Jean Gottmann's theoretical writings: The art of reinventing geography

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Jean-Paul Hubert

The author is a researcher at the University of Namur in Belgium. He works on the regional aspects of transport and mobility, especially in the Walloon region. He devoted his Ph.D thesis to the epistemological issue of the discontinuities in geographical space (1992). That led him to examine and comment on Jean Gottmann's conception of geographical space and Gilles Ritchot's structural theory on the forms of human settlement. Epistemology of geography remains one of his interests in parallel with empirical studies on mobility and on the dynamics of human settlements. Since 1996, he has collaborated with François Moriconi-Ebrard on the "Terrae Statisticae" project, which archives and analyzes historical demographic data at the lowest territorial level, all around the world.

Introduction

In the development of the discipline, Jean Gottmann played the role of a mediator between a descriptive geography that concerned itself with drawing up a comprehensive picture of the surface of the planet, and a new geography, more interested in human actions and explanations based on quantifiable facts. But would it really do him justice to reductively portray him as a key figure in a history that is much less linear than it first appears? Throughout his career, he was able to entertain a harmonious dialogue in his reflections between the contributions of his masters and innovative methods. Indeed, why else should he still have felt the need, in the twilight of his life, to refer to P. Vidal de la Blache or A. Demangeon, as if his own scientific contribution could only be understood in the light of his predecessors? Gottmann was indeed a mediator but the interpretation of his role depends on the way in which one views the progression of science. Did he lead geography onto a new path? Or rather, did he propel geography, which had been enriched by new methods and issues, through the same, inescapable passage of the adoption of the scientific method opened up before him by P. Vidal de la Blache, F. Ratzel, H. Mackinder or W.M. Davis?

We favor the latter hypothesis. The profound transformation of the natural as well as the social sciences was felt with exceptional force in the United States after the Second World War. As a consequence, it became imperative for geography, which was "born of the need to build a bridge between the natural sciences and the human sciences" (GOTTMANN, 1952, p. ix) to reconstruct this bridge entirely, in a more rational manner and with a keener awareness of what was at stake than the 19th century masters had been able to do.

After having developed a formal method for the analysis of spatial organization, Gottmann carried out a critical review of existing theories concerning the determining factors of this organization, and devised a new one. Through this epistemological maneuver which we are going to re-examine, Gottmann re-oriented geography by placing it in the realm of the sciences of organization and structures. It is in this very structuralist orientation, in our opinion, that the value of this theory lies, although it was acknowledged as such neither by geographers, nor by the main representatives of structuralism.

The formalism of crossroads and determinism in geography

The word "determinism" has fallen into disrepute among geographers. Our goal is not to rehabilitate it. And yet, searching for deterministic mechanisms or, as one may prefer, determining factors, together with reducing the diversity of phenomena to principles that determine them, are two golden rules of scientific thinking. Gottmann's theoretical writings pursued these two objectives and have thus helped to make geography more scientific (cf. MUSCARÀ, 1999; PREVELAKIS, 2001). It was materialistic determinism, not determinism in general that Gottmann rejected. No one would deny that there exist determining relationships between the location of certain minerals or kinds of vegetation and certain populations' habitats or lifestyles. These relationships, however, are not universal; they vary in space or time with the psychology and cultures of human groups. For Gottmann:

"In order to be scientific in our discipline, a method of analysis must therefore eschew a type of geographical materialism that would be too simple for facts, and admit that spiritual forces can compensate pressures whose energy comes from other sources."[1]

Geographical space differentiates the living conditions of in-

dividuals in two ways: the first time, through the distribution of substances that are more or less useful to mankind; and the second time, through regional variation in the ways in which resources are exploited. In order never to lose sight of these two levels of spatial differentiation, Gottmann perfected his "chains of cross-roads" method of analysis and presented it in a landmark article published in the Annales de Géographie in 1947. In it, he proposes to analyze the forms of spatial organization by translating them into a formalism of sets of geographical places that can be associated through two types of relationships: on the one hand, relationships between their social, as well as material, "internal milieus," and on the other hand, relations of position within an "external milieu" consisting of physical geography and transportation infrastructures, as well as a whole immaterial organization of exchanges. Thus is a fundamental relationship between man and nature such as the search for the means to survive ensured by networks of relationships in geographical space, between internal milieus, either close-by or far away, extensive or limited, some organized for habitat, others for food production.

This formalism thus integrates the explanations that materialism can supply (for it does supply some) while at the same time surpassing it. By making it possible to conceptualize the multiplicity of spatial relationships, it modifies the approach to geographical phenomena entirely. Thus, regions where, to use Vidal de la Blache's term, "harmony" between natural phenomena and lifestyles is established, now appear as dynamic organizations of coherent relationships between human activities, between physical phenomena, and between the two together. Regional differentiation becomes, therefore, an organizational differentiation of the parts of the earth.

This was to lead to a complete reorientation of the strategy to search for determinism in geography. The book La politique des États et leur géographie, published in 1952, played a pivotal role – it is soon to be re-issued, thanks to Luca Muscarà's efforts and the support of the Bibliothèque Nationale de France. This excerpt from the introductory chapter clearly signals this new epistemological orientation:

"The geographical milieu is a system of relationships inscribed in the differentiated and organized space that is accessible to men. There can therefore be no other determinism in geography than a determinism of relationships. Geographical facts are by their very nature relational facts."[2]

Gottmann adds:

"The study, and possibly the control, of this system of relationships is the logical outcome of the work of geographers on the regional scale, and it is also the goal of those in charge of designing and implementing policies on the national scale" (GOTTMANN, 1952, p. 16). "... whereas geography essentially studies the spatial organization of the earth, politics seeks either to impose new forms on this organization, or to preserve old ones. State policy will therefore be determined, to a very large extent, by the system of relationships that geography will teach policy-makers." (GOTTMANN, 1952, p. 17)[3]

Although Gottmann calls for transcending the compartmentalization of the sciences, the conception of geography he develops belongs to what is commonly called today the sciences of organization and of the living or instead, in a broader definition of the term, advocated for instance by Piaget (1970, pp. 7-10) or Petitot (1985, chap. 1), genetic, or dynamic, structuralism. This approach aims at constructing objects through combinations of relationships that organize a particular material, endow it with wholeness and draw from this very material the means to stabilize these relationships, renew them, or even make them evolve. Geography did have an original approach to organization, but it remained anchored in the 19th century.

As far as we know, Gottmann's approach has never been called structuralist. For many geographers, structuralism in the human sciences simply had to refer back to linguistics or anthropology, which were supposed to be a kind of canonical form of it. But this would have implied fitting abstract relationships between places, which are characterized to a large extent by openness and variability, into closed and invariant systems (BRUNET, 1992). At the other end of the spectrum of organizational approaches, systemic theories, generated by regional econometrics, represent a kind of structuralism that is always based on the search for invariants, where spaces are closed, and abstractions are converted to figures, as if they were materials of a concrete nature, even though they are in reality of the same nature as language.

It was not in these sciences that Gottmann found his inspiration. For him, the objects of geography can be neither fixed nor closed. The crossroads obey the principle assigned by Bergson in L'Evolution créatrice to the "vital properties [which] are never entirely realised, but always in the process of being realised; they are tendencies rather than fixed states. And a tendency can be fully realised only if it is not thwarted by any other tendency. But how could this ever be the case in life, where mutually antagonistic tendencies are everywhere at work?"[4]

Gottmann's structuralism, if we are permitted to say so, is looking less for fully realized structures than for those that are in the process of formation and determine "tendencies." This is why it is adapted to the specific type of organization of geographical space.

The structuralist maneuver

In La politique des États et leur géographie, two chapters are particularly crucial to the understanding of the epistemological step taken by Gottmann: the second chapter, devoted to "Geographical doctrines in international relations" and the last one, entitled "The Genesis of regionalisms," in which he "outlines," as he says, a theory of regional organization aimed at going beyond the problems and impasses noted in the second chapter.

Let us first of all sum up the chronology of geographical thinking as Gottmann presents it. He first considers the works of men of letters or administrators such as Jean Bodin, Vauban, or Montesquieu. These men created political maxims to address problems concerning the exploitation of natural resources or with the way to gain access to them. Then, as he moves on to the 19th century, his analysis focuses on those geographers who turned their discipline into a science that no longer aimed at proposing philosophical or pragmatic maxims as in the past, but at uncovering general laws to explain the natural and human organization of the surface of the globe. But, according to Gottmann, the breakthroughs realized by these thinkers would not be reinforced by their immediate followers. The borders laid down in the 1919 treaties, drawn up according to the geographical principles of the 19th century, gave rise to violent controversies which undermined those principles without allowing new ones to emerge. Ratzel's and Mackinder's ideas were to be caricatured to the point of infamy by the school of Geopolitik, without making the decline of Europe and the emergence of the United States of America easier to understand. With few exceptions, the French school failed to analyze in sufficient depth the horror of World War I, as well as its causes and consequences, and instead diluted its energy in the description of particular cases. Finally, in the United States, supporters of ecological theories stubbornly insisted on explaining even modern history by the evolution of natural milieus.

Gottmann's chronological examination of "geographical doc-

trines," which is to be considered within the framework of a structural theory of the region, comprises three phases: the first one for the conception of the basic model, the next one for its development, and the third being a phase of crisis in the face of the complexity thus introduced and the incapacity to bring it under control.

The source of the model is "geographical determinism." The expression took on a very precise meaning at the end of the 18th century, and can be defined as a system to explain state policies and social rules through the geographical characteristics of countries. For those thinkers who, in the tradition of the enlightenment, Lamarck's and/or Darwin's ideas on the evolution of species, and 19th century positivism, wanted to create a scientific geography, it was a tempting approach, but they realized that it posed a difficult problem. Namely, any explanatory system would need to be validated according to the scientific method. If it is obvious that such determinism cannot be absolute, it is also unthinkable that it might be entirely false, for any policy or social rule must take concrete realities into account. Now, if geographical characteristics determine social policy and social organization, the latter partially determine the geographical organization of the territory as well. Geographical organization is therefore self-determining in a sense that makes it ever more coherent with the maxims of geographical determinism. Hence the following paradox: the explanatory system would of itself produce its own truth and would render scientific validation procedures ineffectual. Even if it were false at the beginning, it would become true at the end.

Introducing the scientific method in geography therefore called for a re-examination of the problem. It became necessary, in particular, to stop considering geography and politics separately, as two elements interacting mechanically, and to posit the existence, to use Vidal de la Blache's words, of "geographical beings," which are endowed with a political function and which use territorial partitioning organically to regulate territories. In modern terms, a region would be a self-regulated structure, and a closed one only in the extreme case of total geographical determinism.

But these geographers also understood that this regulation was not just political and legal. Politics perceives and acts upon geographical reality through a social filter which continuously determines the value of resources that nature distributed unequally. Among other variables, this social process depends on factors that are unique to peoples, as well as on their territories' positions within exchange networks. Thus culture and position must be associated to politics and to physical geography to compose a modern problematique of the regulated differentiation of regions.

This plan, however, was to founder, as Gottmann shows, due to the nature of the link between these differentiating factors and the region. Each in his own way, Ratzel and Mackinder had consistently viewed this link within the framework of separation and mechanical interaction. Ratzel anchored his definition of people in nature by means of physical anthropology, and Mackinder anchored the position phenomenon in the shapes of continents. In both cases, these definitions are overly rigid and sterile because they are set outside of the relational system of human geography. The dispute between Albert Demangeon and the sociologist François Simiand (SIMIAND, 1909) is also very revealing of the problem geography was to be faced with when integrating the social factor into geographical organization. Let us add that Vidal de la Blache's organicism was limited by its generality and a certain naïveté denounced by C. Vallaux, whose remarkable analyses had little influence (1925, pp. 48-49).

This overview of geographical doctrines thus shows that the search for factors that determine how geographical systems function and evolve has been repeatedly confronted with im-

passes and paradoxes. It is impossible to logically separate a geographical region from politics, economics, society, and probably even from language, for these dimensions exist only insofar as they have been grounded in a territory. In order to resolve these paradoxes of inseparability, the only solution is to progressively construct an object that would organically integrate political, economic, and social functions. But this solution comes with a price: such an object functions in a considerably more complex way, and this increased complexity has to be addressed. Such was the challenge that needed to be confronted in order for a theory of the "genesis of regionalisms" to come into existence.

The three tests of structuralism

While considering the problematic of transdisciplinarity within the social sciences, Jean Piaget wrote that one thing these sciences had in common was that they were all dealing with the phenomenon of organization. They are faced, therefore, with three types of problems, which assume specific forms in each discipline (PIAGET, 1970, p. 262):

• How do new structures appear?
• How do the regulatory or self-regulatory processes that preserve the equilibrium of these structures function?
• How do exchanges of goods and information take place within these structures?

This text by Piaget became a landmark in the field of epistemology, and geographers are well aware that it does not mention their discipline even once. We do not know how familiar Gottmann was with Piaget's works and vice versa. Be that as it may, we stand by our thesis that his geography is structuralist and take it as a proof that the last chapter of La Politique des États et leur géographie, entitled "Genesis and evolution of regionalisms" answers these very three questions point by point.

"It is easy to understand, with the help of psychology, sociology, and history, why mankind partitioned itself in this manner, thus compartmentalising the space in which its activities take place. It is harder to see, however, how compartments or partitions come into being or evolve, how a new region is born. Vidal de la Blache believed that no issue was more important for political geography than observing how isolated towns awoke to the general currents of life surrounding them. But one needs to understand why and how these towns became isolated in the first place, and turned away from the circuits without which, unless one believes in spontaneous generation, they could not have come into being and lived."[5]

Not only is Piaget's first question clearly formulated, but it is also emphasized by the evocation of Vidal de la Blache. Circulation is introduced as a first cause of the formation of regions. This is a necessary cause but not a sufficient one, for circulation in and of itself would not have been able to engender phenomena reaching a state of equilibrium, hence Piaget's second question: that of the meta-equilibrium that brings the structure into existence. This question leads Gottmann to introduce his iconography concept:

"If circulation had ruled supreme over the political stage, it would probably have resulted in a near infinite scattering of authority, with each cross-roads or town doing absolutely as it pleased, and establishing its own rules."[6]

"In order to anchor men to the space they occupy, to give them a sense of the links that unite the nation and its territory, it is essential to integrate regional geography into the sphere of iconography. Thus iconography becomes, in geography, a centre of resistance against movement, a factor of political stabilisation."[7]

The term "iconography" has rarely been re-used by other geographers. It designates the material symbols of the norms regulating community life in a territory – monuments, statues, buildings, coats-of-arms, or flags – which are also identity markers. These symbols form an extraordinarily varied body organized according to different scales:

• that of the priorities given by society to its values (politics, religion, art, or sports ...);
• that of aesthetics, which highlights the original, noteworthy, and emblematic symbols of a given style that is reproduced in the most diverse locations (e.g. basilicas and cathedrals versus ordinary, banal churches); and,
• that of the arbitrariness of the sign vis-à-vis its function, which turns it into an identity marker that is more or less impenetrable to the lay person (e.g. heraldry).

This is when Piaget's third question, that of exchanges, starts coming into focus:

"Are circulation, a principle of movement, and iconography, a principle of stability, so constantly opposed in practice? If this were the case, mankind would have found it most difficult to organize space, and create all the forms of differentiation we know so well. We do not believe that the fact these functions are opposed might have long prevented some sort of co-ordination from taking place."[8]

This "co-ordination" is effected through a variety of means. One example is that a significant part of circulation is dedicated to the maintenance and construction of iconography; another is that circulation is channelled through a network of checkpoints, tollhouses, market squares, etc. that makes transportation safe and establishes trust between traders and buyers.

This theoretical outline thus laid the groundwork for explaining the complex way in which regional structures function. Their organization incorporates, on the one hand, a function of control of the flows that go through a region and supply the latter with the materials and information necessary for people to live and work; and on the other hand, an iconographic function which encodes the territory, allows inhabitants to build their identities, and makes them accept the political authority that guarantees this encoding. For "it is indeed necessary that a strong cement bind the community members who accept to live together under the same political authority."[9] In addition to these essential functions, which must coexist in a state of equilibrium in order for the structure to exist, there is also the aforesaid political function, which serves to catalyze the coordination between iconography and circulation.

Where formalism makes theory operational

The "chains of crossroads" formalism makes the system presented above operational. Gottmann's key concepts, circulation, iconography, compartmentalization, and, to some extent as well, accessibility, are not general abstractions but can be analyzed as sets of relationships between the internal milieus of crossroads, and within the external milieu in a given region. We shall have to make slight extrapolations on Gottmann's writings but the opinion he voiced in 1964 on the 1947 article sounds like an invitation to do just that:

"I developed the idea of the role of consumption in geography in my 1957 book, Marchés des matières premières. The concept of cross-roads is a more subtle, more difficult one. I had indeed already dealt with this subject in another book, La politique des États et leur géographie; but it should be explored further and over a longer period in order to learn how to systematically handle this complex network of spatial relationships – some of which are of a material nature, others

abstract, cultural – which progressively form in some places rather than in others to organize the lives of our regions and of whole countries."[10]

A compartmentalized space can be defined as a set of administrative territories whose internal milieus are subject to legal regulations. These territories are crossroads, insofar as they direct the circulation of information and political decisions. They may sometimes be embedded, overlapping, contiguous, or lacking common borders: these terms determine their relationships in their external milieu. The regulations in force within the territories are linked by the very strong logic of a juridical and administrative organization that can be hierarchical, concentrated, or decentralized. This logic organizes the relationships between the internal policies of territories. As far as relationships between these milieus are concerned, the question arises of the coherence between legal regulations and the meshing of territorial entities which conditions the healthy application of policies or, as it is called today, good governance.

It is also easy to conceive that circulation is controlled by a chain of particular crossroads: "markets." The mediating role of the market system between natural resources and consumers' needs is essential if we want to understand markets:

"Therefore, whether one considers foodstuffs, which occasion large-scale exchanges, or industrial raw materials which will be transformed in factories, one can see that raw materials are defined by the fact that they belong to a network leading to an act of consumption. This network requires a complex technical and commercial organization. It creates the need that will be satisfied by the raw material. Without such networks organized by men, there would not be raw materials in the modern sense of the word."[11]

Relationships in the external milieu of markets are determined by goods transportation conditions, present or foreseeable in the not too distant future, and by consumers' access to products – both being unequally distributed. As to relations between internal milieus, they are governed by the economic laws of supply and demand. But for Gottmann, "the law of supply and demand does not apply automatically or without cost" (GOTTMANN, 1957, p. 429). The two sets of relations interact notably by means of political reactions which modify accessibility.

Accessibility appears to be a borderline instance of circulation. Crossroads' internal milieus are linked only virtually by projects, which may become actual transactions or not.

Iconography may seem to be more alien to the formalism of crossroads. Gottmann never devoted a comprehensive book-length study to it, as he did for circulation and compartmentalization. He talks about it as a "network of symbols" (1955, quoted by PREVELAKIS, 2001, p. 48) which led the organizers of the 1996 colloquium on "European iconographies" to write in their circular letter that "what matters is not the content of an iconography but how the latter functions within a network of stable relationships between a community and geographical space." We are not dealing with an abstract ideology, but with an ideology embodied in a set of places and landscapes.

In order to define these places and their relationships in geographical space and between their internal milieus, it is useful to examine not only the 1996 colloquium's contributions, but also, as we have already proposed in a previous article (HUBERT, 1998), to use Ritchot's urban form theory (RITCHOT and MERCIER, 1992; RITCHOT, 1999; DESMARAIS and RITCHOT, 2000). We propose that iconography's crossroads be considered, to use urban form theory's terminology, as "neighborhood units" endowed with a "political positional value" that actualizes itself through the elaboration of "concrete forms" of a certain style. For instance, the style of Haussmann's boulevards symbolized the renewal of Paris and the assertion of the French bour-

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geoisie's power in the second part of the 19th century. Similarly, the style of the buildings that will replace the Twin Towers in New York City will have to express the exceptional value of the site. The term "style" is understood in a broad sense that applies at the same time to urban, industrial, or agricultural morphologies. Relationships in the geographical space are defined by "endo-regulated" or "exo-regulated" positions in an "abstract form" (RITCHOT, 1992, pp. 194-205). Here, relationships between internal milieus are paradigmatic in nature, as are all systems of relationships between symbols: places are differentiated or resemble each other through related or opposed styles, the latter being the concrete signifiers of the actualization in those places of abstract axiological signifieds.

Translating general concepts into the crossroads formalism, then, makes it possible to tackle spatial analysis and field work. It also shows how justified it was to choose these three structural levels, which are clearly separated in essence, to analyze the functioning of regions and neutralize its complexity. Finally, it allows us to buttress the parallel reading of Gottmann and Piaget.

Addressing complexity

The plurality of the regulatory system, as Gottmann viewed it, is intrinsic to geographical organization, but it is – as Piaget and, in slightly different terms, Ruyer (1952) show us – a constant of self-organization phenomena. The structures studied by geographers are both structures in the making and working structures, structures that are forming only because they are functioning, and not ones that are "completed and therefore closed upon themselves" (PIAGET, 1970, p. 266), as are those of mathematics, structural anthropology, or linguistics.

Piaget writes that in these structures "in the making," "A structure's self-regulation process is no longer reducible ... to the set of rules or norms which characterise the completed structure: it consists of a system of regulation and self-regulation processes, where errors are corrected after they occur, and not yet before they do, as in the final system ... Exchanges are no longer limited to internal reciprocal processes, but consist in large part of exchanges with the outside, which bring into the system the supplies necessary to its functioning."[12]

A structure is endowed with several regulatory systems based on *rules* or *norms*, *values* and *signs* (PIAGET, 1970, pp. 273-278).

Rules and norms constitute a static form of regulation. Some rules can be inferred from a certain number of axioms, which makes them particularly rigid and coherent, as in mathematics and also in law, where the historical basis of Roman law has remained to this day that of all western legal thinking (LEGENDRE, 2001). There also exist systems of non-inferrable norms, which result from historical evolution. These norms are all the more stable as they are linked to the psychological, and strongly affective, mechanisms of the construction of the self and of filiation.

But some regulations are intrinsically linked with the structure's dynamism. Indeed, according to Piaget, "Any functioning is at the same time production, exchange, and equilibration, that is to say that it constantly entails decisions or choices, information and regulation. It follows that the very notions of structure and function imply ... the derivative notions of functional usefulness, or value, and of signification."[13]

It is necessary to distinguish between two kinds of values: on the one hand, "primary utilities," also called "finality values," that is, the usefulness of an element considered as playing a qualitative role in the production or preservation of this structure as an organized form" (PIAGET, 1970, p. 270); and, on the other hand, "secondary utilities," or "yield values," which relate to the cost or gain associated to the useful element" (p. 270).

There are also two sorts of significations: "immediate signification": "when a stimulus that is immediately recognised triggers an un-delayed response," and "mediate signification" (p. 271), "if encoding takes place according to a determined code and decoding occurs only later" (p. 271).

This third level of regulation stabilizes all systems of spatial discontinuity through a system of signification, or paradigm. It is of no less importance than the other two, for the differentiation between the parts of a structured totality, that is to say, the discontinuity of space, is a prerequisite for any structure to function.

If we now return to the structural levels defined by Gottmann, it becomes clear that compartmentalization depends on a system of rules and norms, whereas iconography is a system of signs, and circulation control is based on values and utilities. Piaget shows us that the existence of different regulatory systems is the key to the structure's equilibration, for rules, norms, utilities and signs do not have the same effect on a structure's synchronic (spatial) and diachronic (temporal) coherence.

Rules and norms have considerable diachronic coherence. If it does nothing but follow rules, as, for instance, in the case of apprenticeship, the functioning of the system is entirely directed toward achieving a state of stability and completeness. This is why politics is a formidable accelerator of differentiation. But these rules have little synchronic coherence. Thus, as long as conformity with the institutions is ensured, it matters little from the judicial point of view – although it does matter a great deal where circulation is concerned – that laws with opposite effects be in force in neighboring territories. "Three degrees of latitude reverse all jurisprudence," as Pascal deplored.

Systems based on utilities and values do not behave in a uniform way. They function through a series of actions, evaluations, and retroactions which do not necessarily converge; nor are they immune to bifurcations or chaotic behavior. Thus, economic organizations sometimes follow converging trends and then diverge for reasons that may be internal or external. It is sometimes during these periods of breakdown in the diachronic logic that synchronic logic becomes strongest. For instance, economic crisis or strong growth will spread from market to market, causing spatial indifferentiation. Conversely, as shown by Thierry Rebour (2000) long-term economic trends increase spatial differentiation through the growth of urban areas. For Piaget, as for Gottmann, a structure's self-organization cannot be derived only from a type of regulation based on utilities.

Lastly, regulatory systems that are based on signs systems exhibit a third type of behavior: their coherence is essentially synchronic. If iconography can withstand the change introduced by circulation, it is thanks to the strength of its synchronic coherence. It is as it were traversed by circulation, especially when the latter obeys a diachronic logic, and by policies, without being deeply affected by them, at least for a time. Any novelty must pass through the filter of its categories of interpretation and what has no meaning relative to iconography can be rejected almost without having been noticed. But iconography is very sensitive to variations in norms, which, while preserving relations of opposition between symbols, can rapidly reverse axiologies and destabilize paradigms: what was in vogue becomes passé and vice versa, albeit with some exceptions.

A geographical region is thus a complete dynamic structure whose equilibrium depends on three types of regulations: the first is strongly diachronic, the third strongly synchronic, and as for the second, it alternates between a synchronic mode with diffusing effects and a diachronic mode with focalizing effects.

The building of Brasilia (figs. 1 to 5), which was destined to become the new capital of Brazil and was launched in 1956 by President Juscelino Kubitschek, is an example of in-depth intervention on regional geographical structures where the iconographic dimension was especially stressed. Oscar Niemeyer's architecture fashioned one of the most magnificent 20th century representations of the "three powers," executive, legislative, and judiciary, which are the pillars of modern democracy. These forms, symbols of democratic rules, were immediately integrated into the national iconography, as was the overall layout of the city. This layout, "o plano piloto," the brainchild of urban planner Luciano Costa, is inspired by modernist principles and designed for automobile transit. It was compared to a bird, which, incidentally, is reminiscent of a dove landing, the symbol of the Holy Spirit in the catholic iconography. Bank notes illustrated with the Square of the Three Powers and coins adorned with the "plano piloto" thus come to fuse into one object the three elements of regional regulation according to Jean Gottmann: judicial rules and norms, circulation, and iconography.

Fig. 1: Brazil – Location of Brasília, the new capital.

1. Plaza of the Three Powers
2. Esplanade of Ministeries
3. Embassy Sectors
4. Cultural Sectors
5. Public Service and State Enterprise Sectors
6. Banking Sectors
7. Highway Platform and Bus Terminal
8. Entertainment Sectors
9. Hotel Sectors
10. Commercial Sectors
11. Medical-Hospital Sectors
12. Radio and Television Sectors
13. Convention and Exhibition Sectors
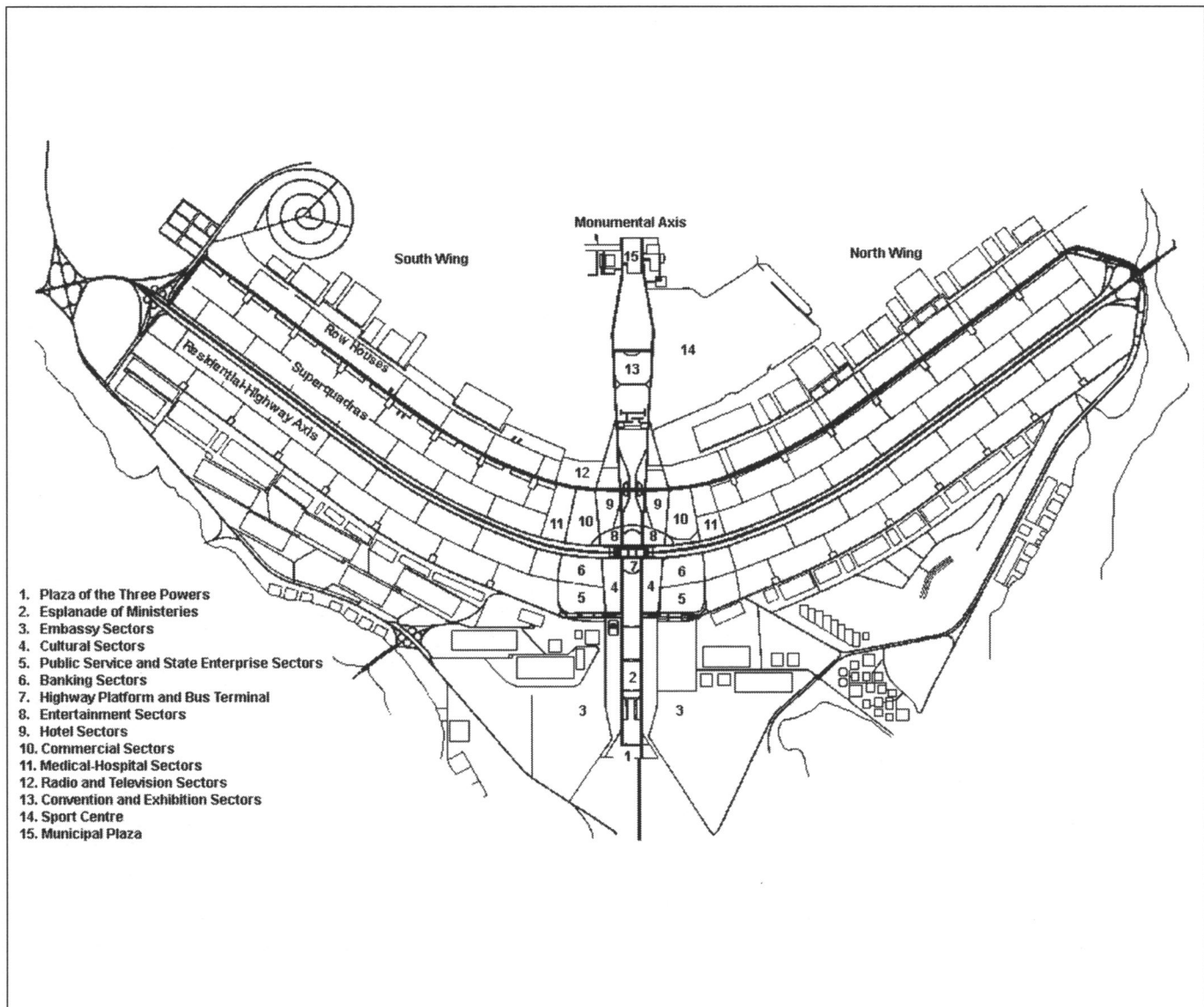14. Sport Centre
15. Municipal Plaza

Fig. 2: Brasília – Sectoral organization and traffic plan of the Plano Piloto, 1957 (the brainchild of urban planner Luciano Costa).

Fig. 3: Brasília – General view of Oscar Niemeyer's architectural synthesis: buildings of Brazilian Congress and Esplanade of the ministries during construction, circa 1960. (*Source:* © Arquivo Público do Distrito Federal, digitized by August Real).

Fig. 4: Brasília – General view of Oscar Niemeyer's architectural synthesis: buildings of Brazílian Congress and Esplanade of the ministries in 2002, with automobile circulation. (*Source:* © etien).

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Fig. 5: Brazilian national iconography – Coin adorned with Lucio Costa's plano piloto of Brasília, bank notes illustrated with Oscar Niemeyer's "Plaza of the three powers," and President Juscelino Kubitschek who launched the project of a new capital in 1956.

The problem of exchanges

The fundamental principles of the equilibrium of geographical structures were discovered by Gottmann. He also perfectly understood how much this equilibrium depended on communication between people. None of these regulatory systems can function and adapt to other systems, or even exist, without some people talking to each other, reaching compromises, travelling, or exchanging goods and information.

When he did us the honor to comment on the book that came out of our doctoral thesis (HUBERT, 1993), Gottmann thus expressed the following reservation:

"I have to say, however, that what I missed the most when reading *La Discontinuité critique*, was the factor of communication between individuals and societies. Mankind sets itself apart from the rest of the animal kingdom through its ever increasing capacity to communicate. Discontinuities are so important because they interfere with communication; the city is an anchoring point of the whole organization system because it has always been the locus of communication *par excellence*. The old myth of the Babel Tower, linguistic diversity, must be incorporated, it seems to me, into any theory of discontinuities." (GOTTMANN, 1993, p. 202)

Within the framework of the chains of crossroads approach, all spatial relationships in the external milieu are mediated by the language and techniques of the inhabitants operating in internal milieus. The vectors of communication are produced by these internal organizations, and distances can be bridged only on the condition that there be a transaction at the point of emission or that of reception, which generally implies that an exchange has taken place. Relationships in the external milieu are therefore more often reciprocal than not, and each crossroads offers multiple opportunities for exchanges. Circulation is thus self-generating, which goes beyond a simple materialistic equilibration of resources. If, as such was and still is our thesis (HUBERT, 1999), Ritchot's theory of structural geography has taken geography one step further on the path of scientificity, then Gottmann was right to ask that it be shown that

this theory also made it possible to better define the role of exchanges within spatial structures.

Despite Petitot's teachings, our interpretation had not sufficiently distanced itself from the imposing anthropological and linguistic model of closed structures. Furthermore, this model made frequent appearances in Ritchot's and Desmarais' writings. Besides, we gave less importance to communication because we were taking particular care not to reduce the phenomena of discontinuity to mere projections of linguistic processes. This reductionist approach is only valid for one form of space differentiation by man, that of compartmentalization, but neither for the types of discontinuity due to circulation or iconography, nor especially for this critical discontinuity from which all other three are derived: *vacuum* (HUBERT, 1993, p. 151 ff).

But geographical organizations are regulated structures only because their inhabitants have organized themselves to pursue different interests by pooling their resources. It is through communication that laws get discussed, norms evolve, and styles come to be imitated or transposed. Even more fundamental, it is through general communication between incompletely informed interlocutors that the levels of values are set, that utilities are estimated according to a common standard. Similarly, it is through communication and transactions for the control of mobility and the occupation of space that inhabitants can let the "deeper values" of the collective imaginary come to the surface of consciousness (DESMARAIS, 1995, pp. 71-82). These values become in turn embodied in their habitat and the geographical landscape they fashion, which are the tangible representations and the symbols of the society they envision.

Communication is the counterpart of the lack of comprehension about and the imperfection of unfinished structures. Exchanges between levels of regulation are thus a crucial question, which can only be explored by analyzing communication and the way it has of converting norms into utilities, utilities into symbols, or symbols into rules. Is it not in part the meaning of this maxim by Montesquieu, which Gottmann liked to quote: "It is in the nature of trade to make superfluous things useful, and useful ones necessary"?

Communication and exchanges, however, also need to be organized in time to allow spatial structures to emerge, and structural geography has put forward some new ideas since 1993. In particular, new attention has been given to a phenomenon largely ignored by Gottmann in his theoretical works, but which seems to play an important role: it is rent, which is not a utility like the others, but a factor regulating and anchoring circulation. Ritchot shows that it enhances the economic value of iconography, and Rebour, that its payment provides cash for the purchase of consumer goods (see the cycle of "redeeming," REBOUR, 2000, p. 57). Rent is therefore at the meeting point of circulation and iconography, and it is not surprising that the selling of land has been controlled by political power for so long. But it goes even further. Rebour also shows that transactions linked to rent generate a profit, whose distribution between social forces determines the morphology of urban networks. The variations of rent and productivity are also linked with the differentiation in circulation flows and with long-term cyclical variations in the importance of these flows. For Moriconi-Ebrard, it is necessary to distinguish between three channels to understand the dynamic of urbanization: that of agriculture and food products, that of the military and high-tech manufactured goods, and finally that of finance and services. In his study of the history of large cities, he reveals an alternating pattern with one channel reinforcing another, and then neglecting it for the benefit of the third one (MORICONI-EBRARD, 2000, p. 293). Each of these phases favors the circulation of a flow, as well as the development of habitat in zones surrounding the main crossroads. For Moriconi-Ebrard, the formation of large urban areas constitutes the unfolding of a complete cycle, with political and economic agents controlling not only the techniques necessary for boosting supplies as well as those ensuring military and financial power, but also the crises, famines, wars, and economic depressions punctuating the passage from one phase to another.

Because it links together the three levels of regulation of geographical structures, communication is the key to understanding the evolution and future of both the content and the form of the different regions of the world.

Conclusion

A dwarf on a giant's shoulders can see further than the giant. If he manages to securely fasten a rope between two giants, he can see other things while staying on their level. Such was this article's ambition. Through inventing this meeting between Gottmann and Piaget, we wanted to show that such a meeting was plausible and could help us to understand how geography can be and remain a science engaged in a dialogue with other sciences.

Such was indeed geography's problem after World War II, which had just shown the ability, multiplied tenfold, of human organizations to impact the geographical milieu. Politicians found themselves charged with greater responsibilities, and immense tasks, which necessitated a better understanding of the system of geographical relations, opened up everywhere in the world: the reconstruction in Europe and Japan, agricultural and industrial development – with or without decolonization – in other countries in Asia, Eurasia, South America, Africa, as well as the management of megalopolitan urbanization in North America. These tasks have not disappeared and have sometimes resurfaced on other continents. This responsibility remains as pressing as ever.

Jean Gottmann is one of the very few geographers whose works shed light on the constitution of geographical knowledge and on its limits: the only thing a geographer can do is observe and analyze the functioning of regions which are both in the making and adapting their functioning to their formation. May-

be those regions will not reach a complete form, maybe mankind will even stop producing regions some day, and will find a new way to combine the strengths of men with a view to improving their living conditions. But in order to understand and apprehend these regions at the very moment they come into being, geography must equip itself with methods, theories, or models that are not always neutral vis-à-vis their object of study. Gottmann has explained the necessary art of reinventing the region in order to circumvent the excess of complexity that may cause us to lose sight of our goal.

Notes

1. "Une méthode d'analyse, pour être scientifique dans notre discipline, doit donc renoncer à un matérialisme géographique trop simple pour les faits et admettre que les forces spirituelles peuvent compenser des pressions dont l'énergie puise à d'autres sources." (GOTTMANN, 1966, p. 91).
2. "Le milieu géographique est un système de relations qui s'inscrivent dans l'espace différencié et organisé accessible aux hommes. Il n'y peut donc y avoir en géographie de déterminisme que sous la forme d'un *déterminisme de relations.* Les faits géographiques sont par leur nature même des faits *relationnels*" (GOTTMANN, 1952, p. 15; this passage was felicitously evoked by G. PREVELAKIS, 2001, p. 48).
3. "L'étude et le contrôle éventuel de ce système de relations est l'aboutissement logique des travaux du géographe à l'échelle régionale, comme aussi le but des responsables d'une politique à l'échelle des Etats " (GOTTMANN, 1952, p. 16) "[…] tandis que la géographie étudie essentiellement l'organization de l'espace terrestre, la politique cherche à imprimer à cette organization des formes nouvelles ou à préserver les anciennes. La politique des Etats sera donc déterminée très largement par le système de relations que la géographie enseignera aux responsables de cette politique" (*ibid.*, p. 17).
4. " Les propriétés vitales ne sont jamais entièrement réalisées, mais toujours en voie de réalisation; ce sont moins des états que des tendances. Et une tendance n'obtient tout ce qu'elle vise que si elle n'est contrariée par aucune autre tendance: comment ce cas se présenterait-il dans le domaine de la vie, où il y a toujours implication réciproque de tendances antagonistes?" (quoted by GOTTMANN, 1966, p. 86).
5. "On peut fort bien comprendre par la psychologie, la sociologie et l'histoire, *pourquoi* l'humanité s'est ainsi cloisonnée, compartimentant en conséquence l'espace où ses activités se situent. On voit moins bien comment se produit et évolue le compartiment ou la cloison, *comment naît une région nouvelle.* Vidal de la Blache croyait qu'il n'était pas de problème plus important pour la géographie politique que de déceler et de suivre l'éveil à une vie générale de localités isolées; encore faudrait-il savoir pourquoi et comment ces isolements sont apparus, ces localités se sont écartées de circuits sous lesquels, à moins d'admettre des cas de génération spontanée, elles n'auraient pu se former et vivre." (GOTTMANN, 1952, p. 214).
6. "Si la circulation avait été maîtresse sans partage de la scène politique, elle aurait sans doute abouti à un éparpillement de l'autorité presque à l'infini, chaque carrefour, chaque ville agissant à sa guise, établissant ses propres règlements." (*ibid.*, p. 219).
7. "Pour fixer les hommes à l'espace qu'ils occupent, pour leur donner le sentiment des liens qui unissent la nation et le territoire, il est indispensable de faire entrer la géographie régionale dans l'iconographie. C'est ainsi que *l'iconographie* devient en géographie un môle de résistance au mouvement, un *facteur de stabilisation politique.*" (*ibid.*, p. 221).
8. "La circulation principe de mouvement, et l'iconographie, principe de stabilité, sont-elles en si constante opposition dans les faits ? S'il en était ainsi quelles difficultés les hommes n'auraient-ils pas eues à organizer l'espace, à créer toutes les différenciations que nous connaissons. Nous ne croyons pas que l'opposition des fonctions ait empêché une coordination de se faire et depuis fort longtemps." (*ibid.*, p. 221).
9. "Il faut en effet qu'un ciment solide lie les membres de la communauté qui acceptent la cohabitation sous la même autorité politique." (*ibid.*, p. 221).

10. "J'ai développé l'idée du rôle de la consommation en géographie dans mes *Marchés des matières premières* [en 1957]. Le concept de carrefour est plus subtil, plus difficile. Je l'ai sans doute repris dans un autre livre *La politique des Etats et leur géographie* [en 1952], mais il faudrait encore y travailler longuement pour apprendre à manier systématiquement cette trame complexe de relations dans l'espace, les unes matérielles, les autres abstraites, culturelles, qui peu à peu se nouent en certains endroits plus qu'en d'autres pour organizer la vie de nos régions, de pays entiers" (GOTTMANN, 1966, p. 93).

11. "Ainsi, que l'on considère les denrées alimentaires qui donnent lieu à de vastes opérations d'échange ou les matières premières industrielles qui se transforment en usine, la qualité de 'matière première' apparaît *déterminée par l'appartenance à un circuit aboutissant à une consommation.* Le circuit exige l'existence de toute une organization technique et commerciale. C'est lui qui crée le besoin auquel satisfait la matière première. Sans circuits organisés par les hommes, il ne serait pas de matières premières au sens moderne du mot" (GOTTMANN, 1957, p. 19; the text's italics).

12. "L'autoréglage de la structure ne se réduit plus [...] à l'ensemble des règles ou normes caractérisant la structure achevée: il est constitué par un système de régulations ou d'autorégulations, avec correction après coup des erreurs et non pas encore précorrection comme dans le système final [...] l'échange n'est plus limité à des réciprocités internes mais comporte une part importante d'échanges avec l'extérieur, en tant qu'alimentation nécessaire du fonctionnement" (PIAGET, 1970).

13. "Tout fonctionnement est à la fois production, échange et équilibration, c'est-à-dire qu'il suppose sans cesse des décisions ou choix, des informations et des régulations. Il en résulte que les notions mêmes de structure et de fonction entraînent [...] les notions dérivées d'utilité fonctionnelle ou valeur et de signification " (PIAGET, 1970, p. 269).

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