No one, wise Kublai, knows better than you that the city must never be confused with the words that describe it.

Italo Calvino, *Invisible Cities*

**Introduction**

If city-craft described the development of the city of Venice out of the everyday actions of people, and statecraft the attempts of the Republic to spatially exercise its visions, story-craft concerns a creative mind’s use of Venice as a catalyst for invention. But what does Venice have to do with the imagination of an avant-garde writer? Not only were key parts of Venice the products of utopian fantasy, such as the Piazza San Marco, which was envisioned as a Roman forum; islands, *campi*, streets and works of art too had several authored and popular ‘fantasies’, variations on the Venice that exists (Figure 3.1).¹ From the Republic’s rituals to carnival celebrations and from Canaletto’s visions to Le Corbusier’s Venice Hospital, Venice exemplifies the encounter of the physical city with the city of the imagination. It is not surprising, therefore, that it has provided the inspirational context for Italo Calvino’s *Invisible Cities* (1972), his most acclaimed work of fiction, which has, for architects at least, attained legendary status.² Reminiscent in its visionary charge of the thirteenth-century travelogue *Il Milione* and More’s *Utopia, Invisible Cities* is about the cities Marco Polo describes to Kublai Khan, the emperor of Mongolia.³ These are fantastic places that the Venetian traveller invents in his mind. Soon the Khan realises that the cities Polo is speaking about have arisen
from the rearrangement of recognisable elements and that in speaking of other places Polo always says something about Venice. Leticia Modena explains that ‘Polo is effectively an architect of invisible cities, and he models for the Khan and the work’s readers how to become architects of their own invisible cities’.  

The title *Invisible Cities* implies the peculiar ability of the human imagination to ‘see’ the invisible. More importantly, the imagination is explicit in Polo’s descriptions of multiform images, making fantastical faraway places ‘visible’ to the reader. The imagination is also central to the exchanges between the Venetian and the emperor, particularly at the end of the book, where they examine the Khan’s atlas. Containing all past and future cities including those that were conceived in thought, the atlas expands the invisible cities to an imaginary universe of the possible. Various critics stress the work’s relation to *ars combinatoria*, the art of uncovering combinatorial rules that govern the arrangement of information objects, such as words in language. Calvino discussed the role of the imagination in *Invisible Cities*, explaining that readers can draw a number of paths and multiple intersecting routes through

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*Figure 3.1* Canaletto. *Capriccio of Rialto with Palladian buildings*. Galleria Nazionale di Parma: su concessione del Ministero dei Beni e delle Attività Culturali e del Turismo - Complesso Monumentale della Pilotta
the fiction. In this chapter I attempt to understand how he inspires the readers’ imagination; by what mechanisms and rules he stimulates readers to envision their own alternatives; and what role the ever-present Venice plays in the fiction.

The idea of literature as a combinatorial machine was central to the Oulipo literary group that explored the possibilities of mathematics and science. Calvino was a member of the group, absorbing many influences from them as well as from structuralist theorists. Roland Barthes’s ideas about language-speech, mental visualisations and the figure of the author had a clear impact on the Italian novelist. The Argentinian writer Jorge Luis Borges and the ancient Roman poet and philosopher Lucretius (c. AD 100) were his two other key sources of inspiration. Borges’s story The Garden of Forking Paths was for Calvino a masterful expression of narrative possibility within a very short description. Lucretius attracted Calvino with his idea about atoms that deviate from their straight course, releasing a chain of events. Triggering possibility, Lucretius’s universe granted freedom to atoms as well as to human beings. Possibility was the central force also in Ovid’s Metamorphoses, another key text for Calvino, in which ‘everything can be transformed to everything else’, opposing hierarchical values with freedom.

Calvino was stimulated as much by these philosophical ideas as by a range of theories about the modern city. In Paris, where he wrote Invisible Cities, he became familiar with the utopian experimentations in architecture and urbanism in the sixties and seventies. Le Corbusier’s project for the Venice Hospital and the visionary project of Richard Rogers and Renzo Piano for the Pompidou Centre (1969) were among the new design approaches that were emerging, searching for dynamic urban possibilities as opposed to the real-estate speculation that was changing cities in northern Europe. These were produced during the same period that Tafuri was debating the role of utopia, and the Italian radical architecture of Superstudio and Archizoom was questioning the undifferentiated expansion of cities under Modernism. Architects such as Yona Friedman, Buckminster Fuller and the architectural group Archigram embraced fantasy and the maximum amount of freedom, playing with light-weight structures of mobility and combinability.

The qualities of a work to be open-ended and indeterminate were explored in an array of other media, literature, music and art, as captured in Umberto Eco’s Open Work. Closely associated with these developments were contemporary debates on chaos theory and complexity, which aroused interest in networks, cybernetics, systems, ecology and cities as evolutionary organisms. Exerting influence on
many fields, the combinatorial possibilities in networks were radically changing many kinds of processes. In his essay ‘Cybernetics and Ghosts’, Calvino addressed the future of literature in a digital world, referring to computers as electronic brains:

even if they are still far from producing all the functions of the human brain, [they] are nonetheless capable of providing us with a convincing theoretical model for the most complex processes of our memory, our mental associations, our imagination, our conscience. Shannon, Weiner, von Neumann and Turing have radically altered our image of our mental processes.

In the same essay, Calvino linked the Oulipo writers with cybernetics, referring to Queneau’s poem *Cent Mille Milliards de Poèmes* as a ‘rudimentary model of a machine for making sonnets, each one different from the last’.

By the end of the twentieth century, *Invisible Cities* had become a key reference for architects and urban planners. However, the book had not been much noticed in architectural circles until interest began shifting away from cybernetics to post-modernism, with its emphasis on historicism, playfulness and the pursuit of complex imaginary meanings. Architects therefore may not have been aware of Calvino’s relationship to the intellectual interactions that shaped architecture, urbanism, complexity theory and structuralism in the interdisciplinary climate of the sixties. Regardless of the repertory of formal variations available to architecture through new digital technologies, the combinatorial thinking of avant-garde writers like Calvino remains largely unexplored in architectural theory. If Calvino used architectural ideas in search of alternatives in literature, can the combinatorial dimensions in *Invisible Cities* contribute to the understanding of the architectural imagination? What can architecture and cities learn from his fiction?

*Invisible Cities – in search of intelligibility*

Calvino was fascinated by canonical and popular texts, which he appropriated in his own works. In *If on a Winter’s Night a Traveller* he recycles the structure of *One Thousand and One Nights*. In *The Castle of Crossed Destinies*, he reworks Ariosto’s *Orlando Furioso* along with Western classics, while in *Invisible Cities* he borrows from Marco Polo’s *Travels*. Marco Polo was a Venetian merchant who opened Central
and East Asia to the West with his journeys to the court of Kublai Khan, surpassing his predecessors in the reach and scale of his travels. On his return he was imprisoned in Genoa, where he reportedly dictated his travels to Rustichello da Pisa, a romance writer. Entitled the *Description of the World, or Books of the Travels of the World*, or the *The Travels* in English editions, Polo’s book was nicknamed *Il Milione* in reference to Polo’s use of the word ‘millions’ to describe his revenues.

*Invisible Cities* is structured as 55 short city descriptions and 18 dialogues between Kublai Khan and Marco Polo. As the emperor faces the potential destruction of his empire, he seeks in Polo’s accounts ‘the tracery of a pattern’ that ‘could escape the termites’ gnawing’. Polo feeds the emperor’s quest for knowledge with pantomimes, games and dialogues that frame the narrative at the beginning and the end of each chapter. The short texts describe cities as fantastical constructions. There is a city suspended between two steep mountains, a city made of a forest of pipes, a microscopic city concentrically expanding over time. Some cities are heavy and monumental, while others are skeletal and dismountable. There are phantom cities reflected in lakes and cities that are subterranean. A few have a secret plan manifested in a carpet or a starry night. Others grow formless and uniform, a reference to the contemporary expansion of suburbs. Finally, there are cities where the roles of people and happenings are interconnected or repeat over time.

The range and sensory qualities of the places Polo describes compel Kublai to understand the invisible order of Polo’s imagination. The dialogues, which are printed in italics, extend the ideas encountered in the city descriptions and move from the two characters’ learning each other’s language, to their establishing a conversation, thinking in silence, playing chess and examining the Khan’s atlas. The novel is intended to provoke thought rather than develop a plot towards closure. However, as the last dialogue focuses on the question of utopia versus ‘inferno’, it advances a proposition: Polo’s final utopia is a city that is ‘discontinuous in space and time’, consisting of interruptions. His closing advice to the Khan is to learn to recognise ‘who and what in the midst of the inferno is not inferno’ and make them last, ‘give them space’. If the genre of utopia has been about idealised geometries, expressions of totality hierarchically applied, Calvino promotes a utopia that is constructed from the bottom up, recombinant and adaptive to change. Characterised in this way, Calvino’s implicit proposition for the ideal city would seem to reflect many of the ideals of the resilient city, which are embodied in today’s utopias.

The 55 city descriptions are organised in nine chapters and distributed under 11 thematic rubrics: ‘Cities and Memory’, ‘Cities and
Desire’, ‘Cities and Signs’, ‘Thin Cities’, ‘Trading Cities’, ‘Cities and Eyes’, ‘Cities and Names’, ‘Cities and the Dead’, ‘Cities and Sky’, ‘Continuous Cities’ and ‘Hidden Cities’. Each chapter contains five city descriptions (with the exception of the first and last chapters, which consist of ten cities each), arranged so as to construct recursively descending sequences of numbers (from 5 to 1). In spite of this mathematical orchestration, to the average reader the fiction is a collection of loosely interrelated narratives that can be read in sequence from the first to the last page or at random. What complicates matters more, as Kublai suspects, is that cities seem to exchange their elements and come to resemble each other. When challenged by the emperor, Polo admits that Venice lies behind all his descriptions. The cities of *Esmeralda* and *Phyllis* that follow the dialogue on Venice branch out in ‘tortuous optional routes on dry land or water’.23 In this, Calvino alludes to the web of alleys and canals of Venice to express the ways in which the lack of unity in the fiction might create disorientation.

Losing oneself in a city or a book sharply contrasts with Kublai’s search for a model from which all other cities derive. In the opening dialogue, Kublai is able to discern in Polo’s descriptions a ‘scaffolding’ of abstract relations. In another dialogue he observes that ‘a splendid hard diamond takes shape’ and that the empire is made of the geometry of a crystal.24 As the emperor plays chess with the merchant, he attempts to understand cities following the rules of the game. Yet, at the end of the game a bare square of wood remains, an emblem of nothingness. Polo advises Kublai to look at the pores of the wood to generate new stories. As the book advances to its end, the last two dialogues between Polo and the Khan focus on the Khan’s atlas. These dialogues refer to cities in the Great Khan’s empire and empires of the West, including all cities known and possible.

*Invisible Cities* juxtaposes images of lightness and coherence with images of entropy and decay, ruins, mazes filled by earth, dirt, refuse, and formless suburbs. Whether in narrative or dialectical mode, Polo systematically frustrates and excites the Khan – as Calvino does the reader – prompting him to think of the book as a labyrinth and speculate on an invisible order resembling the diaphanous ‘tracery of a pattern’.25 The city descriptions and the dialogues construct an echoing system that amplifies the challenge facing the Khan to reconstruct the labyrinth and dissolve its power. The emperor’s search for intelligibility mirrors the question in readers’ minds: what makes a book larger than the sum of the city descriptions, a novel out of these pieces, a story out of these fragments?
Two models of knowledge

Polo’s refusal to speak of Venice is used as a mechanism to provoke the thought of Venice in the mind of the readers and help them visualise it. The Khan grasps Venice immediately as the ideal city, a Platonic model that might explain the variety of the cities Polo describes. Yet, aside from glimpses of green canals and a range of routes over water or land, Polo’s cities tend to be increasingly homogeneous, sprawling through airports, expanding through suburbs or filled with garbage. The Khan searches for a proxy to understand the secret order in Polo’s accounts that can make the ‘formless ruin’ of his empire cohere. Confounding Kublai’s interest in images that assert structural concepts of unity – the tracery of a pattern, a splendid hard diamond, a bridge, a chessboard, an atlas – Polo presents him with a multiplicity of treasures, ginger, cotton, pistachio nuts, silk, souks, tiled courts, whitewashed walls, rubbish bins, houses of zinc with water stored in barrels. The empire of the Khan, like every empire, thrives on order, classification, rules, labels, numbers, sets and systems on a grid where emblems, monuments, people and objects are logically arranged. Kublai seeks unity and coherence through the imposition of a bureaucracy of rituals and rules on a field of cities, vanquishing their variety. The merchant’s interest, on the other hand, is in multiform things, summoned and exchanged one by one, a series of disparate memories, collections of stories and objects. If the Khan yearns to possess his empire in abstract thought while seated in his garden, Polo takes pleasure in the visible surface of the world, exchanging wares, stories and tales through travelling.

Marco Polo and Kublai Khan represent two different modes of knowing. The Khan seeks an ideal order of things in his possession. Polo seeks not-yet-seen adventures, the variety of things that can be exchanged and collected. Soon, however, Polo’s variety is also overcome by the endless homogeneity found in trading similar things in different places, as cities are ‘everywhere the same, in all the bazaars inside and outside the Great Khan’s empire, scattered at your feet on the same yellow mats’. To the list of philosophical binaries and mirrors that permeate the text – author and reader, merchant and emperor, reason and intuition, ideal and real, rational and empirical, mind and matter, visible and invisible, material and immaterial – Calvino adds another opposition: between difference and homogeneity. There are cities that ‘preserve their differences intact’ and cities that merge over the surface of the earth into the same generic city with no beginning or end. The interplay
between variety and standardisation of places and wares infiltrates the dialogues and Polo’s descriptions, drawing attention to the competing processes of innovation and reproduction in modern cities.

The strategy of opposition in poetry and literature often relies on symmetry, through which a particular problem is dramatised. Once a solution to the Khan’s quest for intelligibility is expressed, through the idea of Venice or the tracery of a pattern, it is overturned. Embedded symbolisms in the text cause readers to oscillate between opposites, shifting and challenging meaning. As soon as they follow one direction, they discover that they have returned to the place in which they started. The role of symmetry raises the question of exploring the structure of the text in order to understand if there is an underlying order around which cities cohere.

‘A splendid hard diamond takes shape’ – the text as a digital file

Calvino’s book opens with a list of contents outlining the structure of the fiction. Calvino gives each of the 55 cities a number and orders them from 5 to 1 in each of the nine chapters. The city descriptions have titles based on one of the 11 thematic classifications, each of which is periodically repeated in the book five times (‘Cities and Memory’, ‘Cities and Desire’, and so on). The sequence of numbers (from 5 to 1) remains invariant in all chapters. In contrast, the thematic classifications shift gradually, so that each time a new classification appears, another one is dropped. This pattern generates a gradual succession of repeating themes. By plotting the cities and aligning them according to their numerical indexes – or the forward-shifting numbers – critics have assembled the notation shown in Figure 3.2. This leads to a configuration which is reminiscent of Kublai’s attempts to interpret his empire as a diamond-shaped structure. Reading the diagram from left to right and from top to bottom corresponds with the linear sequence in which the cities are described in the text (Figure 3.3). We can cut the paper along the perimeter of the shape and bend it, joining the top with the bottom vertical lines to form a ribbon. So, arriving at the end of the book we are led back to the start of the fiction. As we turn the pages of the book, the repeating numerical series (from 5 to 1) implies a cyclical pattern of time. The invisible matrix of cities and rubrics, on the other hand, is foreign to time, rendering the narrative armature transparent and motionless all at once in the mind.

The system of names and numbers provides a short list of exactly repeatable standardised signs. These signs lead to a notation which has an
indexical relationship to the work, that is, it determines the precise position of cities in the text and thus the difference between each city and all others. Calvino 'digitises' the structure of the text, providing a list of coordinates, which are concepts and numbers. These can work as computational instructions, or as an algorithm converting the structure of the text into a digital file. Numerical consistency in the notation, based on
the repetition of the identical series of numbers, allows it to be translated into a geometrically consistent pattern, which helps us visualise it and grasp it all at once as a single object. Early in the twentieth century, Henri Poincaré had explained that ‘the advantage of geometry lies precisely in the fact that the senses can come to the assistance of the intellect.’ We can understand the internal relations more easily by looking...
at Figure 3.3 than when reading the text, where conceptual ideas are in a state of flux, emerging step by step in the process of reading. The great advantage of the diamond shape is that it translates the sequences of ideas into numeric and geometric form, bringing geometry and the senses to the assistance of our thoughts in following the linear pathway of language.

This notation can be compared with a musical score, by which we can ‘rehearse’ the same ‘piece’, in this case following the sequence of cities from top-left to bottom-right. This is clearly implied in Zora, one of the cities, which, like a musical score, comprises notes that cannot be replaced or altered. We can also navigate through the diagram in many other ways if we join cities by horizontal and vertical lines (Figure 3.4). The resulting network captures various itineraries through the text, such as starting from any intermediary point, following chapters or thematic classifications, or ordering city descriptions into different sequences according to whether they are underground, geometrical, formless and so on. The diagram in Figure 3.4 is no longer a notation of the work’s sequence, as we no longer adhere to the exact ordering of its elements. However, it is not entirely disengaged from the work, since the modular structure of Calvino’s city-texts allow us to exercise choice, creating our own route through the pages.

This open-ended concordance between the notation and the text evokes Kublai’s apprehension that cities exchange their elements and are perhaps similar to each other. It also alludes to the moment when the Khan attempts to reduce his knowledge of his vast territories to the various arrangements of pieces on the chessboard following the combinatorial laws of the game. We find here the roots of the structuralist understanding of language. If we think of the cities as linguistic units, the geometric notation provides the syntax that organises these units into a network of relationships. Like syntax and grammar in language, which translate a web of concepts into a string of words, the network can offer a code for generating possible strings of city descriptions as variations of the fiction. The notation expresses Invisible Cities as a particular expression of speech (parole) which remains part of the broader system of language (langue).34

These observations help us to accurately describe and distinguish three kinds of concordance in the work’s structure. The first is the numeric concordance of the notation with the text, the thematic and numerical structure in the list of contents. The second is the geometric concordance encoding the work as a shape or figure. The third is a topological concordance based on relations of adjacency among cities in the order in which they are found in the novel (or any order in which they can be combined at will). While the topological concordance between the
diagram and the text provides the narrative sequence, the numeric and geometric concordances translate the sequence into a shape and a rhythmical pattern. By assigning names and numbers to cities (classifications), Calvino digitises and expresses geometrically the topology of the text, producing a stable image. Like a plan of a building or a city enmeshing
the topological structure of spaces into a visual representation, the diagram maps a web of ideas into a geometric notation.

This representation can ‘speak’ notationally and geometrically, just as a plan does, adding conceptual relations to the fiction. In Peponis’s view, the network exposes high-order symmetries with respect to ‘Cities and Eyes’, which are hidden between opposite concepts. So, the past, which we process through memory, interacts with possibilities that are entailed in the future (‘Cities and Memory’ – ‘Hidden Cities’); desires that give cities their form converse with formless cities that have been emptied of desire (‘Cities and Desire’ – ‘Continuous Cities’); cities and their signs are mapped onto cities and their celestial patterns (‘Cities and Signs’ – ‘Cities and the Sky’); cities of exchange that are in a state of unrest are paired with cities whose life is solidified by their name (‘Cities and Desire’ – ‘Cities and Names’). Finally, cities that have a skeletal construction are paralleled with cities of the dead, expressing the idea of the skeleton as the common element between living and dead structures (‘Thin Cities’ – ‘Cities and the Dead’). When thematic categories are mapped onto their diametric opposites along the axis of ‘Cities and Eyes’, the geometric symmetries intensify the relationship between the opaque surface of the text (parole) and the skeletal pattern (langue). They help to unravel poetic relationships that are not made explicit, or are lost in the sequential motion of language.

However, achieving a visual and conceptual understanding of the work as a notation is other than the work, that is, other than Calvino’s text and the experience of reading the fiction. This is not simply because a literary work is the text itself, but also because the diagram is a translation of the work, and not an instance of the work. As Nelson Goodman explains, ‘a literary script is both a notation [the text] and is itself a work’. In contrast, in painting, ‘the work is an individual object; and in etching, a class of objects. In music, the work is the class of performances compliant with a character.’ Thus, literature and painting are ‘autographic’, or handmade by their authors, while music and architecture are ‘allographic’, which means ‘scripted by the authors in order to be executed by others’. In a 1967 essay Calvino explains that in Borges’s fictions ‘the secret watermark of the universe always seems to be about to appear’. Has Calvino then provided the notation as a ‘watermark’, implying that Invisible Cities becomes ‘allographic’, open to ‘improvisation’ by the work’s readers? It is worth noting here that to Kublai’s question whether on his return to the West Polo would repeat the stories he tells him, Polo answers that it is not the voice that commands the story, but the ear.

Arriving at the notation requires the procedure of plotting the numbers provided in the work’s list of contents on paper. The process of
producing the notation defines an analytic form of understanding, contrary to intuitive modes of perception emerging when reading the fiction. What matters is not only what the notation means, but also how the network ‘gets into’ the text; how the step-by-step experience of reading the fiction with its images, ideas, inversions, transpositions and pleasures enables us to grasp the notation as a particular mode of explaining the fiction. The task to undertake next is to describe how reading *Invisible Cities* leads from intuitive to conscious understanding. The question raised is thus two-fold: first, how the notation takes shape in our mind in the process of reading; and second, how ‘improvising’ – as readers often do, flipping through the text and choosing varied reading sequences – leads to grasping an emergent higher order, such as the previously mentioned symmetry between thematic classifications in the novel.

**The world and its copies – emergent local symmetries**

The poet’s mind, and at a few decisive moments the mind of the scientist, works according to a process of association of images that is the quickest way to link and to choose between the infinite forms of the possible and the impossible.

Italo Calvino, *Six Memos for the Next Millennium*

Calvino was an Oulipian, fond of exactitude and mathematical patterns, and would have had a good grasp of the symmetries involved in his thematic and numerical structure. This structure has a close relation to a tessellation, created by repeating a triangle so as to cover a plane without gaps or overlaps. Group theory defines symmetry as an operation that leaves a configuration invariant. There are four types of symmetry in the tessellation: reflection, translation, glide-reflection and rotation (Figure 3.5). This means that bilateral symmetry articulates hierarchical relationships that distinguish ‘Cities and Eyes’ from the rest of the cities, but local-scale symmetries make all points in the diagram identical, confirming Kublai’s idea that cities are interchangeable with each other. A closer look at the content of the city descriptions in the fiction makes one realise that it is often impossible to decide on the basis of a city’s description what thematic classification it appears under. In addition, many concepts would be equally at home under some other city or rubric. In *Isidora*, for instance, desires become memories, blurring the thematic rubrics of ‘Cities and Memory’ with ‘Cities and Desire’. In *Euphemia* memories are traded every solstice and every equinox, exchanging the theme of memory with that of trading. So, the semantic identity of either the discrete city descriptions or
the thematic categories is not unambiguously defined. Peponis’s idea of
symmetries notwithstanding, meaning in *Invisible Cities* is multi-scalar and
multiform, fluid at the small scale of individual tales and more stable and
fixed at the scale of the overall narrative structure.

The individual tales evoke conceptual relationships that express
variations of the four symmetries in the tessellation. Reflection is
systematically encountered throughout the fiction, as most cities have a mirror, an opposite or a double, such as *Valdrada*, which consists of twin cities, one erected above a lake, and the other reflected on water, or *Moriana*, which has a face and an obverse that cannot be separated or look at each other. Translation characterises those cities that are created and abandoned, this process being repeated in another location, such as *Eutropia*. Glide reflection occurs in cities which have a copy that influences the original. In *Eusapia*, for example, the inhabitants build an identical double of the city underground (reflection). As the city of the dead makes innovations that evolve over time (expressing a horizontal shift on the plane, or translation), the *Eusapia* of the living copies the novelties of its underground copy (denoting a reflection which together with translations provides glide reflection). Finally, rotation is expressed through cyclical patterns as in *Sophronia*, which consists of a permanent half and a temporary half. The former is made of stone and periodically shifts on trailers, returning to the original place after a certain time.

*Invisible Cities* is permeated with images and modalities that on the whole express two things: first, the four local-scale symmetries and their permutations, conveying the ideas of organic growth, transformation, evolution and adaptation; second, the idea of a combinatorial syntax between the physical city erect on the ground and the city in the mind as representation through language, signification, discourse, perception, nature, knowledge of the past, projections into the future, memory and desire; or a mathematics of combinations between signifier and signified. The four symmetries evoke the idea of tessellation, gradually constructing a representation of the narrative structure as a network in the reader’s mind. At the same time, additional transformations are present in the text, such as rarefaction, bifurcation, scaling, indivisibility and *mise-en-abyme* (multiple reflections), working in a similar manner. Rarefaction characterises ‘Thin Cities’ like *Armilla*, consisting of a forest of pipes, or *Zenobia*, sitting on piles. These cities are disembodied and skeletal, devoid of the mass and weight we find in normal built structures. Bifurcation is found in cities in which travellers reflect on the multiplicity of routes during their journey, expressing the Borgesian theme of forking paths. Scaling and *mise-en-abyme* are encountered in cities like *Fedora*, in which small copies of the city are exhibited in a museum of metal, or in *Olinda*, which grows in circles, each circle blossoming inside the others. Finally, indivisibility is a characteristic of cities like *Zoe*, in which everything is exchangeable with everything else.
Plotting the transformations used in each city on the diamond shape provides a more detailed algorithm of symmetries in a tessellation than the original notation (Figure 3.6). If the network in the diagram provides the algorithm, the letters are the alphabet, expressing the interplay of mathematics and language in literary combinatorics. Combinatorics is the branch in mathematics that counts the number of ways objects can be combined or ordered. Given a number of different elements $n$, the number of arrangements that can be made of them in any order is expressed by their factorial $n!$, calculated as $1 \times 2 \times 3 \times 4 \ldots \ldots \times n!$. In the case of the four symmetries we have 24 combinations. Eco explains that such ‘calculuses-algorithms’ are employed in the solution of problems, but ‘they can also serve as discovery procedures, that is, procedures for inventing a variety of possible scenarios’. They work as expression systems, which can reveal possible content systems.

*Invisible Cities* is the most characteristic expression of what Calvino meant by the combinatorial imagination: ‘a multi-faceted structure in which each brief-text, value or concept is close to the others in a series that does not imply a logical sequence or hierarchy, but a network in which one can follow multiple routes and draw multiple, ramified conclusions’. This refers not only to the many ways in which it is possible to circulate through the fiction, but also to the relationship between the networks of images in the text and what they mean, or the signifiers and signifieds. In *Hypatia* the traveller realises: ‘I had to free myself from the images which in the past had announced to me the things I sought’. The power of *Invisible Cities* to stimulate the imagination lies in its capacity to convey a multiplicity of virtually embedded combinations leading to the generation of possibility, to meanings that are factual as well as potential and dynamic. Like the philosopher Raymond Lull (see Introduction, note 65), Calvino has created a combinatorial system where symmetries and thematic rubrics rotate on a wheel system, a type of computer, where meaning is encoded through the potential of the system rather than persistently expressed as a static representation. This strategy exposes readers to a wealth of unexpected associations, and generates alternative worlds through a process of combinations, training their imagination.

If we return to the way in which the geometrical ideas are embedded in the semantic content of the text, we see that multiple references to ‘cogwheels’ and ‘spider webs’, ‘interchangeable data’, ‘symmetrical motifs in a carpet’, ‘crystals’, ‘carousels’ and ‘kaleidoscopes’ express the idea of the network in readers’ minds. More significant than these signifiers of symmetrical exchanges, though, are the mental operations constructing step by step the shuffling relationships among elements,
Reflection, inversion; duality; doubling; copying
Translation, repetition + displacement + shift
Glide translation, inversion + repetition
cycle
Rotation, decreasing density – Thin Cities
Rarefaction (Rf), interconnectivity + synchronicity
Bifurcation, reproducing; copying in smaller size
Scaling, identity; sameness
Indivisibility, nesting
Mise-en-abyme

Figure 3.6  Italo Calvino. Invisible Cities. Notation of narrative structure and transformations embedded in the description of cities. Drawing by the author.
actively invoking the tessellation in the reader’s mind. This way of cognitively constructing the network is based on three main strategies: first, modularising the fiction through city descriptions, or discretising the representation of units in the narrative; second, doubling, splitting, copying and multiplying the narrative units in each text through symmetry operations, leading to many units – copies of the original – that are linked in a network-like structure; third, dissociating the signifier (the original unit) from the signified (the copies) through transformation over space and time. For example, the miniature models of Fedora in a museum inside Fedora exemplify the operations of mirroring, scaling, multiplying and mise-en-abyme. With time, these miniature models no longer resemble Fedora, which undergoes transformations that make it a different Fedora from the original and its copies. These strategies enable units to shift and express a variety of meanings. By repeating these microscopic rules in every city description, Calvino makes them accessible to intuition and visualisation, helping to assemble the idea of tessellation both as a single static shape and as an evolutionary network in the mind.

‘This route was only one of the many that opened’

[I]t would suffice to play a game according to the rules, and to consider each successive state of the board as one of the countless forms that the system of forms assembles and destroys.

Italo Calvino, *Invisible Cities*

[I]t is not sufficient to have the whole world at one’s disposal – the very infinitude of possibilities cancels out possibilities, as it were, until limitations are discovered.

Roger Sessions, quoted in Nelson Goodman, *Languages of Art*

*Invisible Cities* not only invokes the idea of the combinatorial novel through the symmetry operations in the text, but also allows multiple reading sequences and points of access. At the end of the fiction we encounter Polo and Kublai in their last dialogue on utopia. Polo advises the Khan ‘to recognise and learn who and what, in the midst of the inferno, are not inferno, then make them endure, give them space’. This final statement suggests that the fiction is potentially one of those things that can train us to ‘to recognise and learn’ through ‘constant vigilance and apprehension’ what is the ‘inferno’ and escape it. Polo’s advice and the folding of the diagram into a ribbon point to a second
reading. Returning to the first pages, we encounter Kublai pondering about the diamond shape of his empire. The cities of Diomira and Isidora welcome us again, speaking of travellers that have passed through them, as we did. In Dorothea, which follows, we are reminded that the route that led travellers’ caravans to it ‘was only one of the many that opened’, alluding to the many reading routes in the fiction.\textsuperscript{52} We are at this point invited to consider possible pathways other than Calvino’s route, which we have followed. With the directionality of the sequence we habitually follow suspended, we wonder which of the 55 cities best escapes the inferno, or what defines our escape from it, our own route and exit from the fiction. As Calvino writes:

A book, I believe, is something with a beginning and an end (even if it is not a novel in the strict sense of the word); it is a space into which the reader must enter, roam around, maybe lose direction, but at a certain point will find a way out, or several ways out, or just the possibility of opening up a road to come out.\textsuperscript{53}

The idea of endless choice at first seems liberating. Yet, the simple operation of freely circulating through the book entails key questions: what is the significance of open points of entry and exit? How many paths including all the cities in a sequence are there? We can use the formula from combinatorics we previously described: $1 \times 2 \times 3 \times 4 \ldots \times n!$, where ‘n’ is the number of entities to be combined, expressed as ‘factorial n’ or ‘n!’ The 55 city descriptions and the 18 dialogues that make up the book lead to 73! distinct sequences. The value that this formula gives is: $4,470,115,462 \times 10^{105}$. If we assume that each of the possible sequences constitutes one book, we have $4,470,115,462 \times 10^{105}$ books, a number so vast that it is impossible to grasp or imagine.

To give an intuitive idea of the scale of possibilities we are dealing with, we can use William Bloch’s computations and compare them with the size of the universe.\textsuperscript{54} Current research approximates this size as being about $1.5 \times 10^{26}$ metres. To simplify the calculations, Bloch supposes that the universe is shaped like a cube, each side of which measures $10^{26}$ metres and whose volume is therefore $10^{26} \times 10^{26} \times 10^{26} = 10^{78}$ cubic metres. If we can fit 1,000, that is, $10^3$ books in one cubic metre, then our universe, if it consisted of nothing but books, would contain $10^{78} \times 10^3 = 10^{81}$ books. It would therefore take

$$\frac{4,470,115,462 \times 10^{105}}{10^{81}} = 4,470,115,462 \times 10^{24}$$

universes the size of ours to contain the variations of Invisible Cities.
We can reduce the vast number of books by devising sequences that keep the order of cities in each thematic classification constant, but combine the thematic categories in different ways to produce different sequences, each forming a different book. This gives a number of 39,916,800 sequences. We can reduce possibility further by combining the nine chapters, yielding 362,880 different ways to read the fiction. Finally, there are 120 possible sequences of combining cities within each chapter (5!). It is worth recalling that most descriptions of cities indicate an infinite process of subdivision into smaller units or multiplication. So, to the enormous potential of the book we could add the stories that could spring from the city descriptions to which these texts serve as a preface, summary or review. In *Chloe*, for example, ‘in each encounter people imagine one thousand things about each other’; in *Zobeide* all men had a similar dream and built the city like the one in the dream; in *Zaira* old men tell the story that the city ‘contains in its measurements of its space the events of the past’.

Embedded as a potential in *Invisible Cities*, combinatorial explosion implies that the imagination is a revolving axis on which turn all the possibilities that have a place inside and outside the fiction, in the minds of the inhabitants of the cities Polo describes, and in the minds of the work’s readers, their own imaginings, fears and dreams. As an exercise in theoretical possibility, combinatorial explosion leads to an unimaginable quantity beyond human conception. Even with the smaller number of sequences enumerated above, we need to extend beyond the bounds of life to read the fiction according to the number of possibilities it enfolds. What is the significance of an enormous number of sequences beyond intuitive reach, and how can it be relevant to the reader? To answer this question, we need to return to the structure of the fiction.

‘The answer it gives to a question of yours’ – emergent global patterns

In *Invisible Cities* Calvino uses elements that are grouped in four main sets: narrative units (city descriptions), thematic categories, numbers for each city and chapters. If it is through the thematic categories, ‘Cities and Memory’, ‘Cities and Desire’ and so on, that the tension between the city and its representation is thematised, what is the logic that distributes cities into these categories and these categories into chapters? Answers to this question can be explored through a diagram based on connectivity relations among thematic classes (*Figure 3.7*). Each time a city belonging
to a category is co-present with a city from another category in one or more chapters, we add a link between the thematic categories they are part of. The resulting representation is a graph in which thematic classes are the nodes and the connectivity links between them form edges, the lines connecting nodes. We can calculate the ‘closeness centrality’ and ‘betweenness centrality’ of each category, both being measures from network theory, which were used in the analysis of Venice. Closeness centrality captures the average number of ‘steps’ each class is ‘away’ from the others. Categories that are ‘close’ to every other category draw them all to themselves, whereas those that are ‘distant’ are less connected. It is worth explaining that closeness and distance is not metric but topological, in the sense of how many steps away in the graph is each element from the others. Betweenness centrality accounts for the shortest paths between all pairs of categories. If, for example, during reading, we move from a city description under the heading ‘Cities and Trading’ to one under the theme ‘Cities and Names’, this measure captures which thematic categories form the ‘shortest’ conceptual links between them.

All thematic groups have almost equally strong values, demonstrating the multi-focal nature of the network of thematic classes. This means that whichever page we are on in the fiction we are not far away from every other thematic class or from the shortest paths between them. However, ‘Trading Cities’, ‘Cities and Eyes’ and ‘Cities and Names’ have the highest values in the system. This means that, although the book can be read in different ways by skipping through the pages, the conceptual links that connect every thematic category to all others are formed through these three classes. The more readers explore Invisible Cities, rehearsing different routes, the more likely they are to discern that in most reading paths they encounter these three rubrics.
What is the significance of the conceptual symmetries based on Names, Eyes and Trading? In ‘Cities and Names’, cities do not match their descriptions, as they shift with the daily routines of people’s lives. In ‘Cities and Eyes’, people either marvel at the visual qualities of their city, or, failing to engage with it, distance themselves from it, ‘contemplating their own absence’. In ‘Cities and Trading’, they trade memories or build new cities, resuming the roles they had in the previous city. The centrality of Eyes, Names and Trading highlights the importance of eyes in seeing and perceiving, names in identifying concepts in language, and trading in exchanging information in communication. For Calvino, Names, Eyes and Trading are at the juncture of thought with the visible world. Our knowledge begins with names or labels assigned to material things. The word ‘bird’, for example, is a universal term for both any particular bird and an unimaginable number of birds. Similarly, Invisible Cities is a particular sequence and an unimaginable number of sequences. The way in which the countless sequences are bound into the specific one (the one used in the fiction) is through the topological symmetries on the thematic categories of Names, Eyes and Trading. Calvino seems to suggest that the acts of seeing, naming and exchanging are what make entities identifiable, categorisable and transformable by human minds.

To Kublai’s observation that ‘his dreams are composed either by his mind or [by] chance’, Polo responds that ‘cities also believe they are the work of the mind or of chance but neither the one, nor the other suffices to hold up their walls. You take delight not in a city’s seven or seventy wonders, but in the answer it gives to a question of yours.’ In Invisible Cities, Polo asks Kublai, and Calvino the reader, to recognise the centrality of eyes, names, and trading as the way of escaping their own ‘inferno’. Escaping can range from defying dysfunctional cities to re-imagining our urban realities as a way to overcome their dysfunctionalities. Calvino provokes readers to ‘learn and recognise’ neither the diamond structure (the work of the mind) nor chance (the unimaginable number of random sequences), but their relationship. This relationship concerns the interplay between possibility and the rules that limit the number of variants to those permutations that organise the work, rendering it meaningful to oneself and to others.

So, our ability to grasp the rules in the fiction works in three, at least, interrelated ways: the first refers to operations which get into the text through geometric symmetry, defining microscopic conceptual relations; the second is related to topological symmetry, establishing relations of all-to-all thematic rubrics, or macroscopic patterns; the third concerns a visual kind of understanding, based on the diamond shape, a pattern
we can grasp all at once. If local symmetries gradually assemble the network as a figurative structure in the mind, topological relationships lead to perception of large-scale centralities in this system. We may look at the notation and comprehend its visual structure, but it is through reading that we can gradually ‘learn’ and ‘recognise’ its invisible patterns. It is not argued that all these types of understanding are consciously absorbed by all readers. However, they are built into the text and are available to human intuition.

We encounter here the definition of imagination as *ars combinatoria*, the art of uncovering combinatorial rules and restrictions that govern the placement of information objects. In fact, all information systems can be reduced to combinatorial patterns in this way. It is from the restrictions in the combinatorial possibilities of letters that we can derive meaningful words, and it is the combinatorial rules inherent in the grammar and syntax of language which allow us to construct meaningful sentences. Pioneers of *ars combinatoria*, such as Lull, sought to understand the power of combinations to express and develop universal languages. Lull came up with a mechanism of three concentric circles of decreasing size inserted into each other. By turning the wheels, Lull could build statements consisting of 84 possible combinations. Calvino was acquainted with the work of Lull, to which he referred in his essay ‘Cybernetics and Ghosts’ as one of the ‘most arduous intellectual efforts of the Middle Ages that had become entirely real’.

**Il Milione – the work and its author(s)**

When you return to the West, will you repeat to your people the same tales you tell me?

Calvino, *Invisible Cities*

The idea of literature as a combinatorial machine is hardly unique to Calvino. McCaffery explains that it was explored by Mallarmé and Valéry, and has been more systematically developed by structuralist critics such as Roland Barthes, Claude Brémond, A. J. Greimas, Vladimir Propp and Tzvetan Todorov. For these writers, a book expands beyond its own boundaries to wider adventures of knowledge in literature, music, poetry, scientific laws and open-ended systems in mathematics. A work therefore is not simply an individual achievement, but also the result of collective formation. *Invisible Cities*, for example, invokes among other works Marco Polo’s *Il Milione*. John Man writes that the original version of *Il Milione*
was written in courtly French by Rustichello following Marco’s dictation, and even incorporated Rustichello’s own tales, but that it was eventually lost. One hundred and fifty copies of it are known to exist, some of which include extensive footnotes and annotations. The hand-made copies of Marco’s book multiplied, ‘many with glorious and utterly spurious illustrations’. The copiers did not simply copy, but ‘misread, shortened, omitted, corrected and translated, sometimes well, sometimes wrongly or badly, so that changes multiplied with every version, and no one could tell what was Marco’s and what wasn’t’. The 150 surviving manuscripts are in many languages, while several are translations of translations. Sometimes translations are ‘in a sixfold sequence: from French into Italian, into Latin, into Portuguese, into Latin again, and finally back into a French vastly different from the first French version’. In its various editions *Il Milione* is, for instance, between 60,000 and 140,000 words. But even the (lost) original is itself a ‘version’ of Marco Polo’s story, which was recounted to Rustichello, who interpreted it, converting Marco’s memories into marvellous stories with paper and quill pen. As Man explains, ‘still no one knows what Marco dictated, and what Rustichello wrote’.

*Il Milione* was recognised as the most important account of the world outside Europe at that time and paved the way for the European voyages of exploration. Christopher Columbus had owned a copy printed in 1490, which contained his observations in the margins. Marco’s book also had an impact on the development of cartography. It informed Fra Mauro’s *Mappa Mundi*, a portolan chart created by a monk from the island of Murano in the Venetian lagoon, with toponyms of Chinese cities familiar from *Il Milione*. For Man, ‘Polo’s memory in the book was vague, and he made mistakes and pretended, and exaggerated. But […] Kublai Khan’s China really was a land of millions.’ Laurence Breiner states that *Il Milione* is a ‘haphazard recall of discrete bits of travel memory, lacking the chronological sequence of a travel diary, a prison rumination, told to an amanuensis’. According to Henry Yule, Marco ‘was the first traveller to trace a route across the whole longitude of Asia, naming and describing kingdom after kingdom’. Accurately marking distances according to days of travel, Marco is considered as the precursor of the scientific geographer.

Calvino had a different view of Marco Polo’s *Travels*:

In all centuries there have been poets and writers that were inspired by *Milione* as a fantastic and esoteric scenography: Coleridge in his famous poetry, Kafka in the *Message to the Emperor*, Buzzati in the *Desert of the Tartars. One Thousand and One Nights* can pose a similar fate: books that become like imaginary continents in which
other works of literature find their own space; continents of ‘elsewhere’, which today we can say do not exist anymore, as the whole world tends to be uniform.\(^{71}\)

It is more the imaginary geography of Polo’s travels and the imaginary ‘library’ of these books that attract Calvino to *Il Milione* than the accuracy of the original or the authenticity of the copies. Quoting Coleridge and appropriating *Il Milione*, he invites readers to *suspend disbelief*, and envision *Invisible Cities* in a larger network, a constellation of other books, maps and records of recounted legends and travels.\(^{72}\)

Just as the 150 known copies of *Il Milione* are appropriations and variations on the original, which is itself an interpretation, when Kublai asks Marco whether, on his return, he would repeat his tales, Polo replies that these will be changed ‘by a writer of adventure stories to whom he might dictate them at the end of his journey’.\(^{73}\) Polo’s anticipation projects from the mythical time of the novel, and the historical time of Marco’s presence in Kublai Khan’s court, to the time in which his travels ‘would be written’ by Rustichello (after Polo’s return to the West), alluding to the copiers of the book, and the oral rehearsals of the stories, multiplying each time through a different listener and narrator. This forward leap in time makes readers conscious of their own historical time, introducing the possibility that *Invisible Cities* prefigures *Il Milione*, or that Calvino’s fiction is the original source of Marco Polo’s descriptions, or just one copy in the series of imperfect copies following Rustichello’s version. An alternative possibility is that *Invisible Cities* is not Calvino’s own but a pastiche narrative, the outcome of multiple appropriations by a plethora of authors. It is as though the stories Calvino recounts have been passed to us through generations since time immemorial.

Calvino’s fiction is indivisible from the collective project of literature, history and geography, of recording, mapping and writing. *Invisible Cities* runs as mythic historicity based on *Il Milione*, a piece of literary history continuously adapted over time. It combines the order of the actual with the order of the possible, so that the historical provenance of Polo’s travels can be appropriated by the mythical desires of the imagination. More importantly, it encourages readers to understand the work as a dynamic, extendable and variable fiction, part of a library of fantastic literature, a collective project of humanism, universal experience and world memory. We encounter here Barthes’s ideas that the text depends not on its origin but on its destination. In his work *The Death of the Author*, Barthes proposed that the text consists of several writings, issuing from
several cultures, and that the reader is someone who holds in a single text all the paths of which the text is constituted. If the city is the analogue for literature and the text, it is Barthes’s question of author and reader, origin and destination, that echoes throughout the novel, translating the dialogues between Polo and the Khan into a dialogue between Calvino and the reader in the reader’s mind. The two characters and what they stand for are the force through which the key questions in the fiction become thematised: If cities inform Calvino’s imagination, do architecture and cities as collective products of people also have an imagination of their own? How can they learn from this fiction? At the heart of these questions lies another one: Who produces cities and texts, and who owns them?

Variability of manuscripts was a common phenomenon in the Middle Ages. As Carpo explains, the modern technology of print ensured the production of exactly repeatable imprints, removing the possibility of errors in texts, which for many centuries had been ‘mosaics of citations, interpolations, additional subtractions and plain copy errors’. Calvino lived before the digital age of wiki-based interaction, which allows users to add, delete or revise content through a web browser, as in the pre-mechanical age of reproduction. However, like a contemporary Wikipedian, surrounded by the works of known and unknown authors, Calvino enfolds readers into the combinatorial adventures of the text and invites them to ‘write’ their own variations. Seizing a narrative that is the amalgam of collective textual interaction with the work of a single author (Marco Polo), Calvino seizes an opportunity for story-craft. This concerns the intersection of multiple authorships: those that are virtually embedded in his own intellectual production and those that are virtually generated by the reader of his work. In a fiction based on an analogy between making stories and making cities, what the author says is that cities are neither the work of the mind nor the outcome of mindless assembly, but the interaction of individual authors with that which is collectively transmitted and imagined. Cities are produced by multiple, multiform, overlapping ‘authorships’. Cities, like people, have imaginative minds.

‘The great Khan owns an atlas’ – the spatio-temporal imagination

The Great Khan owns an atlas where all the cities of the empire and the neighbouring realms are drawn, building by building and street by street, with walls, rivers, bridges, harbours, cliffs.

Calvino, *Invisible Cities*
In the last two dialogues between Polo and the Khan the interaction between single authorship and collective authorship becomes central to the discussion as the two characters examine the Khan’s atlas. Each section of the text begins with the phrase ‘The Great Khan owns an atlas’, reminiscent of the repeating sequences of cities and their numbers. The atlas contains ‘all cities of the empire and the neighbouring realms’, gradually expanding to a catalogue of all possible places. Polo recognises on the map cities he has visited, such as Constantinople and Jerusalem; cities he knows ‘by word of mouth’, such as Granada, Paris, Nefta; places that do not exist, such as Thomas More’s Utopia; those that did exist but fell into ruins, such as Troy and Carthage; cities that will exist or might exist, and finally those that are as yet imagined. From the fantastical places Polo describes, readers are suddenly catapulted into a description of cities of their own historical reality at the end of the book. Containing all cities, past and present, contemporary, fantastical and possible, the atlas must also contain Polo’s imaginary cities. Through the atlas Calvino articulates a vision of *Invisible Cities* coincident with the world of the factual, the imaginary and the possible.

In contrast to this totalising vision of the geographer’s eye and the writer’s inner eye, which sees places mapped on the surface of the atlas all at once, the last section of the penultimate dialogue shifts back and forth in time. From a backward flash to Troy and Carthage, recalling Homer’s and Virgil’s epics, it moves forward to the seizure of Constantinople, finally dashing to San Francisco, New York, Los Angeles and Kyoto–Osaka. At the point where we recognise the current capitals founded by immigrants in the Pacific and the Atlantic, a millennium after the empire of the Khan, we become aware that not only the empirical universe, but also our own native system of reality, is enfolded in the fiction. Temporally dislocated and coexistent with Polo and the Khan, our ‘eyes’ follow the characters’ ‘eyes’, scanning over the geography and the history of explorers, founders, conquerors, immigrants, travellers. Our empirical universe thus merges with the textual world and potential other worlds not present but implied in the fiction.

If the atlas represents both spatial and temporal knowledge, we can express the perspectives it enfolds in Figure 3.8. The x-axis shows cities mentioned in the text in narrative time, that is, the time it takes to move through the text expressed by the sequence of places it describes. The y-axis represents historical time, corresponding to when these cities were founded or encountered by Western explorers. The diagram reveals that Calvino describes an enormously dilated spread of historical time, in a condensed span of narrative time. Of these centuries, of these cities
that were swallowed by the sands, only a few fragments, a few shards of memory can be retrieved and survive. The disproportional relationship between, on the one hand, the enormity of the atlas and the time of recollection (22 centuries) and, on the other, the time available to recollect (the narrative time, expressed through short dialogues) presents the tension between the totality of knowledge and the destructiveness of time. The imagination and the world’s knowledge work with memory fragments from the past, which can never be possessed, but can be reconstructed and re-imagined. The reader’s desire to imagine through

**Figure 3.8** Italo Calvino. *Invisible Cities*. Diagram of narrative space-time (x-axis) and historical time (y-axis) in the penultimate dialogue between Marco Polo and Kublai Khan. Drawing by the author
Invisible Cities becomes blurred with Kublai’s desire to possess his empire and Polo’s desire to continue interpreting the world through stories from his travels. Moreover, it is mixed up with the collective desire for remembering, preserving, transforming and aspiring, the factual and the imagined, through multiform cities, books, empires, conquests, discoveries, population shifts, immigrants’ travels.

As readers access a world of possibility through Polo’s cities and cities in our actual world, they are overcome by the desire to savour them and to transform them. They are thus made to consider the constraints that may prevent Polo’s fantastic cities from materialising; and the limitations in shaping their reality or previous realities that no longer exist. Conversely, readers are asked to examine why their particular reality has evolved in this way, whether it could have taken a different course or what prevents it from being transformed in the future. If Polo’s present, in Kublai’s garden (in the fiction), defines our historical past and if his future is our present, what he could once change (his future) he can change no more. But this makes us aware that our present affords possibilities for transformation. We leap back to Polo’s time and dash forward to current time not to change the possibility in the past that has materialised as the present, but to discover a third possibility that is not yet voiced but may exist. We can in this way look for the constraints that must be breached for it to be realised, in the combinatorial game of the possible.

Invisible Cities does not have a traditional closure like other narratives, advancing the action towards an end and a solution. Yet, by engulfing the reader in the fictional world at the end of the novel, Calvino offers a resolution to the dilemmas and dualities, the mirror-like oppositions and labyrinthine convolutions of images, arguments and thoughts contained in the description of cities and in the dialogues between the two actors. Instead of a relationship between Polo and the Khan (undisciplined imagination and analytical rationality), we are faced with a configurational interdependence between three parties. The two characters and their philosophical positions are at the end understood from a third perspective, the reader’s, the third channel whose very presence externalises and synthesises the encounter between the two opposite channels of thought: on the one hand, the imagination as possibility, which is spontaneous, random, inexplicable, infinite, subjective and episodic; on the other, analytical rationality, which is ordered, reasoned, objective and subject to universal laws and constraints.

The imagination, Calvino wrote, is the union of the ‘spontaneous generation of images and the intentionality of discursive thought, a
plan carried out on the basis of a rational intention’.\(^8\) We recognise here Polo’s habit of generating images and the Khan’s interest in knowledge and discourse. Together they constitute Calvino’s imagination (and the reader’s) as an empirical historical person with a consciousness and unconsciousness. The second definition Calvino gave to the imagination is as something outside the self, ‘an electronic machine that takes account of all possible combinations and chooses the ones that are appropriate to a particular purpose’.\(^9\) The imagination spans the ‘repertory of what is potential, what is hypothetical, of what does not exist and has never existed, and perhaps will never exist but might have existed’\(^9\) This second definition concerns the countless combinations embedded in the text and the other works of fiction to which it relates, all seen as the collective project of society. Combining our empirical world with the textual world and the universal imagination, Calvino advances *Invisible Cities* as a model for creative invention.\(^9\) His proposition is that the juxtaposition of Polo and the Khan presents the paradox of the imagination either as personal, random, obscure and subject to pure chance and flights of fancy, or as the outcome of universal laws that are pre-existing, passively received or waiting to be discovered. Introducing the reader (and writer), he advances the proposition: the imagination and its products, whether cities, buildings, poems or texts, are neither the outcome of individual minds nor the mindless creations of society, neither factual nor virtual. Cities are artefacts at the juncture where multiple authors meet individual empirical authors, and where empirical reality and its laws intersect with possible worlds.

**Imperium and emporium – the role of Venice in Invisible Cities**

What then is the significance of Venice in the fiction? Once Polo refuses to speak of Venice, Venice emerges as a secret watermark beneath the surge of changing images that the combinatorial game of opposites creates and distorts. Across the chessboard of the Khan and over his atlas, two empires, China and Venice, exchange domestic products and foreign treasures. The Khan is the instrument of *imperium*, of ‘boundless extension of the territories he has conquered’.\(^8\) Polo, instead, sails out from a unique bounded city that thrives because of people like him, the agents of *emporium*. Had the two characters met in Venice rather than in Kublai’s court, Polo would have conducted his business from the Rialto.
The Khan instead would have presided from the room with maps and
globes in the Doge’s Palace at San Marco (Sala dello Scudo). Proponents
of opposite models of thought, the two characters soon speculate about
whether they are imagined by one another. Although different, they turn
to two facing mirrors, multiplying and dissolving the diversity of the
world into vast quantities of interchangeable data. Examining the atlas
of real cities at the end of the fiction, Polo forewarns the Khan that ‘where
forms exhaust their variety and come apart, the end of cities begins’.85
What is at stake, therefore, is something larger than the marvels of the
cities readers linger over in the text. What attracts the reader’s attention
at the end of the work is the capacity of cities to give different forms to
different desires. If sameness signals the end of cities, it is only through
imaginative diversity that they can blossom and inspire.

Calvino considered Venice to be a model of complexity. He
described it as a labyrinthine anti-Euclidian city, a net-like topography,
which invokes the idea of infinity.86 There are significant analogies
between the structure of Venice’s spatial networks and the concep-
tual structure in the fiction. Both consist of discrete, small-scale units
that are aggregated into networks. The large number of divisible and
combinable elements in Calvino’s text can be compared to Venice’s
urban fabric, which consists of discrete islands, buildings and plots
which are recursively linked, such as squares, churches, bell towers,
wellheads, bridges and loading steps. Both *Invisible Cities* and Venice
have a poly-focal structure and overlapping networks whose organising
strength is almost equally distributed into multiple centres. Both have
patterns that emerge out of the collective logic of elements, rather than
a pre-conceived idea of a whole. Consisting of a street network and a
canal network, Venice is made of ‘one side and an obverse’, the phys-
ical city and its reflection, like most cities in the fiction. Further, like
*Invisible Cities*, it has a propensity for doubling and splitting into twin
structures: the merchant city of wares and clocks, and the imperial
city of rituals and conquests; the city pieced together by ‘multiform
treasures’, and the bureaucratic city of ideal conceptions; the physical
city of drainpipes and water, and the mythical city of celestial order or
the geometrical design of carpets. These structures emphasise a dual
process: making the physical city and constructing the city of invisible
patterns. The latter is manifested in activities, beliefs, rituals, written
records, legends, history and mythologies, through which we know
society and recognise culture.

Hillier explains that almost every city is composed of small, local-
scale elements. The aggregation of these elements into global structures
emerges out of a dual process, one facilitating movement in order to support micro-economic activity, the other controlling movement that might undermine inherited customs. This generic city-making process is one in which the city creates two kinds of network, one in the economic realm, the other in the socio-cultural domain. The former encourages the generation of unexpected events and information, informality, diversity and inclusiveness, marking differences of individuals rather than social categorisations. The latter preserves socio-cultural and informational stability based on redundancy, formality, hierarchy, exclusiveness and sameness. The first side of the process is generative, privileging morphogenesis over stability; the second side is conservative, favouring the stability of structures over and above unpredictable events.

In Chapter 1 (City-craft) I described how these two processes of the generic city gave rise to Venice, and how Venice’s identity was formed by these two processes. In the early stage of its life Venice privileged the first side of the city-making process through open-ended networks of communication. In later stages, which I discussed in Chapter 2 (Statecraft), it shifted its emphasis towards the second side, privileging stability through institutional structures, rituals, political ideology and historiography, all of which found expression in the Myth of Venice as the Most Serene Republic. In the Khan’s search for unities we can see the attempts of the Venetian state to expand the Piazza San Marco, integrate it with the city and re-invent it as the ancient Roman forum. In Kublai’s anxieties regarding the formless ruin of his empire we can read Cristoforo Sabatino’s and Marcantonio Sabellico’s reassurances about Venetian political perfection and visual form. Beside the dialogues between these two impulses, Calvino juxtaposes the practice of reading, the pleasure deriving from the text and from the experience of moving, viewing and living in cities. He trains readers, not in how to subjugate the variety of cities through excessive ideology, consumerism or bureaucracy, but in how to experience them in the three-dimensional world; how to generate potential other Venices from this experience, giving to different desires different forms.

I do not argue that Calvino wrote Invisible Cities as a literary model of Venice, as these attributes of Venice are generic characteristics of many cities, particularly when we think that Venice influenced Western ideas about cities and their governance. In addition, his fiction establishes movement towards other places and fictions that are present or absent from the text, training readers to think creatively and re-imagine cities in a combinatorial game across form, function and meaning. What is arguably more important than the structural
analogy between Venice and the fiction, though, is Venice’s explicit absence from the text, Calvino’s poignant way of drawing attention to the fact that if today’s Venice is present, tomorrow it may be present no more. In his dialogue with the Khan over Venice, Polo admits his anxiety that, once fixed in words, memory’s images are lost. This seems to allude to the diagrammatic structure of the fiction as a mnemonic device and to the classical art of memory. The art belonged to rhetoric as a technique by which the orator could improve his memory and give long speeches through an association of images with places and words. Frances Yates writes that ‘the first thing was to imprint on the memory a series of loci or places […] We have to think of the ancient narrator as moving in imagination, through his memory, building whilst he is making his speech, drawing from the memorialised places the images he has placed on them’. Calvino articulates a vision for knowledge as the interplay of fixed image and combinatorial emergence (in the process of reading the fiction) rather than possessing it a priori as a memory palace, diagram, model or map.

Postscript

Calvino’s text enables the exploration of the creative imagination in the medium of literature, a world in which in spite of its own laws and constraints the writer remains essentially free to innovate. The challenge for the creative imagination in the medium of architecture is to exercise innovation at the same time as confronting the physical and practical realities of the city. Yet it is through this resistance that architects can be inventive and that great architecture can come about. What might be seen as an obstacle to creativity in the end becomes an essential component of the creative process. The work of Palladio and Le Corbusier, two architectural minds engaging with Venice but centuries apart, will allow us to investigate this proposition in the following chapter.
Figure 4.0  Palladio. Villa Rotonda (top). Le Corbusier. Tokyo Museum (bottom). Drawings by Athina Lazaridou