TYPOLOGY OF URBAN LAYOUTS
the case of Brasilia

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0 Abstract
Many attempts have already been made to offer a typology of cities, more particularly, a typology of city form. Nevertheless, they seem unsatisfactory, mainly for the fact that many different aspects are considered both simultaneously and implicitly. This paper points to the need to make explicit the objectives aimed by each taxonomy in particular, and shows how each objective demands a specific description of urban layouts. The objectives of the analysis here have to do with the social implications of urban layouts. In this context, this means analysing the relations between certain attributes of morphic types, on the one hand, and certain attributes of modes of encounter systems of people, on the other. Starting from Space Syntax, a new taxonomy is put forward, which is synthesised by the expressions paradigm of formality and paradigm of urbanity.

1 Introduction
How many types of cities are there, concerning specifically their urban space, architecturally considered? Theorists have attempted to give answers to this question, but it will be argued here that such answers have been unsatisfactory. In this paper, an attempt will be made to indicate some problems with previous propositions and a new taxonomy will be suggested. This taxonomy will then be applied to the empirical reality of the Federal District in Brazil, in order to reveal the significant variations in spatial patterns that we have here. Such variations, from slums to vernacular settlements which pre-existed Brasilia, from "super-blocks" to the monumental spaces of the city, will be quantitatively described through the proposed taxonomy.

2 The problem of typology
Attempts to propose a typology of human settlement layouts present a series of problems. Among them, perhaps the most important ones are related to the unclear and/or implicit objectives of such taxonomies, on the one hand, and a not well discussed bias towards a preference for certain types, due to an unsatisfactory reading of the record, on the other. Broadbent (1990), Choay (1967, 1970) and Norberg-Schulz (1989) are good examples of this. Broadbentís all-embracing *empiricist* and *rationalist* paradigms (e.g. San Marco Square, in Venice, Italy, and Stanislas Square, in Nancy, France, respectively) involve simultaneously (geometrical) form, smells, activities, air temperature and movement, etc. Choay and Norberg-Schulz have adopted more clearly a *semiological* stance towards architecture, but for both of them the *meaning* of architecture depends on a clear correspondence between certain social categories and certain spatial attributes, thus condemning in fact the most widely found spatial strategy in the record of human settlement, namely one which invests in dense, secular, continuous, interchangeable, differentiated - but not hierarchical - spatial schemes.

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Hillier (1989) has offered a different taxonomy, that avoids the problems of the dichotomies above. He commented on two types of towns: instrumental towns and symbolic towns. Briefly referred to, the spatial patterns of instrumental towns are dense, continuous, intensely "fed" by building entrances everywhere, differentiated in such a way as to allow the penetration of the stranger to the urban core, at the same time that more segregated parts are provided for the calmer residential areas. In turn, spatial patterns of symbolic towns invest heavily in sparsity, discontinuity, places defined by blind walls instead of building frontages with many doors, and public buildings closing perspectives of highly geometricised axial layouts. Two points should be stressed concerning Hillier's proposition. Firstly, there was a clear option concerning the kind of attributes of city form that were picked up in his characterisation of the two types, namely attributes of a topological, rather than a geometrical nature: city space is understood as a complex system of barriers and permeabilities that constitute patterns in which relations of proximity, separation, circumscription, continuity, etc., are the fundamental categories to be considered. This approach has been coined as Space Syntax, and it has been discussed at length in Hillier and Hanson's book *The Social Logic of Space* (1984). Secondly, the objective of selecting those attributes was also clear, in the sense that the theory aimed at relating city form with the type of social structure which was implicated in it: society is here understood as a set of encounter systems, which are related to spatial patterns, and which contribute to the materialisation of social roles. Nevertheless, there are important aspects of taxonomy that remained implicit. When he commented on the two types, he warned that *there are many others, of course*. (Hillier, 1989) A question then poses itself: are there other types still within the same *syntactic* framework, or are there other types according to other descriptive categories, aiming at other objectives? Also, the instrumental/symbolic dichotomy might wrongly give rise to the idea that instrumental cities do not carry in their morphic type symbols of collective life. Likewise, one might think that symbolic cities would only represent social life, without instrumentally constituting specific social roles. Yet, neither is the case, nor is this Hillier's opinion, as it is clearly expressed along his writings. It is not that one type represents social structure and the other type constitutes it: the fundamental point is that each one of these types both represent and constitute radically dissimilar social structures - it is here that the fundamental differences between them reside.

Hillier seems to have identified, however, the fundamental nature of spatial attributes which matter for a study of the performance of spatial patterns, as far as its social implications are concerned, as commented above. In what follows, the taxonomy proposed is thus based on Hillier's ideas, but two points should be made: a) in order to avoid the misunderstandings arising from the symbolic/instrumental terminology, a different dichotomy will be put forward; b) the set of variables which contribute to the definition of types has been enlarged, as compared to those which have been dealt with by Hillier in the cited article, even though these variables still locate within the framework of Space Syntax.

3 Two age-old socio-spatial paradigms

When we look at the historical record of human socio-spatial organisation, we can identify variations which locate each case study along an interval, with opposing trends that I shall refer to as the paradigm of formality and the paradigm of urbanity. The words *formality* and *urbanity* are interesting for our aims because they convey simultaneously ideas concerning physical space - and therefore spatial patterns - and ideas concerning human behaviours - and therefore social life. *Formality* comes from *formal*, pertaining to *form*, from Latin forma - *shape and structure of anything* - but in a certain sense: *established form or custom; conventional; ceremonial*. In turn, *urbanity* has its roots in Latin urb - a city or town -, but also conveys *the quality or state of being urbane; courtesy; politeness; suavity*. (All this as stated in the respective entries of Webster Collegiate Dictionary, 1936) In other words, I take formality to refer to social orders which present strong insulation of agents and/or practices in space as well as in time, marked social asymmetries, ultimately strong authority. In turn, I take urbanity to refer to societies with marked interchangeability of social roles, negotiation, equality.

Now I have shown in another opportunity (Holanda, 1997) that historical evidence strongly suggests a consistent and cross-cultural relationships between the social attributes referred to above, on the one hand, and certain attributes of spatial patterns of settlement form, on the other. In this paper, the main aim will be to present the analytical categories along which such attributes vary, and how such attributes may contribute to the quantitative characterisation of the two paradigms (by attribute I mean the value that each category assumes in each particular case).

I will deal with a group of 9 variables, in 10 areas of study, all located within the borders of the Federal District in Brazil where the Capital of the country, Brasilia, locates. There will be two steps in this. First, the variables values for each of the areas under study will be depicted. The reader will notice that the values thus obtained vary along quite different numerical intervals, depending on the analytical category involved. I will suggest how such intervals are constitutive of the formality/urbanity dichotomy. Here we come to our second step: in order to be able to compare the variables values among themselves, and to be able to arrive at a synthetic final measure for each area of study, I will propose a normalisation procedure according to which the values obtained will be transcribed into an interval ranging from circa 1 to circa 5, meaning respective maximum formality and maximum urbanity (see further comments on this below). The synthetic final measure for each area, all variables considered, will be called the measure of urbanity (URB).

4 The variables

In order to carry out the analysis, three special types of maps are drawn: a) the map of spatial islands depicts from normal maps whatever kinds of barriers to pedestrian movement we find - individual buildings, blocks, ramparts, pools, vegetation, etc. (figure 1 offers a picture of the Esplanade of Ministries, and helps the reader an opportunity to compare what is visually perceived, with the analytical abstractions which are used here; figure 2 illustrates the map of spatial islands which obtain for this area, for example); b) the convex map offers the decomposition of the open space system of the area into two-dimension units, which are called convex spaces,

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Figure 1. A view of the Esplanade of Ministries, Brasilia.

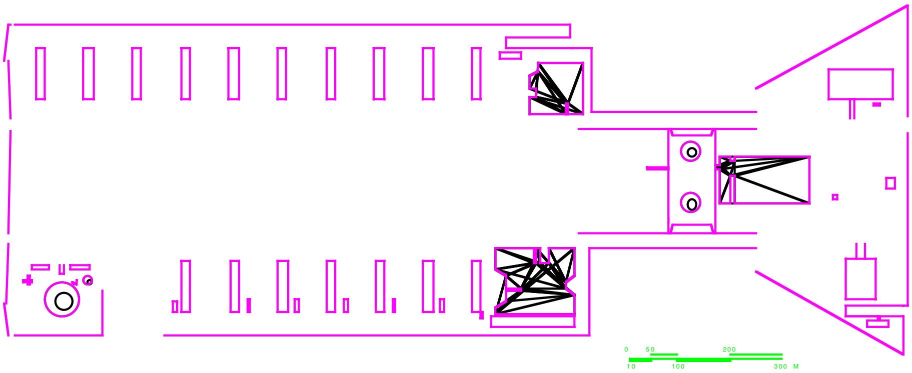

Figure 2. Esplanade of Ministries. Spatial islands.

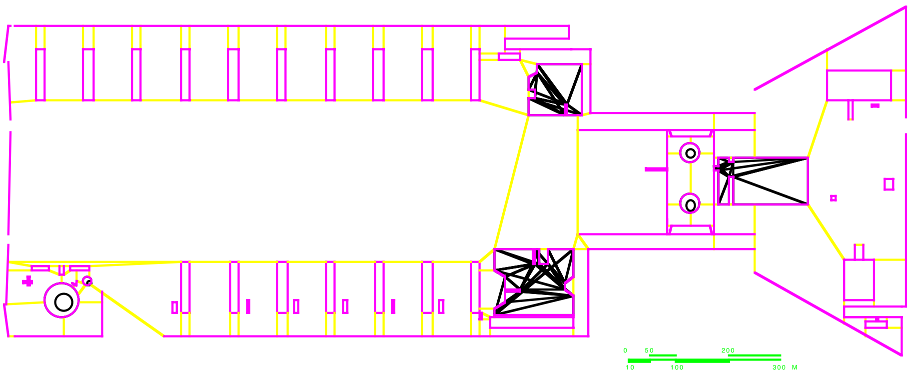

Figure 3. Esplanade of Ministries. Convex map.

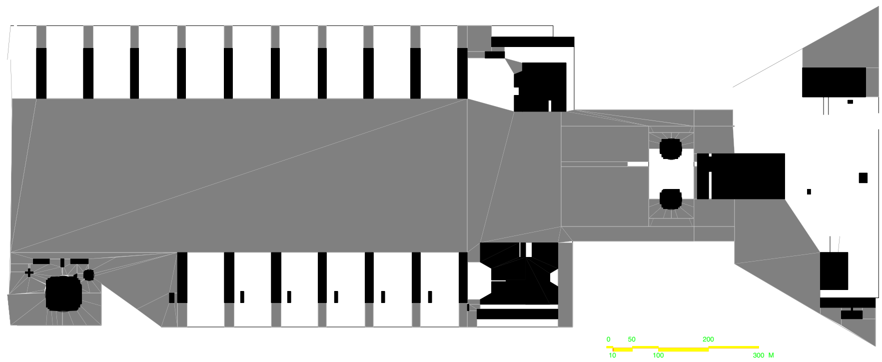

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Figure 4. Esplanade of Ministries. Blind spaces (in dark grey).

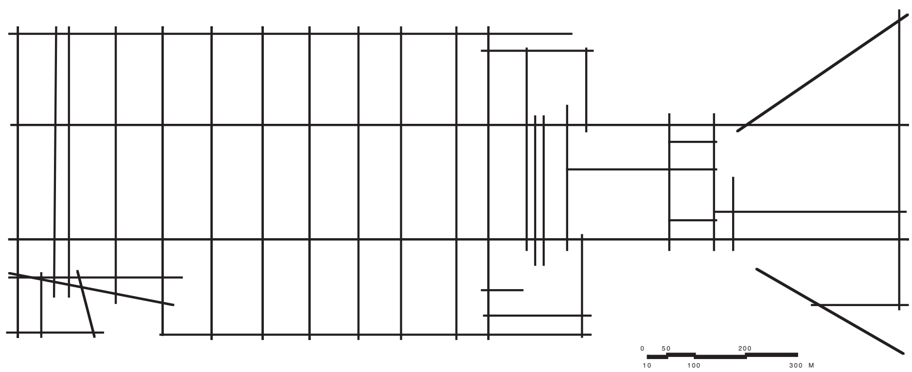

Figure 5. Esplanade of Ministries. Axial map.

The test areas have been chosen in such a way as to represent the main socio-spatial codes we find in the Capital of Brazil. They are: a) the monumental space par excellence of the city: the Esplanade of Ministries (figures 1 to 5); b) two typical "superblock" sets of the Pilot Plan: the 405/406 North Superblocks and the 102/302 South Superblocks (figures 6 and 10, respectively); c) two areas of the urban core of the Pilot Plan: the set constituted by the South Amusement Sector/South Hotel Sector, and the South Commercial Sector (figures 7 and 9, respectively); d) three instances of satellite nuclei: Guara-I, Taguatinga and New Paranoa (figures 8, 16 and 17, respectively); e) a vernacular settlement which existed prior to the construction of Brasilia: Planaltina (Fig. 15); and f) a squatter settlement: Old Paranoa (figures 11, 12, 13 and 14). For editorial reasons, with the exception of the Esplanade of Ministries and Old Paranoa, only the axial maps of these areas are shown in the illustrations.

As follows, I will present the nine analytical categories that have been quantified and normalised. I will also indicate how, on the basis of the research carried out so far, I have conjectured the relationships between their attributes and the interval formality/urbanity.

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4.1. Percentage of open space over the total area under study (y/A).

The larger the open space ratio (i.e., the sparser the builtscape), the more formal it will be considered (ìyî holds for the open space surface, and ìAî for the total area under study). Ritualised behaviour seems historically necessary to overcome large distances. In this variable, the pole of formality are the 405/406 North Superblocks (y/A=91.4%), whereas the pole of urbanity is the vernacular settlement of Planaltina (y/A=32.4%). In order to have a visual feeling of this variable, compare the contrasting spatial islands maps of the Esplanade and Old Paranoa (figures 2 and 11, respectively). A detailed discussion of the formulas used in order to normalise the values is found elsewhere (Holanda, 1997).

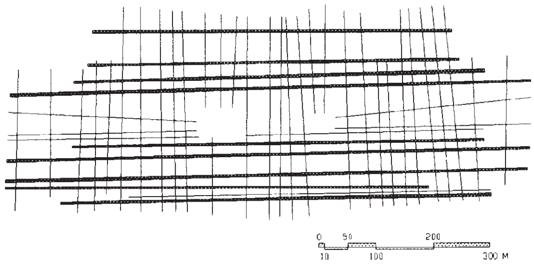


Figure 6. 405/406 North Superblocks. Axial map.

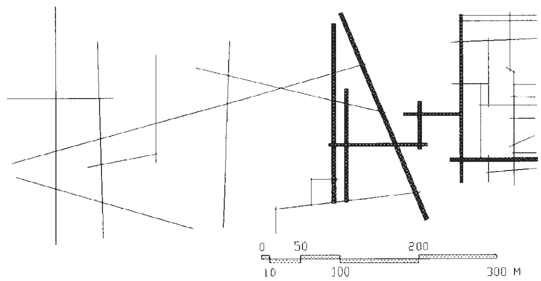


Figure 7. South Amusement Sector/ South Hotel Sector. Axial map.

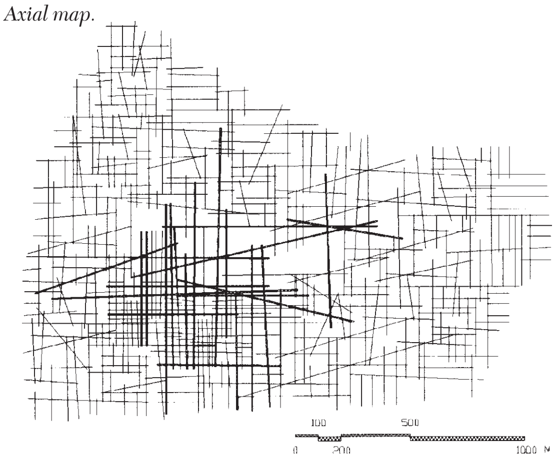


Figure 8. Guara-I. Axial map.

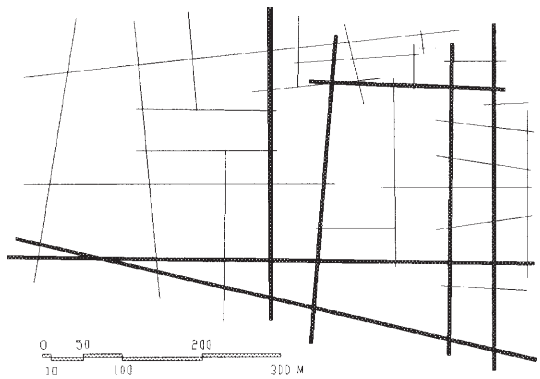


Figure 9. South Commercial Sector. Axial map.

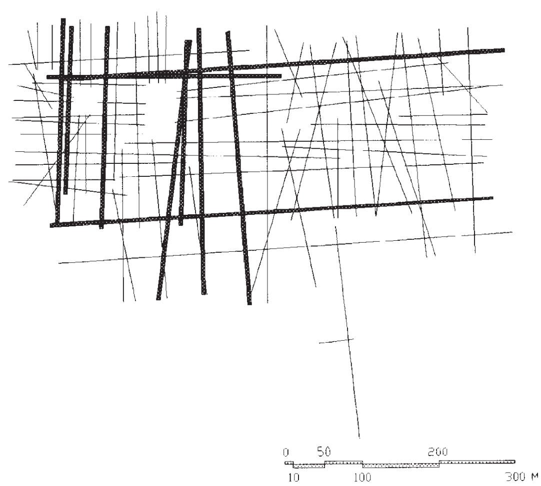


Figure 10. 102/302 South Superblocks. Axial map.

Figure 11. Old Paranoa. Spatial islands.

Figure 12. Old Paranoa. Convex map.

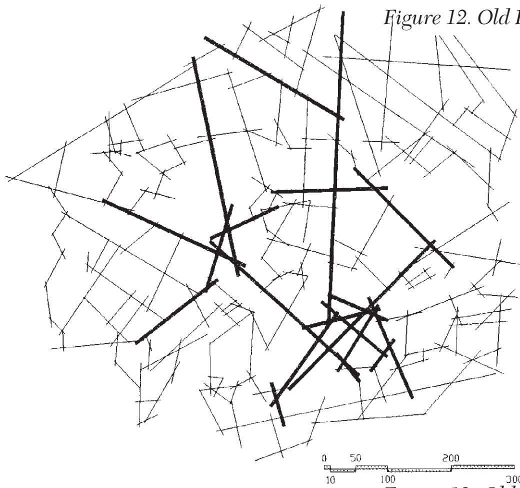
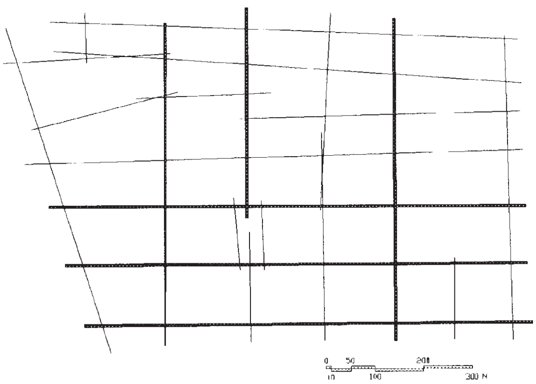
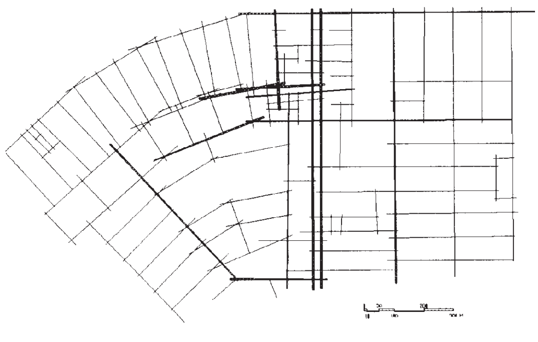


Figure 13. Old Paranoa. Blind spaces (in dark grey).

Figure 14. Old Paranoa. Axial map.





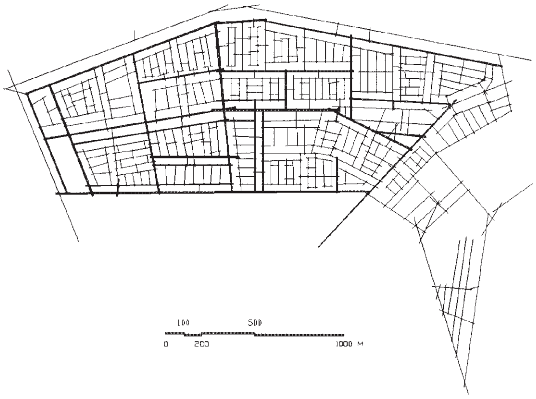


Figure 15. Planaltina. Axial map.

Figure 16. Taguatinga. Axial map.

Figure 17. New Paranoa. Axial map

It should suffice to say here that these formulas have been empirically established with the help of a software of interpolation (Ferraz et al. 1992), by taking into account the minimum, the median and the maximum values obtained along each variable. Table 1 presents the measures which obtained along this and all other variables, for the ten areas under analysis; Table 2 presents the normalisation formulas, in which *Y* stands for the normalised values and *X* for the measures which obtains in each variable, as presented in Table 1; Table 3 presents the normalised values thus obtained, which are distinguished from the original measures of the variables by the suffix *n*. (Note
08.8 that because of the standard error that makes itself present in the definition of the formulas, results may not exactly vary from 1 to 5, but from circa 1 to circa 5)

Table 1

Area	*y/A*	*y/C*	*x/C*	*Cb*	*y/x*	*Ipx* (*Variables*)	*GRA*	*RRA*	*INT*
Esplanade	86.4	6684	0.81	67.5	8232	161.0	0.34	0.5988	0.61
405 NSB	91.4	1466	1.28	66.7	1142	23.3	0.49	0.2991	0.77
SAS-SHS	74.1	1139	3.00	37.3	379	19.6	0.29	1.2203	0.43
Guara I	71.5	1604	5.46	31.4	293	16.9	0.13	0.6090	0.66
SCS	72.5	1135	2.33	44.5	573	27.4	0.32	0.6050	0.89
SSB	54.2	857	1.72	30.5	499	19.1	0.29	0.4038	0.72
Old Paranoa	38.2	410	2.95	17.4	138	17.3	0.11	0.8790	0.46
Planaltina	32.4	3050	11.00	6.6	277	25.2	0.60	0.4658	0.98
Taguatinga	36.7	2484	11.87	14.4	209	16.8	0.21	0.6125	0.66
New Paranoa	34.4	1197	13.50	5.2	89	26.3	0.10	0.7227	0.57
MEANS	59.9	1954	5.14	32.4	1136	34.1	0.29	0.6580	0.68

Table 1. Measures of the variables.

Table 2

Variables	*Formulas*
y/A	Y=7.2420 - 0.0950*SF1 + 0.0003*SF1**2.
y/C	Y=4.9908*0.9997**SF2.
x/C	Y= 1.1621*SF3**0.5345.
Cb	Y=5.3599 - 0.0886*SF4 + 0.0004*SF4**2.
y/x	Y=24.0397*SF5**(-0.3605).
Ip/x	Y=20.6968*SF6**(-0.6132).
GRA	Y=-0.8313 + 27.2858*SF7 - 37.3113*SF7**2.
RRA	Y= -3.8515 + 21.2738*SF8 - 14.2412*SF8**2.
INT	Y=-3.9441 + 12.7602*SF9 - 3.6214*SF9**2.

Table 2. Normalisation formulas.

Table 3

Area	y/A_n	y/C_n	x/C_n	Cb_n	y/x_n	Ip/x_n (*Variables*)	GRA_n	RRA_n	INT_n	*URB*
Esplanade	1.27	.67	1.04	1.20	.93	.92	4.13	3.78	2.49	1.83
405-NSB	1.07	3.23	1.33	1.23	1 .90	3.00	3.58	1.24	3.73	2.26
SAS-SHS	1.85	3.55	2.09	2.61	2.83	3.34	4.08	0.90	0.87	2.46
Guara-I	1.98	3.08	2.88	2.97	3.10	3.66	2.09	3.82	2.90	2.94
SCS	1.93	3.34	1.83	2.21	2.44	2.72	4.08	3.81	4.54	2.99
102-SSB	2.97	3.86	1.55	3.02	2.56	3.39	3.94	2.42	3.37	3.01
Old Paranoa	4.05	4.41	2.07	3.94	4.07	3.60	1.72	3.84	1.16	3.21
Planaltina	4.48	2.00	4.19	4.79	3.17	2.86	2.11	2.97	5.08	3.52
Taguatinga	4.17	2.37	4.36	4.17	3.50	3.67	3.25	3.84	2.90	3.58
New Paranoa	4.33	3.48	4.67	4.91	4.77	2.79	1.52	4.08	2.15	3.63
MEANS	2.81	3	2.6	3.11	3.37	3	3.05	3.07	2.92	2.94

table 3. Normalised mensurations.

4.2. Mean convex space (y/C).

In the formula, *C* stands for the number of convex units into which the open space system has been decomposed. Concerning this variable I have rescued an often quoted statement by Mary Douglas: *greater space means more formality, nearness means intimacy*. (Douglas, 1973) Indeed, consider cathedral squares, baroque esplanades, or the haussmanisation of Paris, as compared to the scale of the secular tissue of medieval towns. The more the mean convex unit grows larger, the more we have a formal settlement as a whole - and not simply the existence of formal *bits* (as large squares or esplanades, for example) in the spatial system. It is worth commenting that what is at stake here is something different from variable 1, for we may have a highly *synchronised* convex system (long and straight streets, thus implying not only long axial lines, but also large convex units, for example), without having high ratios of open space. Among the ten areas under analysis, the most formal is, not surprisingly, the Esplanade of Ministries (y/C=6684m2, y/Cn=0.67), and the most urbane is the Old Paranoa (y/C=410m2, y/Cn=4.41). (See their convex maps, in Figures. 3 and 12, respectively).

4.3. Mean number of constitutions per convex space (x/C).

The open space system of a settlement may, or may not, be *fed* by transitions from the interior spaces: doors, gates or whatever other kind of apertures. When it is *fed* we say the spaces are *constituted*; we call the particular case when transitions disappear altogether *blind* spaces. The mean number of constitutions per convex space gives us the degree of *constitutiveness* of such settlements. In the formula, *x* stands for the number of constitutions of the area, and *C* as before. The smaller is the ratio of constitutions per convex space, the more formal the system. In turn, maximising the number of transitions between interior space and external convex units creates a potential for greater number of interactions in the public realm in daily life, a trait of urbanity so much praised by Jane Jacobs (1961), when commenting on New York, for example. Among the ten areas under analysis, the most formal is again the Esplanade (x/C=0.81, x/Cn=1.04), and the most urbane is New Paranoa (x/C=13.5, x/Cn=4.67).

4.4. Percentage of blind convex spaces (Cb).

The performance of this variable is similar to the previous one, but it is very important to register this limiting case, i.e., where the number of constitutions of a space is zero. (In the symbol *Cb*, *b* qualifies as *blind* the convex spaces) Of course, the larger the percentage of blind spaces, the more formal the system. Among the ten areas under analysis, the most formal is again the Esplanade (Cb=67.5, Cbn=1.20), and the most urbane is also New Paranoa (Cb=5.2, Cbn=4.91). (For illustration, Figures. 4 and 13 show the map of blind spaces of the Esplanade and of Old Paranoa, respectively)

4.5. Square meters of convex space per constitution (y/x)

While in variable 3 it was considered the number of constitutions per convex unit, here what is at stake is the degree of *dilution* of constitutions over the open space surface. (In the formula, *y* stands for the total open space surface, and *x* as before.) The greater this *dilution* the more formal the system will be considered, for more open space surface will have to be overcome in order to establish social interactions. In turn, intensely constituted open space surface has to do with the maximisation of informal encounters in the public open spaces. Among the ten areas under analysis in the Federal District, the most formal is still the Esplanade (y/x=8232m2, y/xn=0.93), and the most urbane is again the New Paranoa (y/x=89m2, y/xn=4.77).

4.6. Linear meters of island perimeters per constitution (Ip/x)

Instead of considering relations between constitutions and open space, now what is at stake is the relation between constitutions and the perimeter of the spatial islands. (In the formula, *Ip* stands for the sum total of island perimeters, and *x* as before) Of course, this is another way of measuring the *dilution* of constitutions over the system, and, in similar fashion as the reasoning presented above, the greater the values here, the more formal the system. But it is interesting to consider this variable specifically, for there are cases in which the values found in this variable may contribute towards urbanity, in an otherwise formal system, as it is the case with the 405/406 North Superblocks, for example. Among the ten areas under analysis, the most formal is once more the Esplanade (Ip/x=161.0, Ip/xn=0.92), and the most urbane is Taguatinga (Ip/x=16.8, Ip/xn=3.67).

*4.7. Grid axiality (GRA=(2*I**(1/2) + 2) / L), and 8. Real Relative Asymmetry (RRA=2*(MD-1)/(L-2)*D).*

Grid axiality gives the relation between the number of axial lines (*L*) and the number of spatial islands (*I*). The result will always fall between 0 and 1 - the more it approximates 0, the more *deformed* is the grid; the more it approximates 1, the closer we are to a *regular* grid. In *deformed* grids, the number of lines is maximised, whereas in *regular* systems, the number of lines is minimised, in both cases in relation to the number of islands. Now my conjecture on this variable is that, both a very high relative number of axial lines, and a very low relative number of axial lines, with respect to the number of islands - i.e., values of grid axiality that both approximate 0 or 1 - constitute the paradigm of formality. In turn, values which are somehow in the middle of the scale, constitute rather the paradigm of urbanity. Before exposing the reasoning behind this conjecture, I must introduce the concept of Real Relative Asymmetry, as follows.

Real Relative Asymmetry is also called the measure of integration, and this is considered perhaps the most fundamental of all syntactic variables. It indicates the smaller or greater level of integration of the various parts of the settlement among themselves, here understood as the lines of the axial map. In the formula, *MD* stands for mean depth. The mean depth of a space is found by calculating the mean minimum distance, in terms of number of turns, between that space and all other spaces in the system. The mean depth of the system, is the mean of the mean depths of all spaces. *L* is the number of spaces (axial lines) in the system. *D* is a factor that normalises the measure according to the number of spaces (Hillier & Hanson, 1984).

There is a significant body of evidence that suggests that the deeper the system, the more difficult is its appropriation by the pedestrian, particularly for strangers, which usually constitute the majority of the people in the public spaces. Hillier's studies concerning the *ghetto effect* of housing estates in London are particularly telling concerning this (Hillier, 1989). However, the analysis of extremely shallow systems in Brasilia suggests that the minimisation of the RRA maximises control in favour of the stranger to the place, at the expenses of the control of the inhabitant. Besides, the radical shallowness of the superblocks, for example, also means a space very little differentiated, under the point of view of syntactic analysis (figures 6 and 10). The social implications of these two cases are different: in the deep labyrinths we have, again, the *ghetto effect*, which prevents the stranger from naturally penetrating the inner parts of the place, maximising local control at the expenses of the control of strangers; in the banalisation of permeability, on the contrary, we eliminate completely the existence of spaces which are relatively segregated, maximising the control of the stranger, at the expenses of the local inhabitant. But neither alternative characterises what is called here urbanity, since this presupposes the existence of a certain balance between inhabitants and strangers, without maximising the importance of neither at the expenses of the other.

Now it is important to stress the relative independence between grid axiality (GRA) and the measure of integration (RRA). Deep systems may be more, or less, regular, and the same holds for shallow systems. Although in the sample of the Federal District we have a reasonably positive correlation between regularity and integration (0.46, measured from columns GRA and RRA, Table 1), very shallow systems may indeed present rather deformed grids, in which there appears a high number of what Hillier has called *trivial islands* - polygons formed by the lines of the axial map, but without islands inside. Planaltina is deeper than the 405/406 North Superblocks (RRA=0.4658 in the former, RRA=0.2991 in the latter), but is a less deformed system (GRA=0.60 in the former, GRA=0.49 in the latter). (See figures 15 and 6, respectively) Also, similarly integrated systems may present remarkably different grid axialities, as the Esplanade (Fig. 5) and Guara-I (Fig. 8), for example, both with RRA around 0.60, but with GRA=0.34, in the former, against GRA=0.13, in the latter. Such variation must therefore be taken into account in characterising and assessing morphic types. Although grid axiality (GRA) and integration (RRA) have generally similar implications for encounter systems, it will be argued that the specific performance of the deformation of the grid, over and above integration, must be acknowledged.

Our tests suggest that we may have *hard* or *soft* deformation. *Hard* deformation arises in rather dense urban tissues (low percentages of open spaces), when a high number of usually short lines is often blocked by spatial islands. We have two clear examples of this in our sample: Old and New Paranoa (figures 14 and 17, respectively). *Soft* deformation is found in sparse systems, in which nevertheless the positioning of the islands on the ground requires a high number of usually long axial lines to cover all the open space surface. This is clearly the examples of the residential areas of the Pilot Plan (Fig. 10, for example). Now the point is: do these two types of deformation have the same implications for urbanity, over and above integration, and what are these?

It is argued that the most successful urban systems are neither too deformed nor too regular, for the following reasons. First, the maximisation of regularity (GRA values tending to 1), of which the almost perfect orthogonal grid of the American city is the typical example, means undifferentiation, and thus disorder: grid axiality, by itself, does not contribute to the structuring of co-presence, in so far as co-presence ratios, other things being equal, tend to be evenly distributed over the

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system. Maximum regularity will thus correspond, in my terms, to maximum formality. Second, the maximisation of deformation (GRA values tending to 0), either of the *hard* or the *soft* versions, seems both to have bad consequences for urbanity, considering: a) in the *hard* version, proliferation of short lines being stopped by islands, maximise a *ghetto effect* in the areas in which they occur (the extreme example is the theoretical labyrinth); b) in the *soft* version, proliferation of long lines and trivial islands maximises permeability in the areas in which they occur, leading equally to an absence of the contribution of the grid towards differentiation of co-presence ratios. Thus maximisation of deformation will again correspond, in my terms, to maximum formality. Finally, and according to what has just been proposed, *balanced* grids will correspond to urbanity, in so far as they constitute the *optimum* degree of morphic differentiation by which the grid may contribute to likewise differentiated co-presence ratios.

Among the ten areas under analysis, the most formal is the New Paranoa (GRA=0.10, GRAn=1.52, Fig. 17), presenting a very high *hard* deformation. The Esplanade, despite a relatively significant number of trivial islands, presents nevertheless a rather balanced grid axiality, remaining as the most urbane area of the sample (GRA=0.34, GRAn=4.13, Fig. 5).

In turn, the procedures in order to normalise the measure of integration were similar to those adopted for grid axiality: maximum formality (i.e., 1) was ascribed to both the deepest and the shallowest system of our sample, whereas maximum urbanity was ascribed to the median value among all. Among the ten areas under analysis, the most formal is the South Amusement Sector/South Hotel Sector, presenting the deepest system of all: RRA=1.2203, RRAn=0.90 (Fig. 7). But the 405/406 North Superblocks, presenting the shallowest system of all (RRA=0.2991), is thus also very formal, according to what has been proposed above: RRAn=1.24 (Fig. 6). The most urbane of all areas is New Paranoa, presenting RRA=0.7227, and RRAn=4.08 (Fig. 17). (Note that in all axial maps presented in the illustrations, the set of the most integrated lines - known as the *integration core* in Space Syntax - are marked in darker tone)

4.8. Intelligibility (INT).

In Space Syntax, intelligibility is the correlation between the RRA of a line and the number of other lines that cross that same line. The number of crossing lines is called the measure of Connectivity (CON) of a certain line. A wide body of research has shown that the more intelligible the system - i.e., the degree to which more integrated lines are equally more intensely crossed by other lines -, the more co-presence is predictable from the measure of integration, and by this it is meant that the most integrated lines are the most intensely used by people (Hillier et al, 1987). In turn, non-intelligible systems imply that people's occupation along axial lines tend to be random, and the grid does not contribute to a clear differentiation between places in terms of co-presence. In correspondence with such research findings, thus the followed is suggestedI: axial differentiation, that in high conditions of intelligibility ascribes the most integrated lines the most intense co-presence ratios, is typical of the most successful urban systems, by which there tends to develop an optimum balance between busier and quieter areas. Thus, in this work, the more intelligible the system, the more urbane it will be considered. By such criteria, the most urbane of all areas under analysis is vernacular Planaltina (INT=0.98, INTn=5.08, Fig. 15), and the most formal is the set South Amusement Sector/ South Hotel Sector (INT=0.43, INTn=0.87, Fig. 7).

5 Discussion

Two comments are now worth making concerning both the limitations of the procedures reported above and their possible future unfolding into better tuned categories. Firstly, the measure of urbanity, as it is presently defined, is biased towards convex categories: we have six convex categories against three axial ones, and no differential weight has been ascribed to them. Also, the variables form clusters, as factor analysis applied to the non-normalised values clearly reveal (Table 7.5): a) factor 1 groups together three convex measures, namely y/C (mean size of convex unit), y/x (open space per constitution) and Ip/x (island perimeter per constitution); b) factor 2 groups together the remaining three convex measures, namely y/A (percentage of open space), x/C (constitutions per convex unit) and Cb (blind spaces); c) factor 3 brings together the three axial measures, namely GRA (grid axiality), RRA (real relative asymmetry) and INT (intelligibility). We might call factor 1 a *metric factor*, factor 2 a *constitution factor*, and factor 3 an *axial factor*. Further research, incorporating a larger sample of case-studies, may thus suggest that such clusters be taken into account, and procedures of ascribing the variables differential weights in constituting the measure of urbanity be developed.

Secondly, there is the issue of differentiating systems according to the spatial distribution of the more integrated lines, over and above their mean integration value. The point is that two systems with a same mean RRA may present nevertheless quite different structures, and in the procedures used in order to arrive at the measure of urbanity no analytic categories have been offered to account for this. One possibility of doing this is to analyse, for example, the form of the integration core according to *line types*, from *0* to *2*, in the following way: a) *type 0* lines are completely internal to the area under analysis, i.e., they do not directly connect the system to the outside; b) *type 1* lines connect the system to the outside in one direction only and c) *type 2* lines connect the system to the outside in two directions.

Table 4

Variable	*Factor 1*	*Factor 2*	*Factor 3*
Percentage of open space (y/A)	0.22122	0.92364	0.07886
Mean convex unit (y/C)	0.96472	0.03074	0.20231
Constitutions per convex unit (x/C)	0.05671	-0.92845	0.04785
Blind spaces (Cb)	0.35345	0.90620	0.15085
Open space per constitution (y/x)	0.93212	0.34858	0.00189
Island perimeter per constitution (Ip/x)	0.95812	0.25283	-0.01870
Grid axiality (GRA)	0.13349	0.20465	0.78304
Real relative asymmetry (RRA)	-0.07703	-0.03104	-0.83442
Intelligibility (INT)	-0.05300	-0.10105	0.9527

Table 4. Factor analysis of non-normalised measures.

Now, it seems that a consistent genotype pervades the modernistic morphology usually found in the Federal District: integration core lines usually cross completely the area under study. Consider the cores of the Esplanade, the 405/406 North Superblocks, and the South Commercial Sector, for example, in figures 5, 6 and 9, respectively. In these cases, the integration core irrigates the whole system, and its lines often reach the limits of the area in both directions. Also, the case of Brasilia is showing that the form of the integration core is crucial in predicting the patterns of distribution of people in public open spaces, over and above the measures of integration and intelligibility (Holanda, 1997). A comparison between the cases of New Paranoa and Guara-I is telling: whereas in the slightly more integrated and more intelligible Guara-I predictability is the lowest in the sample, in New Paranoa it is the highest. It seems that this has a lot to do with the contrasting way the integration core distributes itself in these two places: although a deeper system, in New Paranoa the integration core irrigates evenly the whole area, while in Guara-I it is concentrated in its inner parts, thus constituting a powerful *ghetto effect*. An interesting challenge for future work thus remains: to translate into numbers the form of the integration core, and to devise procedures for transcribing the values thus obtained into the formality/urbanity interval.

6 Conclusions

The set of analytic categories used to characterise urban space patterns calls our attention to a point which has not been acknowledged in the literature: a particular place may present contradictory values, as far as its implications towards encounter patterns are concerned. More specifically, some places may present rather *formal* attributes, at the same time that they present rather *urbane* attributes. It is thus interesting to notice that this procedure allows us to indicate exactly where the *weakest points* are located, if the paradigm of urbanity is to be pursued. For example, when an urban renewal process is carried out in places thus analysed, intervention may be directed precisely in terms of ameliorating the weakest points identified by this procedure, i.e., re-design is done in order to raise lower measurements so that they approach 5.

Nevertheless, the limitations implied in the current stage of the research are clear: the sample studied so far allows only a limited range of types to be considered as the elements through which we establish the parameters for identifying the interval of formality/urbanity. Although the urban areas studied in the Federal District in Brazil offer a wide variety of types, the inclusion of other case-studies from other regions of Brazil, as well as from other countries, will certainly enrich those parameters.

Finally, it is not the intention here to reduce the complex problems involved in the study of human settlement patterns to the interval formality/urbanity. Rather, it should be noticed that this taxonomy aims at objectives which are both limited and very important to be pursued, namely the ones we have in mind when we intend to understand the social implications of urban layouts. Research under way is showing that the measure of urbanity consistently co-varies with modes of life and of evaluating the city form by the people (Holanda, 1997). The more formal the places, in the terms I have put forward here, the more they correspond to political-ceremonial and/or exceptional utilisation, the more their open space system is deserted in daily life, and the more they are praised by middle classes. In turn, the more urbane the places, again in my terms, the more they correspond to intense use in secular, daily life, and the more they present a rich superimposition of varied social agents and practices. But this is already the subject matter for another paper.

Notes

These denominations have been suggested to me, in part, by Bill Hillier, in conversation.

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