Jaime Garretón's cybernetic theory of the city and its system: a missing link in contemporary urban theory

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Abstract

Garretón's "Una teoría cibernética de la ciudad y su sistema" (A cybernetic theory of the city and its system) was published in 1975 by Nueva Visión publishing house in Buenos Aires, a moment when the seminal criticisms against the modernist urban theory of the sixties led by Team 10 were becoming concrete proposals for updating and eventually overcoming its shortcomings. Yet, despite remaining unpublished in English and hence relatively unknown worldwide, few publications in the field compare in scope to Garreton's cybernetic theory. The reason is straightforward: like Shannon's mathematical theory, this work amounts to a general theory of the city. Thoroughly informed by system thinking, whose trademark rule of thumb was described by Luhmann as "drawing distinctions" to guarantee the autopoiesis of a determined system, Garretón's chief objective was to draw distinctions that would guarantee the autopoiesis of the urban system. In doing so, he discovered three fundamental urban laws, namely: the law of urban communication, the law of urban attraction, and the law of urban circulation. This, in turn, allowed him to clearly distinguish a universe that had thus far remained undetected by urbanists and that he called the non-city Universe: the human-made universe that nevertheless does not belong in the urban universe. This paper argues that this allowed him to rediscover and update the ancient and lost art of city-making: not an art of making buildings, roads, and infrastructure in general but rather, the art of building, knitting, fostering, and sustaining communities and whole societies by means of or with the aid of buildings.

Keywords Cybernetics · Cybernetic theory of the city · Non-city · Autopoiesis · Supertheories · Space syntax

1 Concerning *supertheories* (by way of introduction)

"Supertheories are theories with claims to universality (that is, to including both themselves and their opponents)" (Luhmann 1995).

In the revised and unpublished English translation of Garreton's book, concisely renamed "Theory of the city and non-city. Communication as a comprehensive approach", we read: "There are no theories for a specific city; a theory must be general. The concept of 'general' is understood as something that is capable of containing every specific aspect within its propositions, no matter how different they are,

identifying the most essential aspects lying in the depths of every city that make them what they are. Thus, all cities have something in common that links them" (Garretón 2002). With this, Garretón confirmed something about which he surely must have grown convinced since the publication of his book "Una teoría cibernética de la ciudad y su sistema" (TCCS); namely, that his theory fulfilled the necessary requirements for a general urban theory. To our knowledge, there have been only two other attempts (discussed below) with similar open claims to universality: one by the Catalan engineer Idelfons Cerda and the other by the British professor of architectural and urban morphology Bill Hillier. It would certainly take much more than an article to dwell into an in-depth review of such claims and only a few hints can be given here in this direction.

Cerdá's stature as an engineer can hardly be contested. He was a polymath and contributed greatly to the advent of a contemporary, comprehensive, and evidence-based approach to seeing, analyzing, and planning cities. Moreover, he was one of the few urbanists able to combine his

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theoretical work with his practical output in an admirable and unique way. However, Cerda's ideas were still rooted in the then prevailing Cartesian, humanist, and industrial zeitgeist of the XIX century, thus making it difficult to make a case for it in post information age urban thinking. We find clear symptoms of this in his disdainful statements regarding the importance of distance and communication. He wrote: "Distance matters very little, as long as it is not so great as to make communication impossible for the grouped shelters… the real issue lies in being able to achieve the ultimate objective of the grouping, which is the ability to provide each other with reciprocal services. As long as this can take place, it would be childish, even, to spend time measuring and setting distances" (Soria and Puig (Eds.) 1999, p. 98). In this way, despite a good number of pages dedicated to the alleged importance of the size of the block, he ended up bestowing upon his blocks a side dimension that is actually longer than that of the average Hispanic American block, i.e., 113 × 113 m. So, it came to pass that, more than three centuries after the first cities were laid out in the New World, the opportunity to revise the dimensions of the block, with all that this entails, was lost.

Ever since Jane Jacobs pointed directly at the size of the blocks as a factor intimately linked to what urbanists and planners alike, for want of a better term, have usually called 'urban life', urban size has become a central issue in urban studies. In a chapter explicitly titled 'The Need for Small Blocks,' in almost Vitruvian fashion, she wrote: 'Most blocks must be short; that is, streets and opportunities to turn corners must be frequent'. (Jacobs 1961, p. 191). She became one of the first to clearly distinguish and isolate the problem of the size of the urban block in relation to human movement and encounter as a fundamental determinant for urban design; one that Le Corbusier had also overlooked and that Edward T. Hall would begin to formalize with his proxemics studies (Hall 1959, 1969), with Gehl eventually following in his footsteps (Gehl 2001, 2010, 2013). Furthermore, we will argue that the size of the block becomes crucial when it comes to architectonic matters; that is, when it comes to the perception of the block as an architectonic object, an architectural/artistic matter that, unsurprisingly, remained beyond the scope of Cerdá's theory.

Hillier's complex theoretical output—put forward as a road to a "general theory of architectural possibility" is a completely different case altogether. Like Cerdá, he was not an architect or urbanist. Unlike Cerdá, however, he was active during the second half of the last century as well as the beginning of the twenty-first century. Hillier's work could be succinctly characterized as a phenomenology of the grid and has been instrumental in the study and understanding of the direct correlation between urban morphology and people's patterns of movement and rest; something for

which there was no sound evidence until he developed his topological approach to the study of the urban layout. In other words, he provided evidence for phenomena that prior to his work belonged to the field of urban common sense. First, Hillier identified a direct correlation between the most integrated (normally, most central) streets in a city and the patterns of presence and circulation of people in the streets. In space syntax jargon, there is a correlation between the integration value of a given street and the number of people present in it at any given time. Second, he realized that people tend to walk along the least broken/straighter streets and avoid walking along streets that do not guarantee continuity of movement. He calls these general trends in human behaviour in cities "natural movement" (Hillier 1993). In contrast to the common-sense nature of his findings, however, his written work—and for that matter, that of the Space Syntax community in general—has tended to remain abstract and as a result of this, not easily accessible or comprehensible.

The origins of Space Syntax's achievement, as well as some of its shortcomings, can be traced back to the book "The Logic of Space", which laid down the theoretical foundations for Hillier's following book "Space is the Machine" (Hillier 1996). There, we find the following assertion: "By giving shape and form to our material world, architecture structures the system of space in which we live and move. In that it does so, it has a direct relation—rather than a merely symbolic one—to social life, since it provides the material preconditions for the patterns of movement, encounter and avoidance which are the material realization—as well as sometimes the generator—of social relations. In this sense, architecture pervades our everyday experience far more than a preoccupation with its visual properties would suggest." (Hillier and Hanson 1984, p. ix). Yet, the reader is soon struck by the fact that the authors never delve into what they call "encounter". Quite the contrary, they openly cast doubt upon its importance when they write, "Society, it is said, begins with interaction, not with mere co-presence and co-awareness, but we really wonder if this is really so" (p. 25). Thus, while acknowledging that architecture is responsible for the patterns of movement, encounter and avoidance, Hillier is actually never interested in encounter or communication, only in patterns of movement, avoidance and rest. This allowed him to posit what is probably one of his most controversial postulates: that the prime cause of urban—that is, human—attraction and therefore, of natural movement, is configuration itself. We would argue that this abstract line of reasoning has attracted most of the criticism and has kept the theory—more than the practice—controversial (Ratti 2004; Araneda 2017).

Garretón's TCCS, published in 1975 by the Argentinian Editorial Nueva Visión, begins exactly here, with a mathematical study of Space Syntax's blind spot, namely,

face-to-face communication. Despite a failed attempt to republish the book with McGraw Hill (which gave rise to a first updated and revised English manuscript) all of Garretón's work was published in Spanish. Given the renewed interest in cybernetics via cognitive sciences, autopoiesis theory and second order cybernetics, it is intriguing to wonder what might have been the course of this book if a translation into English had been available when, for example, Luhmann was writing his "Art as a Social System" (Luhmann 2000). For the fact remains that this work by Garretón is the only comprehensive urban theory expressly written in this literary context, with the phenomenon of communication at its core. That said, TCCS is a difficult and terse book. It neither provides an introduction into its cybernetics background nor places itself within a wider bibliographical context of urban theory. Like Shannon's "The Mathematical Theory of Communication" (Shannon 1949), it is written in technical language and demands considerable prior knowledge on the part of the reader, a trait that might well account for its limited impact amongst his contemporaries. For these reasons, a brief attempt shall first be made to place Garreton's work within a general bibliographical and epistemological context. Then, an outline of the fundamentals of his urban theory will be offered, placing special emphasis on its chief findings: the law of urban attraction, the law of urban circulation, the law of urban communication and, as a result of this, on his discovery of what he termed the non-city universe.[1] Finally, a few considerations of the TCCS's implications for contemporary urbanism and urban theory will be offered.

2 General epistemological and bibliographical context for a balanced appraisal of Garretón's cybernetic urban theory

The fact that Garretón removed the word "cybernetic" from the title of his unpublished and revised translation into English provides a noteworthy introduction to the epistemological origins of his work. Although this author never discussed with Garretón in depth the reasons for this change, he intimated that the word cybernetic might have contributed to an out of hand rejection of the work. There are good reasons to believe that this was indeed the case. As a word, cybernetics has come to normally be associated with machines, not with human beings. Yet, Norbert Wiener, founding father of the science of cybernetics, was at pains to make plain that cybernetics was, in its origin, a science of human beings and of

life. Introducing his ideas to the non-scientific audience, in a work eloquently titled "The human use of human beings", he wrote: "As entropy increases, the universe, and all closed systems in the universe, tend naturally to deteriorate and lose their distinctiveness, to move from the least to the most probable state, from a state of organization and differentiation in which distinctions and forms exist, to a state of chaos and sameness… But while the universe as a whole… tends to run down, there are local enclaves whose direction seems opposed to that of the universe at large and in which there is a limited and temporary tendency for organization to increase. Life finds its home in some of these enclaves. It is with this point of view at its core that the new science of Cybernetics began its development." (Wiener 1950, p. 12).

With these words, Wiener clarifies from the outset that, despite the omnipresence of entropy—the inherent tendency of matter towards disorganization, homogenization, sameness and ultimately, self-annihilation—and that 'in a very real sense we are shipwrecked passengers on a doomed planet,' (p. 40)—cybernetics, as the science of man that it was always intended to be, was grounded upon life, not death. Life, he wrote metaphorically, "… is an island in a dying world" (p. 95) and elsewhere, that "there are local and temporary islands of decreasing entropy in a world in which the entropy as a whole tends to increase, and the existence of these islands enables some of us to assert the existence of progress." (p. 36). Not leaving any room for doubt, he wrote: "Remember that we ourselves constitute such an island of decreasing entropy, and that we live among other such islands." (p. 39). Lastly: "When I compare the living organism with… a machine, I do not for a moment mean that the specific physical, chemical, and spiritual processes of life as we ordinarily know it are the same as those of life-imitating machines. I mean simply that they can both exemplify locally anti-entropic processes…" (p. 32). Thus, the cybernetic enterprise was a thoroughly contemporary, post cartesian attempt to make plain that man is—even if for a short span of time—a negentropic enclave. This is, indeed, a most improbable, miraculous occurrence in the midst of a deterministic world. In view of Wiener's categorical remarks, the question arises unbidden: why did cybernetics then come to be known as a science of machines rather than a science of man and life? It will be tentatively argued here that the answer is undeniably linked to the new kind of "gold rush" triggered by the rapid rise of intelligent electromagnetic machines, later known as computers, and more recently, by the rise of artificial intelligence as the ultimate logical consequence of early cybernetician's efforts to understand and replicate the human nervous system and ultimately, the brain. This all-pervading historical event eventually gave rise to transhumanism, an increasingly influential, quasi-religious set of beliefs that advocates and promotes

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[1] Due to its idiosyncratic character, it is worth mentioning that this took place seventeen years before Marc Auge introduced the notion of Non-Place into mainstream academy.

the blending of humans and machines as the only feasible way forward for the evolution of the human race (Lee 2019).

Overshadowed by the paraphernalia of the advent of technology, around the mid-seventies, there arose from within the cybernetic movement a distinctive branch led by the likes of Heinz Von Foerster (2003) and Francisco Varela (1993), among others, that focused not only on the mere observation, characterization and replication of living systems, but rather on what first order cybernetics (and for that matter, traditional physics before it) by its very own nature, left necessarily unstudied: namely, the observer, or more properly, cognition itself. In this way, second order cybernetics was born. A crucial consequence of this event in the biography of science is that natural sciences, via cybernetics and systems theory, coupled themselves, to the indisputable benefit of each, with the philosophical tradition known as phenomenology. The essence of phenomenology is to be found condensed in Goethe's classic maxim: 'The highest is to understand that all fact is really a theory…' and the following warning: "… search nothing beyond the phenomena, they themselves are the theory." (Seamon and Zajon 1998, p. 4).[2] Goethe's stance has the power to reduce the generation of knowledge to one basal condition: the coexistence of an object of study (be it physical or noumenal) and of a corresponding organ of perception, a way of knowing called "enaction" by Varela (1993). In Wiener's cybernetic spirit, Garretón published his work 2 years after his fellow countrymen Maturana and Varela (1979) introduced the idea of autopoiesis into the world of sciences. This pursued in urbanism the same aim that Maturana and Varela pursued in biology and Luhmann in sociology: the distinction of the autopoietic unit whose recursive operation secures the subsistence of the urban phenomenon without succumbing to the disorganizing effects of entropy.[3] So, when looking for the urbanist's own object of study, unlike Cerdá and Hillier, Garretón did not start with the study of already built cities but with a study of the observable aspects or "footprints" of face-to-face communication.

3 Towards a distinction of the urban universe

In line with the classic Aristotelian evolutionary point of view, Garretón recognized our world as consisting of: the physical universe or mineral kingdom, governed exclusively by physical laws; and the biological universe, made up of the plant and animal kingdoms (that in turn contain and transform the physical universe) and governed by biological laws. Together, these constitute what we normally call Nature or the natural universe, which in turn is governed by what we know generically as natural laws. Then he asks: What about the human kingdom? According to Garretón the first categorical sign of this kingdom's existence properly speaking begins with the appearance of the Rural Universe around ten thousand years ago, later to become the Urban Universe around five thousand years later. As will be explained in the following section, the urban universe is for Garretón a "field" thoroughly permeated by human communicative possibilities. The next question is: what are the laws of this universe and where do these stem from? In a lengthy article exclusively concerned with the notion of Non-City, Garretón explains that, since human beings were not solely governed by natural laws, we had to gradually separate from nature (Garretón 1993). In order for such a separation to be effective, we had to generate a new universe, different from the natural one—our own universe with its own laws and dependent exclusively upon us. The rise of urban society was characterized from the start by its permanence and continuity and signified a most unnatural, improbable event. If cities were not the direct result of natural laws, what forces then colluded in the rise of the Urban Universe? Garretón's whole written oeuvre is a strenuous effort to demonstrate how, to begin with, the simultaneous rise of an urban organized social body and the urban universe was the product of supra-natural, negentropic, human laws, which, in the context of his argument, can also be called communicative, informative laws.

4 Drawing a distinction between the city and the non-city[4]

To characterize the urban universe, Garretón begins by stating that this will be made up of information embodied in persons and objects in a state of permanent communication. He writes: '… in the universe there will be three types of sets of points. The set of points with information will be called 'City', the set of points without information will be called 'Non-City' and another set of points will be called 'border' between the two' (Garretón, 2000, unpublished, p.105). Further clarifying this, Garretón assesses the concept

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[2] With the exception of Ludwig von Bertalanfy, neither second order cyberneticians nor phenomenologists have paid open homage to Goethe.

[3] Autopoiesis can be understood as the circular or recursive elemental operation that allows and makes possible the existence of any system for a certain amount of time without succumbing to the entropic effects of gravity.

[4] Unlike the TCCS, his unpublished translation into English is more generous in literary explanations. Thus, for the sake of clarity and understanding, we will freely quote a few passages from it. The mathematical expressions remain identical to those in the original publication.
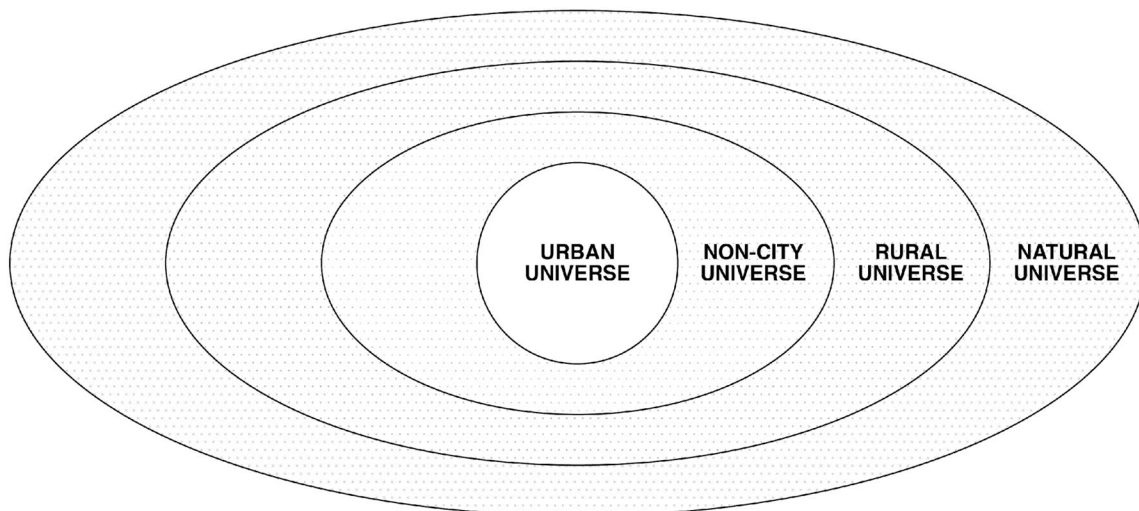
Fig. 1 Universes making up the totality of our present world of experience

of universe from a topological point of view. 'Let A be a point of the universe and let us define neighbourhood $V(A,e)$ as the set of all the points B that are to be found at a distance from A that is less than e, where e is a quantity higher than cero. This is also called a 'radius':

$$V(A, \varepsilon) = \{B/B \in M2 \times dAB \ V\varepsilon\} \quad \text{for } e < 0$$

The concept of neighbourhood also allows us to incorporate three new concepts: the concept of the interior point of the set, the concept of exterior point and the concept of border point. We will call interior point of the set 'city' all those points whose neighbourhood is completely included in the set C. We will call exterior point of the city all those points whose neighbourhood is completely included in the non-city." (p.105). A little later he adds: "Since there are interior and exterior points in the city, there will also be another type of point, which will define another set of border points. A point will be a 'border point' when a neighbourhood over that point, intersects points of the city and the non-city. This set of points will be called border of the city and the non-city (p. 106):

$$V(A, \varepsilon) \cap (C) \text{ and } V(A, \varepsilon) \cap (NC)$$

For Garretón, this topological or 'neighbourhood' viewpoint is crucial since the distinction between these different points (persons) reveals the importance of 'continuity' within the urban universe. Continuity in a set must be understood as a homogeneous space that does not include any point or element of a different nature. In other words, it does not possess any 'voids', which, in the case of the universe under definition, must be regarded as communicative voids or, more precisely, as direct communication "voids". "The idea of continuity tells us that for any point in the city, if

we apply a neighbourhood with a radius 'e' less than $[x]$[5] metres, there will always be points with information that will allow us to establish a relation of direct communication" (p.107). This leads Garretón to a second crucial distinction, the one between 'open set' and 'closed set'. 'A set is open if it only contains interior points, points of the same nature and with information. A set is closed if, besides containing the interior points, it also contains the border points; that is to say, points of a different nature.' (p.107). It goes without saying that the ideal for the city is to be an open set, i.e., to possess only points with information. This guarantees that communication will be always active within the city and this in turn guarantees the preservation of the urban system. When a set is open, its complement is by mathematical definition a closed set. 'In defining the city as an open set, the non-city will be understood as the complement of the city, that is to say, as a closed set. In consequence, since the non-city is a closed set, it must contain all the exterior points of the city, including all the border points. The border of the city and of the non-city will not be in the city… it will belong to the non-city.' (Garretón 1975, p. 99). It can thus be mathematically demonstrated that the non-city universe, as Garretón has always pointed out, is the "complement" of the city (Fig. 1).

Now, this is closely connected with another important notion, namely, the notion of "limit". Let us consider the city as a set once again. We said that if the set contains its border points it becomes a closed set, something that Garretón expresses as follows (Garretón 2002, p. 184):

$$[a, b] = \{x/a \leq x \leq b\}.$$

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[5] Where 'x' is the maximum distance for face-to-face communication to be possible.

Now, if the set does not contain the border points it becomes an open set, whose mathematical expression is as follows (p.183):

$$[a, b] = \{x/a < x < b\}.$$

The former is the mathematical expression of a "frontier", the latter of a "limit". For the purpose of understanding the idea of 'limit', it must be clear that '*x*' can approach '*a*' and '*b*' as much as is desired without ever reaching them. Garretón says: 'A limit obeys and is generated according to a determined law; in consequence, it will only be valid for that law and not any other one that could trespass it. Therefore, the trespassing of a limit, when effective, is the product of a change of law.' (p. 188). Therefore, the necessary questions here are: what are the laws of the city? What is the 'function' of the urban universe? For Garretón there is never any doubt: urban laws are communicative laws.

5 Concerning the laws of the urban or city universe

The laws of the urban universe are, according to Garretón, derived first and foremost from a study of face-to-face communication. From here, three fundamental urban laws are derived: the law of face-to-face communication, the law of urban attraction and the law of urban circulation.

5.1 The law of face-to-face communication

According to Garretón, the Theory of Communication establishes the following general model for communication (Garretón 1975, p.11):

$$\text{SOURCE(S)} \rightarrow \text{TRANSMITTER(T)} \rightarrow \text{CHANNEL(C)} \rightarrow \text{RECEIVER(R)} \rightarrow \text{ADDRESSEE (A)}.$$

By taking the case of an internal transmitter and receiver and grouping the source and transmitter together on one side as A and the receiver and addressee on the other side as B, Garretón adjusted this to his own purposes[6] (p.15):

$$\text{ST(A)} \rightarrow \text{C} \rightarrow \text{RA(B)}$$

We then have two human beings and a channel of communication. This illustrates different people in a state of communication since, as we will see, human beings naturally possess the means to emit communication signals as well as to receive such signals. This is the fundamental structure of human communication known as 'direct face-to-face communication.' Thus, the city can be defined as a concentration
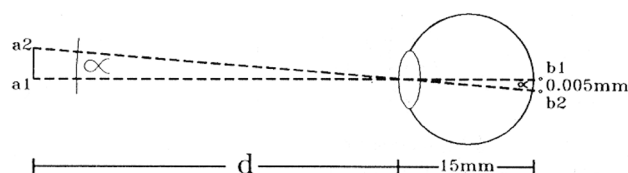

Fig. 2 Diagram of variables involved in Garretón's calculus for the determination of the maximum distance for face-to-face communication potential to become activated. Source: Garretón (1975), p. 18
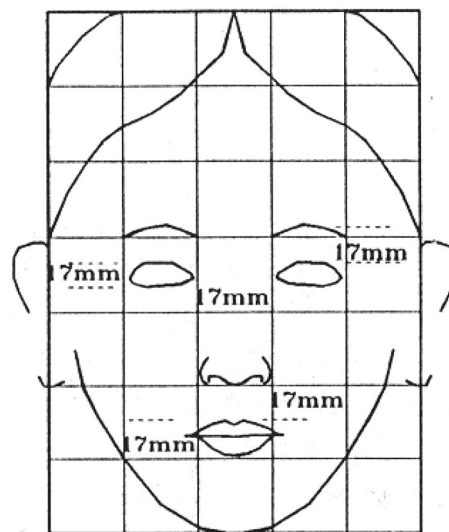

Fig. 3 The human countenance as a complex of visual signals after Garretón's study. Source: Garretón (1975), p. 19

of people and objects with information. According to Garretón, the prime condition for face-to-face communication to be possible is that the two parts involved should not be at a distance greater than the distance that allows the average human eye to recognize the features of another human countenance. Beyond that, all chances for face-to-face communication cease and, therefore, a communicative discontinuity will appear. Establishing a mathematical relationship between the retina cells distance constant, the diameter of the ocular, the distance between the retina and the crystalline lens and another constant measure derived from a study of the human countenance—in the tradition of Hermann Maertens (1877) before him—Garretón fixed that measurement at 48.5 m (Figs. 2 and 3).

In this way, Garretón introduced a new "meta-communicative sphere" so to speak, one that embraces all the other ones involved in face-to-face communication

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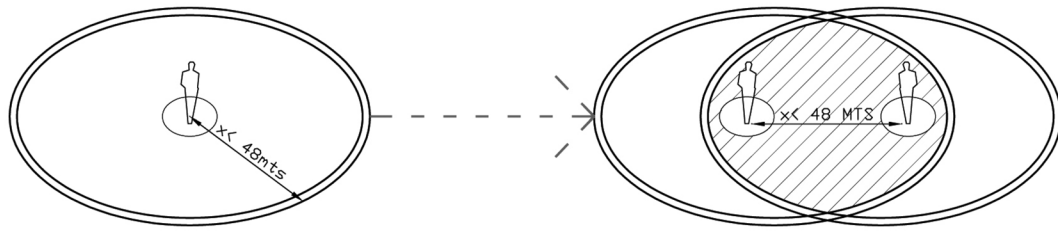[6] Adapted idealized noiseless model after Claude Shannon's mathematical model.

Fig. 4 Direct contact neighbourhood or maximum distance for face-to-face communication potential to become activated. Source: Garretón (1975)

(already studied by E.T Hall, Gehl and others) and that he called 'direct contact neighbourhood.' Writing in the unpublished English version of his work, regarding the all-encompassing nature of this neighbourhood, and this time giving full credit to Hall's findings, he wrote: 'This neighbourhood of contact includes other minor neighbourhoods arising from other sensory experiences such as hearing, tactile and olfactory signals, as well as object signals [e.g., architecture], thus reinforcing each other.' (Garretón, unpublished, p. 21). A little later: 'Each of us carry our own neighbourhood at all times and this in turn gets intersected by other people's neighbourhoods. It is in the interior of this intersection that the probability to establish communication increases. Architecture can certainly profit from this in order to conform spaces like squares, streets, rooms, halls, etc.' (p. 21) (Fig. 4.).

Garretón writes: "Intuitively, the concept of continuity suggests a surface without gaps. However, we can define continuity in a more rigorous manner, considering a given geometric point p fixed in a surface, taken as a centre upon which we apply a neighbourhood $V(p, e)$; if for any e it is true that:

$$V(p, \varepsilon)\varepsilon M2 \times \exists q \in Iq - pI < \varepsilon \cap M2.$$

In fulfilling this condition, the space will be continuous, something that can be interpreted as the enactment of direct communication; that is to say, in order for this kind of communication to be possible an addressee must always exist within the contact neighbourhood of the source, so as to keep the direct channel uninterrupted. In this way, the interior space of a city will always be continuous." (Garretón 1975, p. 99).

Thus, put axiomatically, it can be said that the city remains a city inasmuch as the potential for direct communication continuity is preserved throughout the whole urban universe. On the contrary, whenever a discontinuity appears, like the one diagrammed above, the 'entropic',

forces of the Non-City become active within the Urban Universe. These rather simple considerations have far-reaching consequences since they reveal that a city is not synonymous with buildings. In other words, a building does not necessarily become urban by the mere fact of having been built in the city. In Garretón's words: "housing alone does not have urban potency" (Garretón 1979, article 3, p. 3.3). We can have buildings everywhere, but if the primordial condition for the subsistence of the Urban Universe is not fulfilled (i.e., the conservation of the potential for face-to-face communication to take place at any given time), then the autopoiesis of the urban universe will cease. The Non-City presents itself in these cases as 'islands' or 'voids' that must be avoided at all costs for they constitute the germ of the city's destruction.

5.2 The law of urban attraction

In contrast to the law of physical attraction, which states that the attraction between any two bodies is directly proportionate to mass and inversely proportionate to the square of the distance that separates them, the law of urban attraction, is an eminently human, *negentropic* law that escapes natural determinism and originates in the generation of information and its communication. It acts upon a population able to discern and discriminate between different sources of attraction, behaving in a probabilistic rather than a deterministic way. According to Garretón, attraction is a relative and potential relationship between source and addressee, an orientation prior to circulation, a latent state, a 'probability' of establishing future communication contact where the most important thing is to favour the coexistence of many diverse orientations of the population, avoiding a single and exclusive orientation for all.

A basic system of communication involves (Garretón, unpublished, p.82):

UNCERTAINTY → REDUNDANCY → ATTRACTION → CONTACT → COMMUNICATION → ACTION → UNCERTAINTY.

Information eliminates the uncertainty impeding decision-making capacities. This incapacity in turn affects the action, since in a regime of uncertainty the action diminishes or tends to be paralyzed. Therefore, information is a source of orientation and in a more elevated form it will provoke circulation.

5.2.1 The law of urban circulation

Garretón writes: 'Urban circulation is motivated by the need to be connected to a communication system, above all when establishing direct (face-to-face) communication is necessary. If the distance separating the source (A) from the addressee (B) surpasses the maximum distance for direct communication to be possible, one or both parties will try to bridge the distance and establish communication. The need to communicate is attraction. Therefore, attraction is the origin of circulation, and circulation is the manifestation of attraction.' (Garretón 1975, p. 85). As already stated, face-to-face communication is the most complete and effective form of communication. As such it constitutes the norm for all communicative processes, an ideal towards which, at any rate, all other communication processes should strive. That said, the channel that makes it possible is limited by physical distance. This is where circulation comes into play, motivated by the need for direct communication. It can be represented by the expression (AzB'), where, as explained above, A is the source of information and B' is the addressee who needs to establish direct communication. Garretón explains that "this need is a characteristic of urban circulation: the tendency to become direct communication. The term z is the means by which circulation becomes possible." (p. 85). By tendency to become communication Garretón implies that circulation is not important in itself: "… 'z' possesses direction and orientation, determined by the extremes A and B; once its objective has been accomplished, it loses its purpose… 'z' is only a means, its importance lies in the efficacy with which it makes direct communication possible." (p. 85).

So, the concept of circulation can be expressed as follows (p. 90):

$$\text{ATTRACTION} \rightarrow \text{DECISION} \rightarrow \text{TRANSPORT}(Z) \rightarrow \text{DISTRIBUTION} \rightarrow \text{ACCESS} \rightarrow \text{CONTACT} \rightarrow \text{COMMUNICATION}.$$

Now, according to Garretón, circulation (z) has an inherent potential flaw: "… although originally it is only a relationship between the terms A and B, it eventually acquires a concrete physical representation and in doing so becomes a fixed link; that is to say, it becomes a unique solution to the exclusion of all others and tends to persist…" (Garretón 1975, p. 86.). It is in this tendency towards persistence that Garretón sees "the germ of destruction of circulation as communication… Even when circulation is necessary in order

to accomplish direct communication, it is not important in itself." (p. 86). And he adds, "… any study concerning circulation must always bear in mind its ultimate goal, i.e., to become direct communication." (p. 86). It follows that since the ultimate aim of circulation is to allow communication, the transport of people in the urban system must 'always' be minimized and 'never' maximized. He then goes on to say that urban circulation must be viewed as 'accessibility' and be designed as such. Further elaborating, Garretón points to a distinction of the utmost importance for the subsistence of the urban system and for the postulation of the non-city concept, the distinction between circulation and transport: "Urban circulation is not a synonym of transport, for people are not transported in the same way as objects. People are able to decide where they wish to go and choose the means of transport and the time to be spent on this journey. Urban circulation is the circulation of people, not vehicles, people who make their decisions autonomously." (Garretón 1979, article 4, p. 4.1).

Transport is not necessarily concerned with the complete relationship between A and B and as such, "it represents a danger for direct communication and its equivalent, the city." (article 4, p. 4.1). These statements expose a very common and grave mistake made by those responsible for providing the city with appropriate circulation, i.e., "to consider circulation as an end in itself… without taking into account direct communication" (article 4, p. 4.1).

6 The rise of the non-city universe

In a study undertaken for the National Planning Office (ODEPLAN), Garretón explains that, following centuries of development, our social body is today essentially made up of three fundamental systems: the cultural system, the juridical system and the economic system.[7] Of them all, the economic system is the last to reach maturity and is roughly composed of three sub-systems. These are: the productive sub-system, distributive sub-system and consumption sub-system. According to Garretón, of these, the productive sub-system

and, to a certain extent, the distributive sub-system do not strictly speaking belong in the city. Indeed, the development of the productive sub-system within the city generated the first great distortion in its structure, thus planting the seeds of destruction of the Urban Universe. Garretón explains that

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[7] They are all linked and coordinated by the Communicative System, a system to which Garretón devoted an in-depth study, crucial for a clear distinction between direct (including artistic communication) and mediated communication.

Fig. 5 Tres Riches Heures du duc de Berry. Depiction of sowing, the classic theme for October. Source: Fanny Fay-Sallois, Desclee de Brouwer (2002)

'Up to the XVIII century approximately, the natural, rural and urban systems coexisted in mutual harmony, keeping a reciprocal equilibrium.' (Garretón 1993, p. 17). He writes: 'if we observe an engraving of a city before the eighteenth century, we will see that a clear demarcation exists between it and the surrounding countryside. Its frontier appears signaled by the protective walls that conferred the impression of eternal security. Location, structure and activity appear clearly differentiated without a transition between them' (p. 15) (Fig. 5).

According to him: 'In this landscape is reflected the condition of the cities immediately preceding our own age, something no longer existent in a modern city where it is not known with precision where they begin or end, when we enter or when we leave them. In the same way, the countryside does not exist in its pure state anymore, but is completely crossed by roads, industrial installations and agro-industry. The natural universe on the other hand has almost completely disappeared, at least in the proximities of inhabited centres.' (p. 16). Thus, the excessive growth of the productive sub-system overtook the limits of the city, demanding simultaneous expansion of the distribution sub-system thus increasing transport demands, which were later to be met by Ford.

And here comes the crucial distinction which probably amounts to one of his most important discoveries: "As transport speed increased and its cost decreased, an unexpected increase in travel opportunities was produced. This is why, beyond the limits of the cities, transition zones unknown until then, began to appear. These could not be considered either as city or as rural areas. The transition zone that generally gets mixed up with what is clearly a city or threatens to destroy the agricultural land and nature is called the Non-City.' (Garretón 2002, Chapter K). Elsewhere: '… the Non-City was effectively generated by the massive-scale production and distribution. This Non-City was simply viewed as the price to be paid for explosive urbanisation. It has never been considered as a new universe that is appearing and so deserves its own place, separate and different from the other universes.' (Garretón 1993, p. 16). The fact that the Economic System was conceived in the heart of the city and grew simultaneously with it would, according to Garretón, explain why people today usually get the impression that the city is essentially driven by economic factors, a belief later backed and endorsed in the sixties by study techniques such as 'planning' which, in Garretón's view, amounts to nothing more than the application of economic thought to territorial and urban development and as such should really be called 'spatial economic planning'. Therefore, the still not clearly perceived conflict between the city and the non-city stems from the economic system and its inability to insert itself correctly into purely urban processes. According to Garretón, the economic system should be conceived as a "mediator" between the rural universe on the one hand and the urban universe on the other, whose fundamental role is the proper transformation of raw materials and energy for internal urban use. In terms of its location, 'the Non-City is to be found next to the city and often between two or more cities.' (Garretón 1985, p. 82). For this reason, Garretón has called the circulation infrastructure in the form of high-speed and heavy traffic motorways extending beyond the limits of the city and connecting one city with another, the "Lineal Non-City."[8]

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[8] The landscape that has emerged along London's M25 ring motorway and its techno-corridors between cities, such as the M11 and M4 are good and highly differentiated contemporary examples.
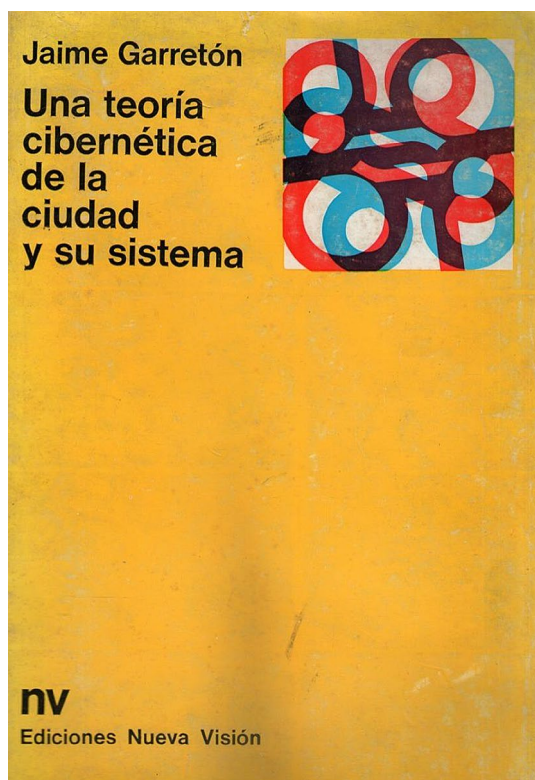
Portada original de: Garretón, Jaime (1975). *Una teoría cibernética de la ciudad y su sistema,* editorial Nueva Visión: Buenos Aires.

7 Conclusion

It is hoped that this article has managed to provide an adequate overview of the fundamentals of Garretón's urban theory thus helping to place his work within a wider bibliographical and epistemological context. In doing so, we also hope to have made the ongoing validity and universality of its postulates self-evident. By being grounded in the study of human and societies' basal activity—i.e., face-to-face communication—rather than in the study of other cities (strictly speaking, an archaeological procedure), Garretón was able to derive/discover three fundamental urban laws: communication, attraction, and circulation. This in turn enabled him to further distinguish a new universe that has thus far escaped the full awareness of urbanists: the non-city universe. This is a crucial discovery upon which hinges the very survival of the urban universe. This set of distinctions provides a glimpse into a complex and updated vision of the city, one that would enable a clear-cut distinction between what is urban and what is not. Indeed, in his revised unpublished text, Garretón goes on to elaborate upon a detailed inventory of the content and laws of the non-city. Today's uncertainties surrounding the imminent arrival of 5G technology reminds us that discrimination in this sense is an ongoing exercise. What is urban and what is not? From this point of view, it could be argued that the overarching achievement of the TCCS is the updating and rediscovering of the ancient art of city-making. This is not the art of building buildings—strictly speaking, an architectonic deed—but the art of knitting, building, fostering, and keeping communities and whole societies together by means of buildings. It is an art where buildings are understood not only as architectonic objects but also as "urban walls". Indeed, one of Garretón's trademark calls is for both: an architectural urbanism and an urban architecture. Giving full credit to the proxemic impulse (mainly carried over into twenty-first century urbanism by Gehl) we saw how, starting from a mathematical study of face-to-face communication, Garretón helped bring it to further completion by discovering the maximum distance for face-to-face communication potential to be activated. This provided a fundamental new layer to the communicative atmosphere surrounding human beings, which he called 'the direct communication neighbourhood,' a meta neighbourhood beyond which all possibilities for face-to-face communication to become activated come to a halt. Thus, a new, emerging image of what a citizen is arises: not one but at least two human beings within the face-to-face communication potential field, each in turn surrounded by their own communicative atmosphere in a constant state of expansion and contraction. A pulsating and living image of the archetypal citizen, so to speak. This eventually led Garretón to postulate that the new centres of the city are human beings themselves and accordingly, to propose a new structure for the city, one that he called "central structure within limits" whose study must here be left pending.

References

Araneda C, Gatica B (2017) Mapping the crowd from within. An immersive strategy for the recording and management of visual information in the shape of people as a complement to syntactic spatial analysis. In: Proceedings of the ninth international space syntax symposium, 77, pp 1–17

Garretón J (1975) Una teoría cibernética de la ciudad y sus sistema. Nueva Visión, Buenos Aires

Garretón J (1979) Hacia y desde la ciudad. Ediciones Universidad Católica de Chile, Santiago

Garretón J (1985) De ciudades y sistemas de ciudades. ODEPLAN, Santiago

Garretón J (1993) La no-ciudad, complemento de la ciudad. Arquitecturas del Sur 20.

Garretón J (2000) Theory of the city and the non-city. **(Unpublished)**

Garretón J (2002) Espacio, Devenir y el Rescate del Tiempo. CESOC, Santiago

Gehl J (2001) Life between buildings. Using Public Space. The Danish Architectural Press, Copenhagen

Gehl J (2010) Cities for people. Island Press, Washington

Gehl J (2013) How to study public life. Island Press, Washington

Hall ET (1959) The silent language. Doubleday, New York

Hall ET (1969) The hidden dimension. Anchor Books, New York

Hillier B (1996) Space is the machine. Cambridge University Press, Cambridge

Hillier B, Hanson J (1984) The social logic of space. Cambridge University Press, Cambridge

Hillier B et al (1993) Natural movement: or, configuration and attraction in urban pedestrian movement. Environ Plann B Plann Des 20(1):29–66. https://doi.org/10.1068/b200029

Jacobs J (1961) The death and life of great American cities. The failure of town planning. Penguin Books

Lee N (ed) (2019) The transhumanism handbook. Springer Verlag

Luhmann N (1995) Social systems. Stanford University Press, California

Luhmann N (2000) Art as a social system. Stanford University Press, California

Maertens H (1877) Der optische-maassstab oder die theorie und praxis des ästhetischen sehens in den bildenden künsten. Auf grund der lehre der physiologischen optik. Cohen, Bonn

Maturana H, Varela F (1979) Autopoiesis and cognition. The realization of the living. Kluwer Academic Publishers, Boston

Ratti C (2004) Space syntax. Some inconsistencies. Environ Plan B Plan Des 31(4):487–499. https://doi.org/10.1068/b3019

Seamon D, Zajonc A (eds) (1998) Goethe's way of science. A phenomenology of nature. SUNY, New York

Shannon C (1949) The mathematical theory of communication. University of Illinois Press, Illinois

Soren B, Glanville R (eds) (2003) Heinz Von Foerster 1911–2002 (cybernetics & human knowing). Imprint Academic, Exeter

Soria y Puig (ed) (1999) Cerda. The five bases of the general theory of urbanization. Gyngko Press, Barcelona

Varela F, Rosch E, Thompson E (1993) The embodied mind. The MIT Press, Cambridge

Wiener N (1950) The human use of human beings. Da Capo Press, Cambridge