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SOME UNEXPECTED TRAJECTORIES OF URBAN MORPHOLOGY IN FRANCE

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ABSTRACT

This paper is not an update of Darin's account on the study of urban form in France in 1998. Rather, it's a complement to it, dealing with two overlooked issues that produced unexpected trajectories for urban morphology in France. The first is Merlin's 1988 publication of an important book on urban morphology and plot systems, after the organization of an international conference on the subject. Produced at the request of the French Ministry of Urbanism, this work was extremely critical of the emerging field of urban morphology and exerted a long-lasting negative influence on its development in France, namely in the field of urban planning. The second is the contribution to urban morphology by theoretical and quantitative geographers. Much of this contribution is indeed posterior to Darin's account, but it shows that the study of urban form can now count on two different traditions in France: finer scale and design-oriented urban morphology within the schools of architecture and larger scale, sometimes trans-scale, computer-aided urban morphology from quantitative geography. Huge potential lies in engaging collaborations among these two traditions.

KEY WORDS

FRANCE

PIERRE MERLIN

MORPHOLOGIE URBAINE ET PARCELLAIRE

THEORETICAL AND QUANTITATIVE GEOGRAPHY

URBAN MORPHOMETRICS

Research in urban morphology in France has already been thoroughly presented by M. Darin (1998) up to the end of the 1990s. His paper started with the forerunners of morphological research before WWII, Pierre Lavedan and Michel Poëte. After the 1970s, great attention was given to the so-called French school of urban morphology, strongly marked by the founding works of the schools of architecture of Paris-Belleville, Paris-La-Défense and Versailles, as well-as some other schools outside the capital region (Marseille, Grenoble, Lille, Nantes and Nancy). A quick overview was also given to morphological research outside of the schools of architectures, in urban history, art history and geography.

The goal of the present paper is not to update such a remarkable paper. Working within the community of French geographers, my knowledge of architectural research in urban morphology is limited and not first-hand. I will thus bring some attention to two more specific aspects of the development of urban morphological research in France, which are perhaps less known within the international community of urban morphologists. The first is the series of events that lead to the publication of the book “*Morphologie Urbaine et Parcelle*” by Pierre Merlin et al.¹ We will see how, unexpectedly, this rich anthology of contributions from eminent urban morphologists exerted a long-lasting negative impact on the role that urban morphology could play in academia and on national urban policies. The second is an overview of morphological research carried out in the last twenty years or so by theoretical and quantitative geographers in France, a community that was overlooked by Darin’s original paper.

Using urban morphologists against Urban Morphology.

The genesis of “*Morphologie Urbaine et Parcelle*” is fundamental to understand the scope and, ultimately, the outcome of the book. In what follows, I’ll try to remain as factual as possible. My eventual interpretations will always be highlighted as such. Insight of the genesis of the book is indeed given directly from its authors and the workflow of the related conference was double-checked with Ivor Samuels, who took part in it.

In France, like in other countries, and maybe more than in other countries, the praxis of urban planning from the 1950s and up to the 1980s had been strongly rooted in the functionalist approach. Modernist forms were embraced since the 1950s (the first “*cité radieuse*” by Le Corbusier was built in Marseille in 1952, the second in Rezé in 1955), and later shaped many large housing projects. Growing criticism arose in the 1970s-1980s, among which one from the emerging field of urban morphology. For one, the work by Castex et al. (1977) is exemplary in its critique of the progressive dissolution of the perimeter block through the history of modernism. A French specificity, at least within western countries, is that the top-down governance of the French administration had had an important role in favouring both functionalism and the new modernist forms, both seen

¹ P. Merlin, F. Choay, and E. D’Alfonso, eds., *Morphologie urbaine et parcelle*. 2 volumes (Paris: Presses Universitaires de Vincennes, 1988).

as a way to accelerate the modernization of the country after WWII.² However, the very top of the governmental decision-making process was being affected by these criticisms, as witnessed by the 1973 circular by minister O. Guichard, putting an end to the development of large functionalist public housing projects.

In the mid-1980s, the French Ministry of Urbanism, Housing and Transportation was finally considering the emerging approaches of urban morphology. In 1985, M. Roullier, in charge of research and innovation at the Ministry, looked for academics to produce a report on urban morphology, its conceptual basis, its methods and its pertinence for the urban planning praxis. Was the Ministry interested in understanding the role that urban morphology could play in improving its approaches to urban planning? Or was it disturbed by the fact that the success of urban morphology would necessitate a complete renewal of its policies, praxis and, probably, even internal culture?

What we know is that the Ministry did not ask a critical assessment of the new research field from the leading groups of French urban morphologists (those accounted for by Darin, who were in full activity in the mid-1980s). On the contrary, Roullier solicited the research unit Theory of Urban Mutations in Developed Countries at University Paris VIII, led by Pierre Merlin. Merlin was the leading figure of urban planning in French academia at the time and had strong connections with the French central administration. He had just become the president of the French National Council for Higher Education and Research (CNESER), a position that he would hold until 2003. He also participated to the creation of the French Association for the Promotion of Teaching and Research in Urbanism and Planning (APERAU), of which he will be president between 1992 and 2000. He had previously contributed to several public policies of the French government in urban and regional planning and was recognized in academia for his highly praised development of the theory of general cost of transportation. In this endeavour for the Ministry, Merlin associated his colleague Françoise Choay, a leading theorist of urbanism in France, author of the remarkable “*Urbanisme: utopies et réalités*”³ and promoter in France of a new reading of the urban and architectural theory of Leon Battista Alberti.⁴ Despite their intellectual stature, neither Merlin nor Choay were specialists in urban morphology or active in the urban morphological debate.

They thus invited eleven leading scholars and practitioners who were differently related to the emerging field of urban morphology, to present their viewpoints at an international conference at the prestigious site of the Royal Saltworks of Arc-et-Senans (October 28th-29th 1985). Special attention was given to three countries where urban morphology seemed particularly important: Italy, Britain and the US. Four invited experts were from Italy: Vittorio Gregotti (architect at IUAV Venice), Bernardo Secchi (urban planner at IUAV Venice), Sergio Crotti and Ernesto D’Alfonso (both architects at Milano Politecnico). Three

² K. Cupers, *La banlieue, un projet social. Ambitions d’une politique urbaine, 1945-1975* (Marseille: Parenthèses, 2018).

³ F. Choay, *Urbanisme: utopies et réalités* (Paris: Seuil, 1965).

⁴ F. Choay, *La règle et le modèle. Sur la théorie de l’architecture et de l’urbanisme* (Paris: Seuil, 1980).

were from Britain: Bill Hillier (architect at the Barlett School, UCL), Ivor Samuels (architect at the Joint Center for Urban Design, Oxford Polytechnic) and Micha Bandini (architect at the London Architectural Association). Three were from North America: Stanford Anderson (architect at MIT), George Baird (architect at the University of Toronto) and John Whiteman (philosopher, architect and urban planner at Harvard). One was from Switzerland, the architect and urban semiologist Albert Lévy (University of Geneva). None of the French urban morphologists was invited to the conference, and the point of view of Merlin and Choay was considered as a last contribution representing the French community. These twelve contributions made up the theoretical part of the conference, dealing with goals, concepts, theories and methods of urban morphology. The second part of the event was dedicated to more specific advancements in the role of plot-patterns in urban morphology. Mainly carried out by young researchers from the same institutions, these contributions were published in the second tome of the aforementioned book. Research on the role of the plot system in urban morphology was apparently the main reason for the conference. Even in this respect, it is from my point of view surprising that French urban morphologists were not invited to the conference, knowing the leading role that the French school (and more specifically the Versailles school) had had in first highlighting the role of the plot system in morphological processes.⁵

However, what interests us most here is the work carried out with the experts, which was published in the first tome of the book and was used to produce the official report demanded by the Ministry. The experts received individually a questionnaire in preparation of the event, asking them to define a certain number of terms (morphology, typology, urban design, urban structure, etc.) and identify recognized leading figures and seminal works in the field. They were also invited to write a personal contribution on the vast subject-matter of the new emerging approach of urban morphology in their countries, which was the object of their oral presentation at the conference.

Urban morphology is characterized by different theoretical and methodological views on the way to study its very object of research (the form of the physical city and its transformation processes over time). This is still true today and was even more the case in the mid-80s, when many scholars and practitioners could declare an interest in urban morphology without inscribing their work in any common scientific or professional institution. Despite two decades of efforts by ISUF (established in 1994) to create a common language or, at least, a common arena of discussion on urban morphology, Gauthier and Gilliland (2006) could thus observe at the beginning of the 2000s how the wide variety of disciplinary, linguistic and cultural backgrounds of urban morphologists was an inevitable source of misunderstanding in the definition of common concepts, methods and aims for the emerging interdisciplinary field. The first tome of “*Morphologie Urbaine and Parcelaire*” is thus an extremely rich and interesting text, confronting diverse and sometimes divergent positions on the very concepts and motivations of the morphological approaches (the plural is mandatory), on their role in architecture and

⁵ J. Castex, P. Celeste, and Ph. Panerai. *Lecture d'une ville : Versailles* (Paris: Moniteur, 1980).

planning, and even on a renewed relationship between architecture, urban design and urban planning.

However, Merlin and Choay went beyond a simple anthology and proposed a quantitative and qualitative synthesis of the viewpoints, which was the very demand of the French Ministry. Their protocol was neither Delphi (which could have been allowed by their pre-established questionnaire) nor focus group, for which the meeting in Arc-et-Senans could have offered an excellent opportunity. Actually, both Delphi and focus group aim at helping participants identify common points and possibly converge towards a consensus, although retaining the different opinions that resist this attempt of convergence. Experts were neither confronted with their fellows' answers to the questionnaire, nor asked to participate in a common discussion to elaborate consensual proposals. The organizer's goal was not to arrive to any sort of consensus, be it full of nuances and exceptions and hard to obtain. They limited themselves to take stock of the existing divergences among the experts (including themselves in the observed panel) and come to the following conclusions, which are first stated in the introduction of the book, later developed in its first chapter, and constitute the core of the report produced for the French Ministry:

The morphological approach has no serious scientific bases (Introduction, p. 7). There is no agreement among international experts of this approach on common concepts, common historical roots and founding authors or texts. Therefore, we cannot be surprised by its lack of theoretical content (*ibid* p.7). The success of the urban morphology fashion in some professional or academic circles is proportional to its conceptual emptiness.⁶

Even methodologically, the conclusion is harsh:

Urban morphology has not been able to develop any specific methodology, disseminated in the praxis and recognized by all (*ibid*, p. 61). As a consequence, the impact of urban morphology both in higher education and training and in institutions is insignificant, with the possible exception of Italy.⁷

Merlin being the only author of these texts, we can infer that these conclusions are more Merlin's than Choay's. Inasmuch they were integrated in the report for the Ministry, their logical consequence in terms of policy is clear: there is no need to modify the functionalist approach to planning by integrating the new insight of urban morphology. We are thus not surprised that no sign of renewal in urban planning policies and practices was observed at the French Ministry of Urbanism, Housing and Transportation in the following years.

In my opinion, leaving deliberately aside the community of French urban morphologists, two leading figures of French urban planning had organized a relevant event, bringing together internationally renowned urban morphologists, but had used this event against the emergence of urban morphology in France. Morphological research remained a niche of some schools of architecture and never played a significant role in the French urban

⁶ (Chapter 1, p.28)

⁷ (*ibid*, p. 61)

planning institutes. Of course, this didn't prevent French urban morphologists from carrying on their research agenda and even their cultural battle, with some success in professional praxis. And it did not even make the French Ministry of Urbanism, Housing and Transportation completely impervious to any interest in urban morphology, as witnessed by Levy and Spigai's report for the Ministry on the quality of urban form in contemporary French urbanization.⁸

But urban morphology underperformed in both its research and policy potential, beyond heritage conservation. The Ministry of Urbanism and Transportation (which had between them incorporated the responsibility of the Environment) and French research agencies renewed their interest in urban form at the end of the 1990s and at the beginning of the 2000s, within the new agenda of sustainable urban development. We can only regret that early debates on urban densification to contain urban sprawl, just like the latest policy of net zero net land take to protect natural and agricultural land, have made so little consideration of urban morphological insight on these very issues.

In the most recent years, local planning agencies have shown a sincere and pragmatic interest in urban morphology, as witnessed by the growing number of morphological atlases of French cities: sampling urban fragments as in Marseille (AGAM 2005), or covering the whole urban area as in Paris/Ile-de-France region (IAU-Idf 2016) and Lille (ADULM 2016). The beautiful cycle of seminars "*Morphogenèse et dynamiques urbaines*" (Franceschelli et al. 2012) has also been organized by several academic institutions (EHESS, ENSAD, FMSH) in partnership with PUCA (*Plan Urbanisme Construction Architecture*), a governmental agency particularly linked to the Ministry of Urbanism.

However, this movement has not completely rehabilitated urban morphology in ministerial and academic circles of urban planning. Merlin's book continues to exert a distant, but never extinguished negative influence on urban morphology. New research projects in urban morphology have always to first overcome that peremptory judgement formulated in the mid-1980s and show that urban morphology has indeed taken stock of those early hesitations and is now capable of a more theoretical and methodological coherence.

Urban Morphology where you wouldn't expect it: the contribution of theoretical and quantitative geographers.

The renewed interest in urban form at the end of the 1990s also motivated different disciplinary traditions to study urban morphological issues. Urban geography has always been a founding discipline of urban morphology, as witnessed by the works of German urban geographers in the inter-war period and by the historico-geographical approach to urban morphology developed at the University of Birmingham after M.R.G. Conzen's seminal work. This is true in France as well. Darin (1998) thus cites the early contribution

⁸ A. Levy, and V. Spigai. *La qualité de la forme urbaine*. Rapport pour le Ministère de l'Équipement du Logement et des Transport (Paris : Secrétariat Permanent du Plan Urbain, 1992).

by Marcel Poëte on the forms of French cities, but also the more recent work by Marcel Roncayolo (1996) on the genesis of urban forms in Marseille. However, all these works belong to the specific tradition of cultural and historical urban geography.

During the 1970s, with a delay of 10-20 years in respect to English-speaking countries, a new research tradition emerged in French geography: theoretical and quantitative geography. Its origins date back to the new geography movement, which can be also linked to Walter Isard's regional science in American economics during the 1950s. Works like "Locational analysis in human geography"⁹ or "Models in geography"¹⁰ began to have an audience in France, passing through young colleagues who had started their academic career in Canada. Urban geography was also concerned by the new theoretical and quantitative approach. The new domain of urban spatial analysis was established. However, the kind of problems treated by French quantitative urban geographers, were mainly urban regional systems, urban factorial analysis within the city, city/transportation interaction seen through the lenses of land use and mobility flows, and urban locational analysis at different scales. Urban form was not the focus of quantitative urban geographers. France academia lacked the equivalent of the Centre for the Land Use and Build Form Studies at Cambridge University,¹¹ which was seminal in introducing quantitative approaches in the study of urban form.

Several factors contributed to a partial change in the research landscape during the 1990s and 2000s. First of all, the already mentioned renewed interest in urban form within policies of sustainable urban development. Secondly, the diffusion of geographical information systems, both within academia and local urban planning departments, as a support for urban spatial analysis. Thirdly, the new availability of intra-urban data in the context of technological advancements and the open data movement: more precise remote sensing data (allowing meaningful intra-urban analysis at metric scale) and urban vector data (first from national and/or local agencies, later from collaborative platforms like OSM) were now available. Since 2006, the French National Geographic Institute IGN has opened its *Géoportail* initiative, a web-based platform giving access to the BD Topo, a nation-wide vector description of metric precision, including 2.5D buildings and streets, BD Ortho, a nation-wide orthorectified high-resolution raster image, and the numeric version of the national Cadastre. Finally, the lowering cost of computing power has allowed the development of faster and more sophisticated algorithms in urban spatial analysis.

The first group of French quantitative urban geographers developing a research agenda on urban form has been the Théma research unit in Besançon. Pierre Frankhauser wrote a seminal book on fractal analysis of urban space,¹² which was published the very same year as Batty and Longley's at UCL. Fractal analysis of urban forms mainly addresses the question of the distribution in space, and through different scales of observation, of built-up elements and voids within the city. It is a very specific approach to urban morphology,

⁹ (Haggett 1965)

¹⁰ (Chorley and Hagget 1967)

¹¹ (Martin et al. 1972)

¹² P. Frankhauser, *La fractalité des structures urbaines* (Paris: Anthropos, 1994).

in some respects just as innovative in the urban morphological agenda, as Bill Hillier's space syntax. The former focuses on the full-void spatial distribution of built-up forms, the latter on the topological properties of networks of axial lines within the voids. Both innovate in studying urban form through geographic scales within a unique geo-computational approach. Intense collaboration has later been established between French geographers at Théma and the Centre for Operation Research and Econometrics (CORE) at the Catholic University of Louvain-la-Neuve, Belgium, around Isabelle Thomas. Fractal analysis of built-up forms has been used to study Brussels and its periphery¹³ and later to differentiate and characterize whole cities and neighbourhoods in Wallonia¹⁴ and in Europe.¹⁵ Fractal analysis has also been extended to the street network in the case of Antwerp.¹⁶ Tannier (2023, in press) gives a general overview of fractal analysis in urban geography, synthesising research at Théma and CORE. Another work giving an overview on urban planning challenges for fractal analysis is Dupuy (2017), integrating contributions beyond Théma and CORE. In most cases, however, geographers working on fractal analysis of urban form have failed to connect their new insight into urban form with the existing corpus of knowledge produced by urban morphology. Spatial analysis of urban form at CORE has not been limited to fractal analysis, as witnessed by Caruso et al. (2017). Within Théma, other geographers worked on the link between urban morphology and mobility behaviours in urban space.¹⁷

A third group of quantitative urban geographers working on urban form was established around Dominique Badariotti at the LIVE research unit at the University of Strasbourg (including a period of activity at the University of Pau). Badariotti was first interested in possible applications of fractal analysis of urban form in planning,¹⁸ while rooting his

¹³ M.-L. De Keersmaecker, P. Frankhauser, and I. Thomas, "Using Fractal Dimensions for Characterizing Intra-urban Diversity: The Example of Brussels," *Geographical Analysis*, 35(4) (2003): 310–328; M.-L. De Keersmaecker, P. Frankhauser, I. Thomas, "Dimensions fractales et réalités périurbaines. L'exemple du Sud de Bruxelles," *L'Espace géographique*, 33(3) (2004): 219–240; I. Thomas, P. Frankhauser, and M.-L. De Keersmaecker "Fractal dimension versus density of built-up surfaces in the periphery of Brussels," *Papers in Regional Science*, 86(2) (2007): 287–308.

¹⁴ I. Thomas, P. Frankhauser, and C. Biernacki. "The morphology of built-up landscapes in Wallonia (Belgium): A classification using fractal indices," *Landscape and Urban Planning*, 84(2) (2008): 99–115.

¹⁵ I. Thomas, P. Frankhauser, and D. Badariotti. "Comparing the fractality of European urban neighbourhoods: do national contexts matter?," *Journal of Geographical Systems*, 14(2), (2010): 189–208.

¹⁶ I. Thomas, and P. Frankhauser. "Fractal Dimensions of the Built-up Footprint: Buildings versus Roads. Fractal Evidence from Antwerp (Belgium)," *Environment and Planning B: Planning and Design*, 40(2) (2013): 310–329.

¹⁷ See : C. Genre-Grandpierre, and J.-C. Foltête. "Morphologie urbaine et mobilité en marche," *Cybergeo: European Journal of Geography*, 248 (2003).

¹⁸ D. Badariotti, "Des fractales pour l'urbanisme ?," *Cahiers de géographie du Québec* 49 (2005): 133-156.

approach to the morphological process in the urban morphology and planning literature.¹⁹ He later worked at the development of a new spatial analysis protocol to study topological neighbourhoods of buildings within the city, which was applied to the cities of Strasbourg and Pau,²⁰ introducing a new network dimension in urban morphology, beyond street networks. His team also worked at a morphogenetic model of urban sprawl, which was never applied to a precise case study.²¹ Research at LIVE has later been developed towards the more classical issue of the link between mobility and urban form,²² less focused on the study of urban forms and their evolution over time.

The fourth group of French (or French-speaking concerning CORE) quantitative geographers having invested in urban morphological issues is ESPACE, and more specifically its unit at Côte d'Azur University in Nice, around Giovanni Fusco. This group followed a reversed trajectory compared to the one in Strasbourg. First interested in the interaction between urban form and urban mobility,²³ it later focused increasingly on urban morphology issues. Fractal analysis played a minor role for morphological research at ESPACE, and was mainly used to characterise retail fabrics in the city, within the protocol of Retail Fabric Assessment.²⁴ Building typology was also addressed by quantitative geographers at ESPACE, with computer-aided protocols capable of processing data of a whole metropolitan area²⁵ or even for the whole of France.²⁶ Above all, geographers at

¹⁹ D. Badariotti, "Les processus morphodynamiques des villes, énigmes et traces," in *13èmes journées de Rochebrune, Rencontres interdisciplinaires sur les systèmes complexes naturels et artificiels* (Paris : ENST, 2006), 325-336.

²⁰ D. Badariotti, A. Banos, and D. Moreno, "Morphologie urbaine et réseau. Etude des discontinuités et des ruptures induites par le réseau de circulation à l'aide du modèle Remus," *Revue Internationale de Géomatique*, 19 (1), (2009): 45-66.

²¹ D. Moreno, D. Badariotti, A. Banos. "Un automate cellulaire pour expérimenter les effets de la proximité dans le processus d'étalement urbain : le modèle Raumulus," *Cybergeo: European journal of geography*, 606 (2012).

²² A. Piombini, T. Leduc, and P. Woloszyn. "Usage de la morphométrie dans la révélation des préférences de mobilité. Application aux cheminements piétons," *Revue International de Géomatique*, 24, (2014): 101-130; T. D. Binh Tran, A. Piombini, M. Ignatowicz, and D. Moreno et al. "Morphologie urbaine et mobilité dans la Communauté Urbaine de Strasbourg," *Cybergeo : European Journal of Geography* 702 (2014).

²³ G. Fusco, "Beyond the Built-up Form / Mobility Relationship: Spatial Affordance and Lifestyles." *Computers Environment and Urban Systems*, 60 (2016): 50-66.

²⁴ A. Araldi, and G. Fusco, "Retail Fabric Assessment: describing retail patterns within urban space." *Cities*, 85, (2019): 51-62.

²⁵ J. Perez, A. Araldi, G. Fusco, and T. Fuse. "The Character of the Japanese Urbanization: Overview of Osaka-Kobe's Cityscapes," *Urban Science*, 3(4), 105 (2019); J. Perez, G. Fusco, Y. Sadahiro. "Classification and Clustering of Buildings for understanding Urban Dynamics: A Framework for Processing Spatiotemporal Data," *Revue Internationale de Géomatique*, 32 (1-2) (2023) (in press).

²⁶ A. Araldi, G. Fusco, D. Emsellem, D. Overal. "Building types in France. Clustering building morphometrics using national spatial data," *Revue Internationale de Géomatique*, 32 (1-2), (2023): in press.

ESPACE developed the AI-based data-driven protocol Multiple Fabric Assessment (MFA) to identify and characterize urban fabric types within large metropolitan areas.²⁷ Following the Italian tradition of urban morphology, the basic unit of analysis for MFA is the street-segment, and its goal is typifying the organization of plots and buildings in a proximity band around it. The latter is an operationalization of the “*banda di pertinenza*”²⁸ and the analysis of its skeletal streetscape²⁹ allows the consideration of the pedestrian view of the urban fabric. MFA was used to study urban forms on the French Riviera,³⁰ Marseille,³¹ Osaka,³² Bruxelles,³³ Izmir (forthcoming) and in a comparative analysis of Lyon, Marseille, Lille and the French Riviera.³⁴ Geographers at ESPACE are presently working on a morphological atlas of French cities, using the MFA protocol. Other research subjects at ESPACE are the forms of self-organized urbanisation,³⁵ morphological resilience,³⁶ and the morphological process.³⁷ Many of these works have been presented within the ISUF conferences, which resulted in a more regular participation of French quantitative urban geographers to international urban morphological research.

Other quantitative geocomputational contributions to the analysis of urban form came from research units outside of, but close to, theoretical and quantitative geography. This is the case for the works of Olivier Bonin and Jean-Paul Hubert at LVMT, Gustave Eiffel University (formerly IFSTTAR) in Paris. Baro et al. (2016) proposes thus a new approach to urban morphological analysis using raster socio-economic and building data. The application of their protocol produces morphological regions for French cities. Bonin also

²⁷ A. Araldi, and G. Fusco, “Retail Fabric Assessment: describing retail patterns within urban space.” *Cities*, 85, (2019): 51-62.

²⁸ (Caniggia and Maffei 1979)

²⁹ (Harvey et al. 2016)

³⁰ (Fusco and Araldi 2017)

³¹ G. Fusco, A. Araldi, and J. Perez. “The City and the Metropolis: Urban Form through Multiple Fabric Assessment in Marseille, France.” In *ISUF 2021 - Proceedings*, 884-894. Glasgow: University of Strathclyde, 2021.

³² J. Perez, A. Araldi, G. Fusco, and T. Fuse. “The Character of the Japanese Urbanization: Overview of Osaka-Kobe’s Cityscapes,” *Urban Science*, 3(4), 105 (2019).

³³ (Guyot et al. 2021)

³⁴ G. Fusco, A. Venerandi, C. Chaumery, Ph. Dardelet-Doya, *Formes résilientes, urbanisme et métropole. Learning from Nice*. Les Cahiers POPSU (Paris: Editions Autrement, 2023).

³⁵ A. Venerandi, M. Iovene, and G. Fusco. “Exploring similarities between informal and medieval settlements: A methodology and an application,” *Cities*, 115, 103211, (2021); M. Khader, and G. Fusco “Self-organized peripheries in Mediterranean cities. Examples from Rome and Jerusalem,” in *6th ISUF Italy International Conference. Morphology and Urban Design. New strategies for a changing society. Proceedings*, (Bologna, 2022) (in press).

³⁶ G. Fusco, A. Venerandi, C. Chaumery, Ph. Dardelet-Doya, *Formes résilientes, urbanisme et métropole. Learning from Nice*. Les Cahiers POPSU (Paris: Editions Autrement, 2023).

³⁷ C. Prouin, G. Fusco, M. Caglioni, and D. Overall. “Morphogenesis of urban peripheries in the 20th century: examples from the French Riviera,” in *ISUF 2022: Urban Redevelopment and Revitalisation. A Multidisciplinary Perspective* (Łódź – Kraków, 2022).

worked with Pierre Frankhauser to a new urban model, Franctalopolis, integrating a fractal approach to urban planning.

Interdisciplinary research between physicists and geographers has also contributed to the agenda of computational urban morphology. The research group around Marc Barthélémy at the Center of Social Analysis and Mathematics at EHESS in Paris has worked more specifically on the analysis and on the morphogenesis of urban street networks.³⁸ The same can be said for the Morphocity research group between MSC and LAVUE research units in Paris, federating physicists like Stéphane Duady and architects/morphologists like Philippe Bonnin. Lagesse et al. (2016) is an example of the contribution of this research group to the quantitative analysis of urban street networks, applied to the city of Paris.

Quantitative computer-aided approaches to urban form have also been developed in engineering, architecture, urban geography and planning research on energy consumption (consumption model related to different urban forms and building types), urban climates (urban micro-climate, urban heat island) and urban pollution (dispersion of air pollutants, noise), but these applied domains of urban morphology will not be considered in this account.

In conclusion, theoretical and quantitative urban geography has increasingly contributed to research in urban morphology in France (and in French-speaking Belgium) in the last two to three decades. These contributions come from a small number of research groups which have often collaborated and worked in interdisciplinary contexts. Methodological innovation has been a main focus of quantitative urban geographers, allowing for innovative applications, which have been used in different research agendas. Globally, they worked at the emergence of the domain of computer-aided urban morphometrics, but in many cases they overlooked the connection with the tradition of urban morphological research and participation to the ISUF network. The geographic scales of their works are extremely varied, and generally wider than architectural and urban design research in urban morphology. Some approaches, like fractal analysis of urban form, are more specifically trans-scalar and applied to a range of geographical scales. A wider and deeper dialogue between quantitative and qualitative approaches to urban morphology, among all the disciplines of urban morphology and first among architecture, geography, and urban planning, could only be beneficial to the advancement of the urban morphological agenda and to its contribution to the understanding and the answers to the current challenges of our urban world.

³⁸ M. Barthelemy, P. Bordin, H. Berestycki, and M. Gribaudo, "Self-organization versus top-down planning in the evolution of a city," *Science Reports* 3, 2153 (2013); (Barthélémy and Flamini 2008)

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