
Rejoinder to Hillier and Penn

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Abstract. Some questions about space syntax—a well-known technique of urban analysis developed over the past decades by Bill Hillier et al—were raised by Ratti in this journal. Hillier and Penn produced a detailed rejoinder, rebutting most of the criticisms and restating the assumptions made by the technique. However, their arguments, if accepted, lead to paradoxical consequences.

1 Prologus

After having detailed some concerns about space syntax in this issue of *Environment and Planning B* (Ratti, 2004), I did not anticipate the kind of response offered by Hillier and Penn (2004). I had hoped for a more academic response, stating the field of applicability of the technique, defining its limits, and suggesting future work: how it might be improved and integrated with new computer techniques for urban analysis. Something like: touché, let's move on. After all, as I have stated, the questions underlying space syntax are very interesting and deal with a long-lasting dilemma amongst architects and urban planners: what is the impact of built form on social life?

To the contrary, Hillier and Penn's rejoinder is a strenuous and defensive rebuttal of each point highlighted in the paper. Instead of addressing the broad meaning of the criticism (dealing with the limitations arising from the use of the topological measures), they have chosen to restate most of the assumptions of space syntax in an effort to prove the technique flawless. However, this defence at all costs, if accepted, leads to paradoxical results, as explained below.

2 *Absurdum primum* (first section in Hillier and Penn, 2004)

It is said that “a picture is worth a thousand words.” I would like to illustrate the paradox of Hillier and Penn's logic with a simple image. Consider the following quiz: given the two urban configurations shown in figure 1, which of the statements below is true?

(A) The “two grids are simply not the same, and the kind of discontinuities arising from minor geometric changes...[do] have significant effects.” “Behavioural evidence is also compelling.” Therefore, we should assume that pedestrian movement in two hypothetical cities based on the two patterns of figure 1 is likely to be radically different.



Figure 1. Are they the same or not? There is an elemental difference between the two patterns (say a 0.01 degree, or arbitrarily small variation in their skew), which is not perceptible to the eye. Hillier and Penn argue that this would lead to a radical transformation in terms of pedestrian movement in hypothetical cities based on the two patterns above.

(B) The two grids are geometrically the same. Movement patterns in two hypothetical cities based on the two patterns of figure 1 are the same.

The troubled reader is invited to trust his or her visual intuition. She or he should also know that there is an elemental difference between the two patterns (say a 0.01 degree, or some arbitrarily small variation in their skew), which is not perceptible to the eye. Answer (A) contains quotes from Hillier and Penn (page 502) and summarizes their argument; answer (B) is my choice.

3 *Absurdum alterum* (second section in Hillier and Penn, 2004)

The second section in Hillier and Penn is a response to my questions about the most common archetypal city pattern: a regular grid. There, the axial analysis becomes useless, as it outputs uniform values for all streets. How to deal with such simple evidence? Hillier and Penn state: “in spite of the fact that, theoretically, a pure orthogonal grid yields standardised values for axial lines, in practice such grids do not occur” (page 503).

The above answer seems a rather facile way to settle the issue. Even if infinite regular grids do not exist in the real world, they certainly can be thought of and subjected to what physicists would term *Gedankenexperiment*. If the experiment yields different results from those obtained in reality, it is then necessary to understand the cause. In our case, this would mean asking the following questions: what are the applicability limits of space syntax? If these uniformly gridded configurations do not occur in the real world because they are always connected to an outside world (such as Manhattan to Brooklyn), what is the extent of this world that we should consider? How does space syntax deal with boundary conditions? These questions, clearly set out in my previous paper, do not find a clear answer in Hillier and Penn’s rejoinder.

A very interesting point arises in Hillier and Penn’s discussion of regular grids. In my initial paper, as an aside, I made the following observation about the axial analysis and the city of Manhattan: “The first concern of the newcomer to axial analysis would probably be related to its topological representation of the city, which discards all metric information. The difficulty in accepting this becomes clear when considering pedestrian decisionmaking rather than urban configuration. Convincing a pedestrian that his urban movement strategy is not based on metric but on topological distance might prove as difficult as convincing a New Yorker living on Fifth Avenue, between 111th and 112th Streets, that going to Central Park North round the corner (two changes of direction in the axial map) or to Columbus Circle (a few miles away, but still two changes of direction) is the same” (page 490).

Hillier and Penn promptly jump on this point to state that my observations “betray a misapprehension of what it is that space syntax seeks to predict. Space syntax in itself says nothing about ‘pedestrian choice making’, but deals only with observed flows and thus only with aggregate statistical effects in different alignments in the grid” (page 504). Their assumption is very interesting: it implies that a New York pedestrian’s decisionmaking might be based on metric distance (or on some other nontopological measure), but that global patterns of pedestrian movement can be predicted using topological measures, such as the axial map analysis. This assumption, however, leads to a paradox, as demonstrated by the following *reductio ad absurdum*.

Take the map presented in figure 2(a), which represents a five-by-five street portion of New York City. Individual patterns of pedestrian movement will respond, say, to the metric structure of the city (or to some other nontopological measure). All these individual patterns add up and lead to an aggregated pedestrian movement diagram, which can be determined, according to space syntax, by a topological analysis of the axial map. Now imagine deforming the grid by inserting a large unbuilt area between

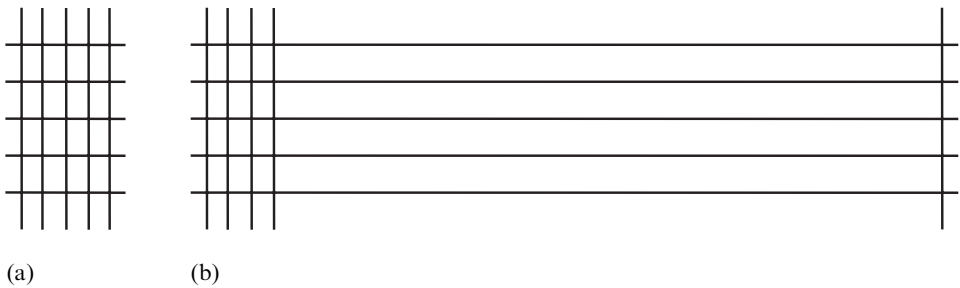


Figure 2. A five-by-five street portion of New York City (a) has been deformed by inserting a large unbuilt area between two streets (b). Topology is unchanged, but geometry is radically different.

two streets, as schematised in figure 2(b): the topology of the axial map will remain unchanged, while the city geometry (and all other nontopological measures) will have been transformed in an anisotropic way. This would surely cause an anisotropic change of individual movements, which should then be reflected in their aggregated form. But this will not be the case: topology is unchanged and, according to space syntax, the same global patterns of pedestrian movement should occur in cases (a) and (b). *Quod erat demonstrandum.*

The reality is that, if we assume that aggregated patterns of pedestrian movement can be described only using a topological analysis of the axial map, then we are forced to admit that individual decisionmaking also responds only to topology. I would still not be comfortable in explaining this assumption to any New Yorker.

4 The methodology

The first two sections of Hillier and Penn's rebuttal have been discussed above. The reader can easily carry out a similar analysis through the rest of their paper to highlight some of the contradictions and paradoxes that arise.

I would simply like to make a couple of observations on the methodology. Take the discussion about the Parisian district of La Défense. In my paper I made a passing reference to it, and to other types of planned developments where the axial map analysis might not hold (paragraph 3.2). Instead of discussing this broad problem, Hillier and Penn focus on the La Défense example to inform us that: "As such it is of course a highly syntactic piece of design, and functions accordingly" (page 505). "One of us was there during the summer of 2003 on a Saturday" (page 505). Hillier and Penn state that, based on his observations, results confirm space syntax analysis.

The first assumption is rather uninformative: even if the design of La Défense were "syntactic" (?), would this imply that space syntax analysis applies? But the second observation is more troubling. No axial map analysis and observational data are produced and compared, but only the assurance that space syntax's predictions are true because "One of us was there during the summer of 2003 on a Saturday."

I would like to add that I lived in Paris for three years and that, based on my experience, the axial map analysis would never be able to characterize pedestrian movement in La Défense and in its neighbouring system of bridges, high-speed roads, and public transport exchanges. Could our disagreement, then, be reduced simply to an observational discrepancy?

5 Future and past

Despite its scholarly interest, the technical assessment of the axial map and traditional space syntax—which has been the focus of this exchange—is probably not the most pressing theme confronting the urban studies and planning community today. The questions underlying space syntax, however, retain all their topicality. Would it be possible to use today's increased power of computer analysis to provide a more refined understanding of the relationship between urban morphology and human behavior? Could a more complex representation of urban systems take into account the extraordinary geometric and visual richness of our cities? Would such tools help professionals make better designs without giving them oversimplified prescriptions?

A debate on the 'good city' ran through the end of the 19th century. Baron Haussmann and many of his later followers (including Hillier et al?) argued for the opening of new *boulevards* to maximise lines of sight. Others, such as Camillo Sitte and several *Gestalten* acolytes aimed for the exact opposite, by promoting urban enclosure.⁽¹⁾ The show goes on.

References

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- Hillier B, Penn A, 2004, "Rejoinder to Carlo Ratti" *Environment and Planning B: Planning and Design* **31** 501–511
- Sitte C, 1965 *City Planning According to Artistic Principles* translated by G R Collins, C Crasemann Collins (Random House, New York); first published in 1889 as *Der Städtebau nach seinen künstlerischen Grundsätzen* (Vienna)

⁽¹⁾ "Modern city planners are unaware of this most important and really essential prerequisite of any artistic effect. In olden times, on the other hand, a variety of means were employed to achieve, under the most diverse conditions, a decidedly enclosed quality of space" (Sitte, 1965, pages 32–33).