation process by the CTNP and stated that theoretical ideals were employed in the planning of towns and cities. Through an analysis of land organization such as city plans, railways and the layout of rural areas, Rego and Meneguetti (2008) revealed the CTNP's planning process. As a counterpoint, Rosaneli (2013) insisted that the general characteristic of layout regularity of the new towns and cities in the northern region of the state of Paraná, among which the CTNP may be included, revealed commercial motives and a profit-aimed utilitarian model rather than aesthetic pretensions. Within the colonization context of the north of the state of Paraná, Londrina is the first city founded by the CTNP. A morphological analysis of Londrina may reveal the spatial guidelines of the initial project and its first transformations through an investigation of the future city's pre-planning and the interpretation of sequential maps published by Yamaki (2003).

Among the several analytic strategies for towns and cities, Munizaga's (1993) analysis favors a composition reading of the structure from the point of view of Structural Configurations, which are the typologies, or prefigures. These describe the traits and association modes that constitute the urban structure and the understanding of the city through the formal arrangements of space organization and form composition by iconic models that essentially configure the city's project.

The above analysis has never been applied to Londrina and may reveal the strategies of the formal concept of the first city founded by the CTNP. It may contribute towards the understanding of the formation and transformation in a descriptive and prescriptive manner. According to Moudon (1997), the descriptive form foregrounds the theory of constructed environment and focuses on issues such as the way the city is built and thereby the reasons involved. The prescriptive form evaluates the impact of the form throughout a time foregrounded on differences and similarities.

Through a historical and morphological study on formal configuration arrangements of the Types and Patterns of Munizaga's (1993) Configurations, current analysis investigates the development of the urban plan concept as an operational approach and contributes towards an understanding of the urban structure and its evolution from an idealized city. Although current analysis focuses on the specific case of Londrina within the 1932-1951 period, current research may foreground the paradigmatic application of space structure analysis of traits, such as the configuration patterns, for other Brazilian's new towns.

Material and methods

Current analysis on Urban Morphology employs secondary data as its main tools. Research starts from a focus on the history of Londrina Paraná State, Brazil within the context of the transformations and continuities of the urban plan identified in the 1932, 1934 and 1938 maps of the city, published by Yamaki (2003), up to the first aerophotogrametric register in 1949 and the subsequent map of 1951. The essay comprises an analysis of the theory by Munizaga (1993) who defines the Structural Elements of the urban form and its Space Configuration Categories. Research is divided into the following stages:

(1) A bibliographic and iconographic survey: a survey on previous studies on the city under analysis and a bibliographical investigation on Morphology and the strategies of morphological analyses;

(2) Analysis: Comparative morphological analysis coupled to the identification of transformations and continuities of Londrina's urban plan through maps and the identification of the configuration patterns and types defined by Gustavo Munizaga (1993) in his 'Typos y elementos de la forma urbana'.

Theoretical background - Munizaga's urban structure

City structure in its totality, transformations and self-regulation with regard to space and time, foregrounds Urban Structure, as theory and method of the analysis of the city form, proposed by Munizaga (1993). All the structure's components and relationships are explicit in the city and they are traits required to explain and investigate an urban project, taking into account the scale, complexity phenomena (functionality and activities) and transformation aspects. The

method comprises morphological, functional and semiological issues. The morphological aspects are related to the descriptive and explicative urban analysis in the observation of its elements, components and formal models. Functional configurations analyze the city as a system of activities and movements and refer to the absence of structure components which do not have functional implications. Semiological configuration takes into account pragmatic and syntactic (in organization and morphological norms) representations, and representation and interpretation modes, generally by analogies.

Three Basic Configurations, also called Structural Prototypes, are identified. They are produced by the combination and order of the city's elements: Nodal configuration – a concentric and centripetal organization – develops from a node or a focus, such as a nucleus space; Linear configuration – directional organization by which connecting lines define tension in one or two directions and relate extremes; Reticular Configuration – bi- or multi-directional plot at the surface formed by areas, zones or fragments. These three basic types define the operational categories and structural elements, which may form more complex typologies when amalgamated.

Structuring elements (Table 1) establish patterns for the configuration and definition of homogeneous areas and may be analyzed within the differentiation of hierarchies, intensity, density, functional interdependence and transformation. With regard to macro-scales, the above analytic strategy defines the typologies of structure processes of observable urban development in most cities, such as extension, aggregation, densification and superposition. The application of these patterns constitutes a methodology for the analysis of the configuration of the urban form.

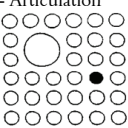



The configurations and types defined by Munizaga (1993) are the paradigmatic representations of the structure, which establish a space synthesis and establish formal types of the city's scale, organization and space. They also foreground the analyses for morphological and spatial configuration within the localization of activities and standards of movement. Thus, through such interpretation and within an integrated process of configuration, the author relates operational categories and structural elements and the resulting Configuration Patterns of the urban form (Table 2).

Table 1. Structural Elements of the Urban Form (SEU).

Structural elements of the urban form (SEU)	
SEU	Description
Downtown or Epicenter	Unique central area featuring homogeneous concentration and characteristic density. It is generally the city's political, commercial and administrative center, characterized by building density, mixed activities, importance of buildings, high accessibility.
Boundary and limits	Boundaries limit morphological or functional urban areas and sub-areas in different hierarchies and in association among them.
Grand connecting ways and roads	Linear elements of directional tension, organization, distribution and aggregation; they are configured at different hierarchical levels.
Articulating junctions and localizing focuses	Elements of space articulation which organize and associate elements that converge on one point.
Interstitial space	Heterogeneous areas, without any identity and with difficult interpretation, featuring typological differences: it is generally a relatively residual and undefined element of the city.
Fragments	Homogeneous sub-areas, relatively independent from the urban plan, with some type of morphological, functional and semiological consolidation, and strong configuration and identity. They consist of residence areas, commercial or industrial zones, with a potential for urban re-qualification.

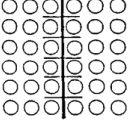
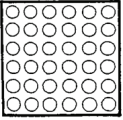
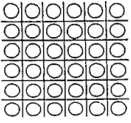

Source: Munizaga (1993, p. 191-197) modified.

Table 2. Configuration integrated process: Categories (C.C.E.), Elements (E.C.E.) and Patterns of Configuration – Types.

What Aims/Activities Categories (C.C.E.)	With which Agents/Mean Elements (E.C.E.)	How Effects/Model Patterns' configurations – types
1. Focalize (select)		
- Concentration		Description Reinforcement of centrality of a determined structure.
- Articulation	Junction, Focus, Landmark, Articulation, Intersection, Epicenter, Centers.	Nodal Focalization; Nodal Articulation
		Formal types
		  

Continue...

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What Aims/Activities Categories (C.C.E.)	With which Agents/Mean Elements (E.C.E.)	How Effects/Model Patterns' configurations – types
2. Connect		
- Tension - Direction and orientation - Sequence	Connector, Axis, Seccession, Direction, Orientation, Sequence.	Axial connection Nodal sequence Directional tension
		
3. Limit		
- Inclusion - Exclusion	Edge, Barrier, Border, Fragment, Interstitial space.	Inclusion of areas or zones; Exclusion by borders and residual spaces.
		
4. Mediate		
- modulated aggregation	Plot, Grid, Fragment, Tissue.	Mediation of area and plot. Modular inclusion of the elements.
		
5. Repeat		
- Aggregation of components	Grain, Module, Components, Fragments, Filling, Interstitial space.	Aggregation by: - Similarities - Closeness - Tension, direction.
		

Source: Munizaga (1993) modified.

Results and discussion

Morphological analysis of Londrina according to Munizaga

The method of morphological analysis proposed by Munizaga (1993) comprises an interpretation of Structural Elements and Categories of Space Configuration. The approach is employed in the following analysis by a sequence of the 1932, 1934, 1938, 1949 and 1951 maps of the city of Londrina, Paraná state, Brazil.

The 1932 map, the first document of the planned city, shows that the basic structure has been maintained until the present. It consists of an orthogonal plot with 105 x 115 m blocks, with a central ellipse and a diagonal axis that disrupts the plot's regularity. The initial nucleus reveals 'damero' type features, or rather, a reticular configuration formed by an orthogonal grid. However, the ellipse and its adjacent blocks of the northern and southern area are not divided into lots forming a central fragment. The initial accesses extend

themselves as important axes, with special reference to the Avenida Paraná, running parallel to the railway, Rua Quintino Bocaiúva, Avenida Tiradentes, Avenida Celso Garcia Cid and Avenida Heimtal (currently Duque de Caxias). As Yamaki (2003) underscored, Rua Rio de Janeiro and Rua São Paulo are already planned as respective connecting axes to and from the railway and the Avenida Paraná. Borders are defined on the north and on the south respectively by the railway and the cemetery. The plan consists of 86 blocks, seventeen of which planned as public squares (Figure 1).

The 1934 map shows the addition of 39 blocks, with the same dimensions, to the original structure. They face north and east within a modular aggregation pattern by repetition. The railway to the north is transposed creating a great linear void space in the grid. The 1935 map demonstrates that the Partial Plan of the Londrina exhibits the initial plan inserted within the group of adjacent rural parcels, contiguous to the initial plan. Since the 1934 map seventy-eight blocks were added by module repetition, as theorized by Munizaga

(1993), as an aggregation by repetition of elements, with the appearance of the Avenida Higienópolis as a new axis. The cemetery is still the southern border.

A significant increase in blocks and urban plots may be verified when the 1934 initial project of the city nucleus is compared with the 1938 Partial Plan of the Londrina Estate. The initial 86 blocks of the original plan of the city area reached 229 blocks and 3610 plots of land (Figure 2).

According to Boni (2009), who analyzed the birth certificates of the period, a population of 25,270 inhabitants may be estimated. One may note the division of the central ellipse which strengthens the distinct form with regard to the reticulated plan. According to Yamaki (2003), it is the first register of such characteristics in a map of the city. The district Vila Agari appears as a

fragment without any connection with the initial plan. An interstitial space, a rectangle, is produced, without the repetition of the initial modules of the central nucleus. Thus, the connector Avenida Quintino Bocaiuva is reinforced as a link with Nova Dantzig (currently the town of Cambé).

The plan of the city of Londrina provides a clear definition of Munizaga's (1993) Structural Elements. The 'damero'-type structure characterizes the limited and homogenous urban area of the orthogonal grid. Homogeneity is a consequence of the implantation of a standard model of blocks with land plots which reinforce the north and south axes. Borders and limits are sharply defined within the counter-position of the urban and rural plots.

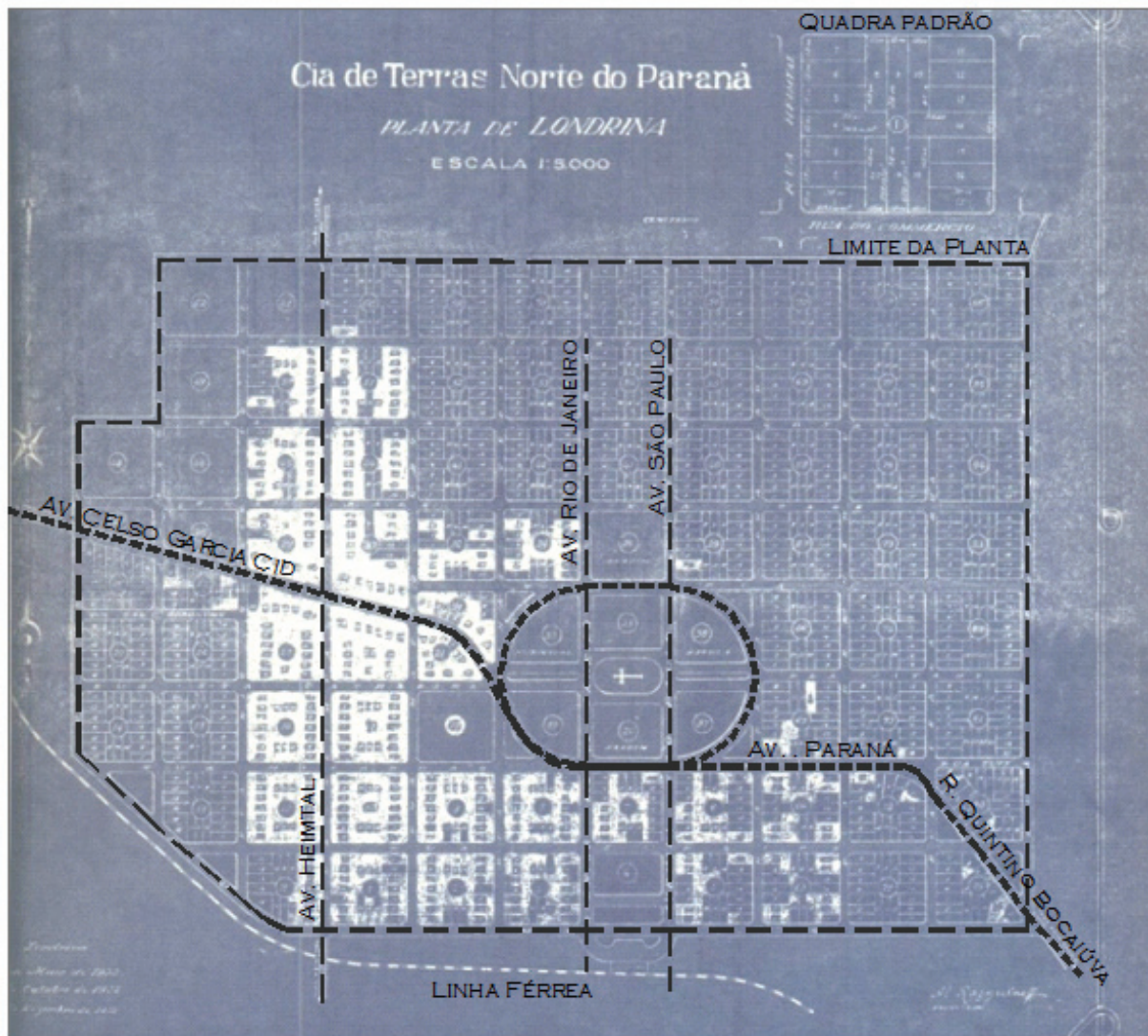


Figure 1. Blue Map. 1932.

Source: Yamaki (2003, p. 17) modified.

Following the perspective of Munizaga's (1993) Functional Analyses, it should be underlined that the repetition process of a standard block also results in the non-distinction of functional categories. Only the Rua do Comércio (currently Rua Benjamin Constant), parallel to the railway station, is discriminated as commercial street in the 1932 map. The internal (Avenida Rio de Janeiro and Avenida São Paulo) and external connectors (Avenida Celso Garcia Cid and Avenida Quintino Bocaiuva as an East-West connection, and the former Avenida Heimtal, South connection) extend beyond the initial city plan. The central ellipse, comprising the church and adjacent squares, forms the plan's articulating node. Interstitial spaces and fragments are not extant in the idealized city plan. In spite of the permanence of initial urban structures, the 1935 plan enhances the railway as the first fragment (linear form). Five years after the foundation of the city, interstitial spaces and the so-called 'tree'-type system appear. The latter is defined by Munizaga (1993) as a relatively autonomous unit, as a district or fragment linked to a greater urban unit by a linear hierarchized connection. The city increased by 143 blocks and 2417 plots, which occurred in the subdivision of rural areas. The trapezoidal form of rural parcels becomes an impediment for the repetition of the planned initial block-type structure.

Considering the Urban Configuration Patterns, the analyses identified: inclusion by border or

membrane, with the transposition of limits to aggregate new blocks and in the transposition of the railway. Mediation by reticular plot is the initial pattern with a highly regular module which extends in the repetition. Nodal articulation reinforced the centrality of the ellipse contrasting the surroundings. The ellipse is the articulating element in which the diagonal of the city's main access is inserted. The Focalize typology may be enhanced in the initial plan under two main elements: the ellipse and the Railway Station (Table 3). It may be seen that before 1949 the configurations occur by simple aggregation within the maintenance of the homogeneity of the typical block and in the addition of areas by similarity. However, the beginning of disarticulation of the planned urban area may be observed from the expansion of the idealized city planned by the geodesist Alexandre Razgulaeff responsible for the Londrina project.

The 1949 map was a result of the first aerophotogrametric register of Londrina. It was a secondary datum and a highly relevant tool for the analysis of what remained and what was transformed. A significant increase of interstitial space between the initial city plan and the fragments may be verified by the implantation of new residential areas. The fragments, such as Vila Nova, Vila Primavera, V. Independência, Vila S. Caetano and Vila Ypiranga differ from the central nucleus (Figure 3).

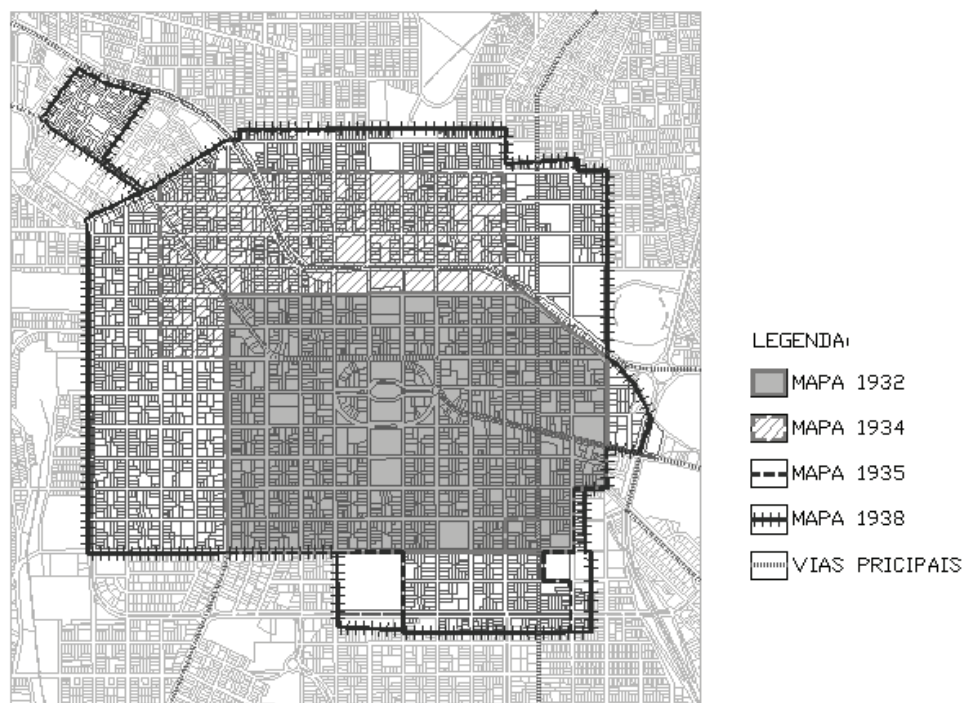
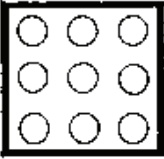

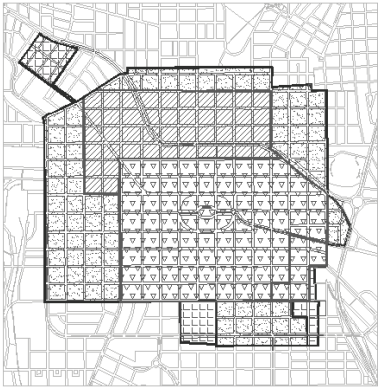
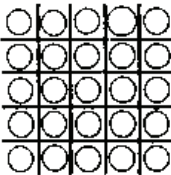
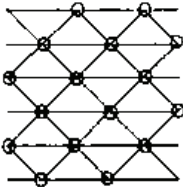
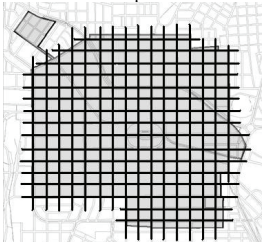
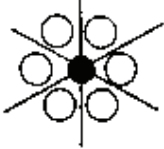


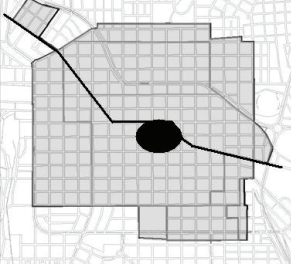
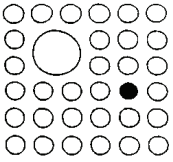
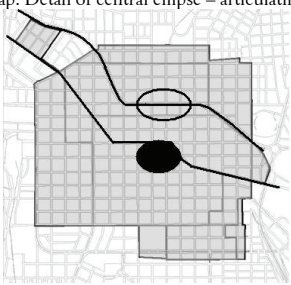


Figure 2. Imbrications – Limits of Londrina in 1932-1938 placed over the current map.
Source: Londrina (1991) modified.

Table 3. Identification of the urban configuration patterns established by Munizaga (1993): city plot of Londrina 1932-38/39.

Comparative table – configuration patterns in londrina before 1949	
Urban configuration patterns/ Space configuration categories (MUNIZAGA, 1993)	1932-38 Map of Londrina
  <p>Inclusion by border or membrane. C.C.E.: Limit.</p>	 <p>Transposition of the limits of the Londrina city plan – Overlaying of 1932-38/39 maps.</p>
  <p>Mediation by plot. C.C.E.: Mediate.</p>	 <p>Orthogonal city plan of Londrina till 1938/39.</p>
   <p>Nodal articulation.</p>	 <p>1932-38 map. Detail of central ellipse – articulating element.</p>
 <p>C.C.E.: Focalize.</p>	 <p>1932-38 map. Foci of Londrina – ellipse and railway station.</p>

Source: Munizaga (1993, p. 192-193); Londrina (1991) modified.

The 1949 maps exhibits 80 more blocks when compared to the 1938 map, with an urban population of about 30,289 inhabitants (Table 4). It should be enhanced that the new areas are introduced along the great connecting axes – those existing in the 1932 maps and the new axes such as Avenida Higienópolis (to the South), Rua Pernambuco/Guaporé (to the North) and Rua

Araguaia (East-West direction). One may perceive aggregation by directional tension caused by blocks with new forms and by intense occupation at the connecting roads. It also shows the de-structuring of the city's great development and its extension through the connecting axes. With regard to the physical site, no natural impediments to be incorporated or transposed are extant up to this period.

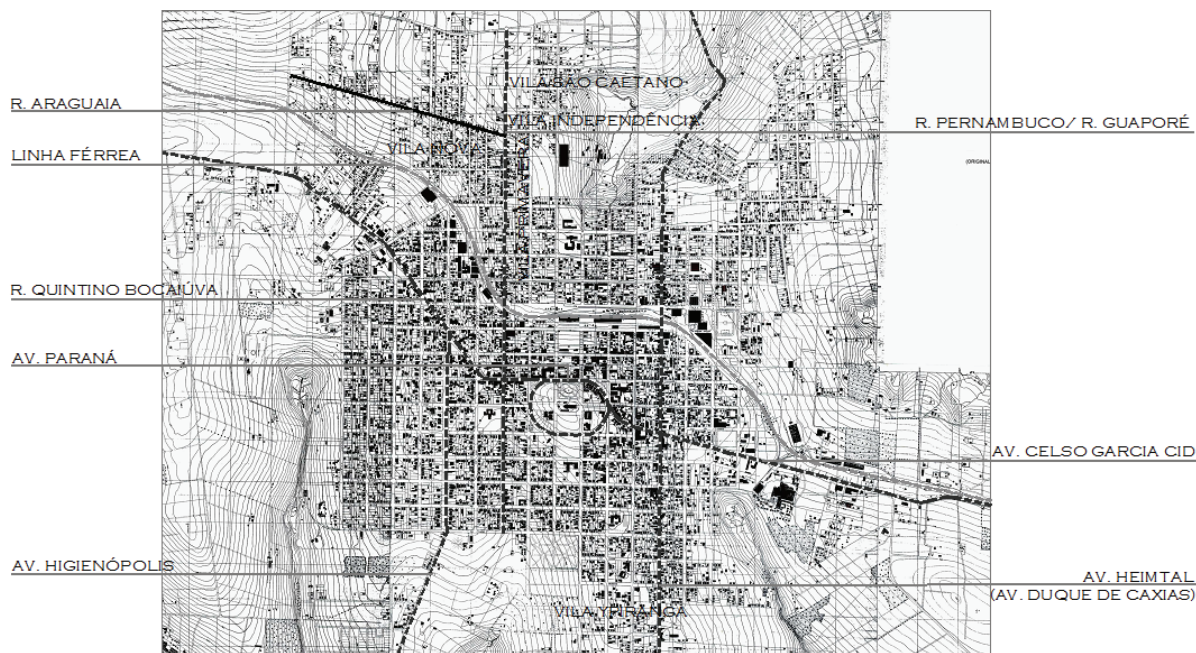


Figure 3. The 1949 map with special focus on the axes and the new urban districts.
Source: Yamaki (2003) modified.

Table 4. Evolution – Aggregation of blocks and population estimates.

Map	Total number of Blocks	Total number of plots	Free spaces	Population (estimates)
1932	86	1193	17	8351
1938	229	3610	16	25270
1949	309	4327	10	30289

Munizaga (1993) classifies as nodes the public squares, stations, relevant cross roads and public facilities, very similar to some elements from the imagetic analysis of Lynch (1960). Whereas the table shows 17 public places in the original plan, the blocks that constitute the central ellipse were parceled in 1938 and thus the amount of free space available decreases, even though two triangle-shaped squares are added within the sequence of squares throughout Avenida Quintino Bocaiuva. Consequently, the proportion of open spaces decreases gradually during the city's expansion, especially as from the implantation of new public buildings.

Due to Law 133/1951, the 1951 map exhibits new shapes for blocks, which differ from those of the initial plan. New fragments appear, such as the districts Jardim Shangri-lá, Vila Industrial, Bairro Aeroporto, Parque Guanabara, Vila Yara and Jardim Santos Dumont. Natural borders formed by streams and valleys are exhibited as void spaces. During the 1950s, Avenida Higienópolis, Rua Souza Naves and Avenida Santos Dumont become important axes, while the construction of the currently intermunicipal road BR 369 transforms Rua Guaporé/Pernambuco into one of the city's most important accesses to the city. Vila Higienópolis and

Parque Bela Vista were constructed and the outlines of Vila Sian and Jardim Santos Dumont may be perceived. Post-1949 Londrina has new configurations, following the typology of Munizaga (1993). The city map shows the 'line' with a growth-inducing role within the above-mentioned development by axes and the plot's space configuration (Figure 4). This occurs until the 'line' becomes a fragment (Figure 5) which transforms the limits and borders of the planned city, even though these are already connected.

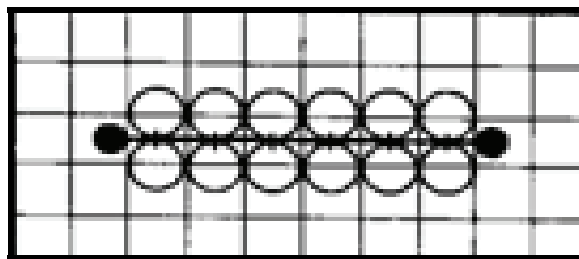


Figure 4. Typological patterns of the 'Line'.
Source: Munizaga (1993, p. 208).

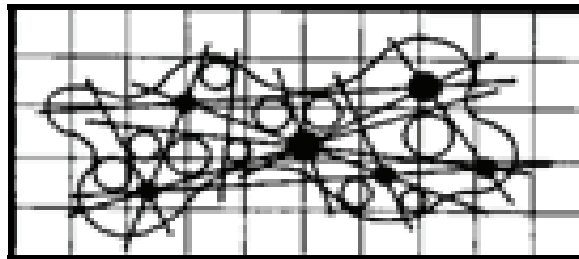
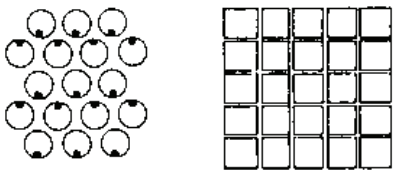
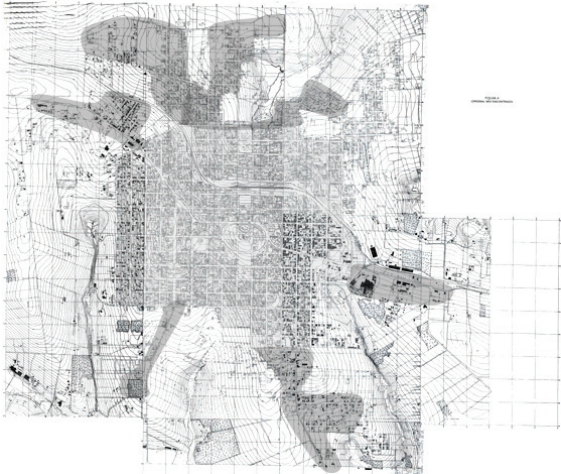
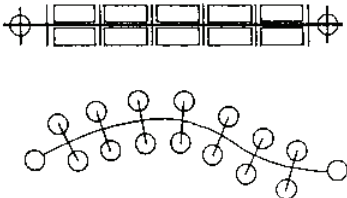
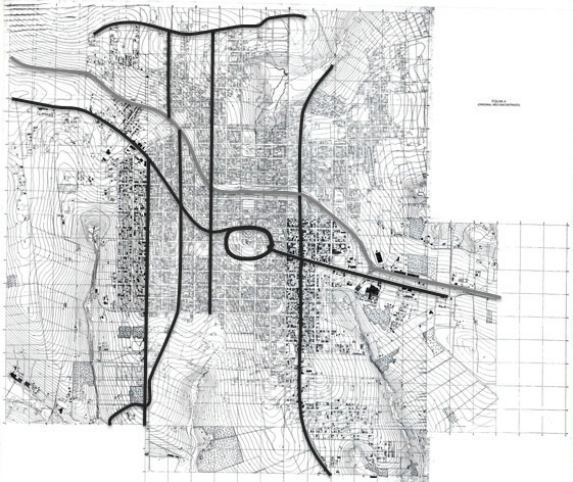
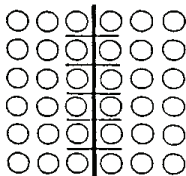


Figure 5. Typological patterns of the 'Blot'.
Source: Munizaga (1993, p. 208).

With regard to the Configurations by Simple Aggregation, the addition is produced by tension, or rather, by an extension with directions and not by similarities, closeness or exclusion (homogeneity). Considering the Configuration Patterns, the following may be underscored: the aggregation by repetition of elements occurs dynamically recombined with the previous plan. The axial connection, which already existed in the first plan, now emphasizes the importance of streets and connecting factors (Table 5). With

regard to Structural Elements, it should be observed that after 1949 the interstitial spaces and the fragments become relevant within the city plan. The 1951 map clarifies the new structures that form around the initial plan, namely new districts and sectors and by a residual space between the plan and the new configuration patterns. The city planned for about one thousand plots transforms itself and reaffirms the CTNP’s entrepreneurship as the new Brazilian frontier of that time.

Table 5. Identification of urban configuration patterns, established by Munizaga (1993), within the 1949 plan of Londrina.

Comparative table – Configuration patterns in post-1949 Londrina	
Urban configuration patterns/ Space configuration categories (MUNIZAGA, 1993).	1949 map of Londrina.
 <p>Modular aggregation by repetition. C.C.E.: Repeat.</p>	
 <p>Axial connection.</p>	
 <p>C.C.E.: Connect.</p>	

Source: Munizaga (1993, p. 192-193); Yamaki (2003) modified.

Conclusion

The morphological analysis of the first city implanted by the CTNP shows a homogeneous idealized city. According to Munizaga (1993), the non-distinction of functional categories may be verified. The 1938 plan, gives rise to the ‘tree’-shaped system.

The 1949 map shows that the initial nucleus took another pattern. Such transformations occur from the original plan over a new territory. The initial imprints are still visible and define land, public space systems and preserved valleys.
The configuration’s basic elements within the initial plan may foreground discussions of a project

of urban transmutations or strategies for the sale of property as a great real estate entrepreneurship.

Current analysis may be a baseline for a morphological approach of new towns and its spatial durability of idealization. Together with other researches on CTNP activities this investigation will contribute towards the consolidation of the historical and morphological knowledge of Brazilian's new towns.

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