Plan analysis of historical cities: a Sino-European comparison

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Abstract. *Until recently Chinese and European approaches to the study of historical urban form have differed markedly. Here a comparison is made of the historico-geographical development of the ground plans of the walled cities of Como, Italy and Pingyao, China. Adopting a largely Conzenian approach previously mainly employed in Europe, considerable use is made of field surveys and series of large-scale plans to map patterns of change over time in streets, plots and the ground plans of buildings. In both cities, series of planned developments over some 2000 years have left major physical legacies that have acted as frameworks for long-term morphological development and given rise to distinct intra-city patterns of present-day physical forms. Cross-cultural similarities in the processes of development are revealed, especially with regard to the influence of ancient street lines, plots and successive city walls. Among the significant contrasts between the two cities are those stemming from socio-cultural differences, notably relating to cosmological influences.*

Keywords: cross-cultural, urban form, ground plan, Conzenian approach, Como, Pingyao

The historico-geographical study of the form of cities may well be entering a new phase. Two developments suggest that this is the case: first, a reawakening of interest in the exploration of links between the different disciplines within which urban form is studied, perhaps most evidently between geography and architecture (Moudon, 1997); and secondly, an apparently incipient growth in the number of attempts at cross-cultural comparison (Conzen, 2009; Conzen *et al*., 2012). These developments have occurred at much

the same time as the increasing interest in historical urban landscapes that has accompanied the growing concern for 'heritage' (Bandarin, 2006). However, these welcome changes have on the whole yet to crystallize in significant substantive outcomes. Major strands of research tend to be poorly interconnected, there is a weak relationship between most of these strands and planning practice, and linguistic barriers between researchers remain significant (Whitehand, 2012). Ill-developed relationships between research on different cultural regions and weak cross-disciplinary links present particularly salient challenges. This paper is principally a contribution towards remedying the first of these. Building on foundations that have been provided in this field by architects and especially geographers, it offers an urban morphological comparison across a major cultural divide, that between China and Europe.

Until the last few years studies of the physical forms of traditional cities in Europe and China have differed in one respect in particular. The Chinese studies have neglected what has come to be seen in Western studies as a fundamental aspect: analysis of what is, for many purposes and many parts of the world, both the smallest and one of the most significant geographical units of human occupation and functioning: the individual plot of land. A major factor implicated in this is the virtual absence in China of true plans, showing plot boundaries, until well into the twentieth century: rare exceptions are small urban areas where the form of urban development was controlled, or at least heavily influenced, by European colonial powers. However, a respect in which Chinese studies have for long outpaced their European counterparts is in their concern for the symbolic aspects of urban form, especially the role of cosmological and geomantic forces (Schinz, 1996; Whitehand and Gu, 2006).

Attempting Sino-European comparisons of urban form when the cultures involved are so sharply contrasting poses a challenge. It is not made easier by the fact that the urban morphological research traditions in these two parts of the world are distinct. The response to this challenge adopted here is to rely to a considerable extent on the approaches of schools of thought that have become associated with two different disciplines: the Conzenian school, within which the principal movers have been geographers (Conzen, 2004), and, to a lesser extent, the Muratorian or Caniggian school, which has received its main impetus from within architecture (Caniggia and Maffei, 2001). Both of these approaches have been largely developed in the Western world. Both have dealt with a wide range of geographical scales, though most notably examining in detail streets, street blocks, plots and buildings, and, especially in the case of the Conzenian approach, the combinations of these forms that have enabled the recognition of hierarchies of intra-urban unitary areas (Conzen, 1988).

Particular emphasis is given in this paper to the layout of urban areas, or what M. R. G. Conzen terms their town plan – composed of the street system, the plot pattern and the building pattern (Conzen, 1969, p. 131) – and little attention is given to building types (except as block-plans), building materials, architectural style, and land utilization. Thus while the broader concern is with the long-term morphogenesis of cities and with concepts, especially Conzenian concepts, that explicate the physical form of change, the more specific focus here is investigation of the spatial structure of the urban ground plan: a field recognized in the urban morphological literature as *plan analysis*. Consideration is given to the implementation of key decisions leading to the skeletal structure of ground plans, modular design of street systems, and characteristic building arrangements within this larger matrix. However, limits of space preclude more than cursory consideration of special morphological complexes, such as administrative and religious precincts, the significance of which at various stages in urban development amply repays dedicated study.

The spatial structure of the ground plans of the historical centres of two culturally representative medium to small cities in Europe and China will be examined, the aim being to

derive insights concerning their similarities and differences and account for these in terms of both broad formative factors and locally relevant conditions. In selecting traditional European and Chinese cities for comparison the representativeness of these cities within their cultural regions has been a major consideration. The chosen cities, Como in northern Italy and Pingyao within Shanxi province in northern China, have been the subject of recent research on which the present comparison builds (Conzen, 2010; Conzen *et al*., 2012; Whitehand and Gu, 2007; Whitehand *et al*., 2011). Both cities have more than 2000 years of history. Such a long history is commonplace among cities in northern China and the Romanized parts of Europe. Both cities have from fairly early in their existence been significant centres within a surrounding area of several 1000 km^2, located on major transcontinental routes, but never ranking among the most important cities administratively or commercially within their continents.

The two cities are in many ways characteristic of their continents with respect to the sources for historico-morphological study that they possess. For Como, as for many European cities of similar size and significance, there exists a series of precise plans, the earliest dating from the mid-nineteenth century. In China most cities still lack accurate detailed plans. However, thanks largely to its designation as a World Heritage site, Pingyao's ancient core was the subject of a detailed survey, including plot boundaries and the block-plans of buildings, in *c*. 2000. Earlier cartographic representations of the city are diagrammatic, that of 1883 showing little more than the approximate lines of streets and the positions of special buildings and other important structures, such as the city walls. With regard to documentary sources, Como has tax records that have enabled fairly detailed mapping of each urban block in the years 1615, 1751 and 1861 (Gianoncelli and Della Torre, 1984). No comparable systematic records exist for Pingyao, the principal records for that city being a number of local gazetteers.

Morphological frames

As in all cities, the plan elements of Pingyao and Como – the patterns of their streets, plots, and building block-plans – have developed in relation to *morphological frames*, namely plan features and topographical outlines whose configurations exert an influence on subsequent development. The more linear and protective of these, notably city walls, can be considered conceptually as *fixation lines* (Conzen, 1969, p. 125). The morphological frames of the two cities both exhibit strong grid characteristics, but are unlike in the degree to which topography influences the extent and orientation of the regularities of those grids.

Pingyao: multiple city walls and consequent streets

The old core of Pingyao, comprising almost the entire city as it existed at the end of the Second World War, is still contained within a city wall constructed towards the end of the fourteenth century. Extending to a little over 2 km^2, this old core is some six times the size of the walled area of the old core of Como (Figure 1). This great difference in size is indicative of the major difference between China and Europe in the sizes of their cities in the medieval period.

Embedded within Pingyao's present walled area are earlier formerly walled areas. Documentary and archaeological evidence of the former walls is minimal but their positions can be hypothesized based on street alignments and other aspects of the city's layout (Whitehand and Gu, 2007). The ancient core contains centrally within it the city's administrative offices, located at the junction of north-south and east-west axial streets (Zhaobinanjie and Xihujing Street–Zhengfu Street) (Figure 1).

This is a type of layout noted by Chang (1970, p. 78) as one of the four commonest street patterns in Chinese cities. The limits of this early settlement (almost certainly originally city walls) are followed now by streets

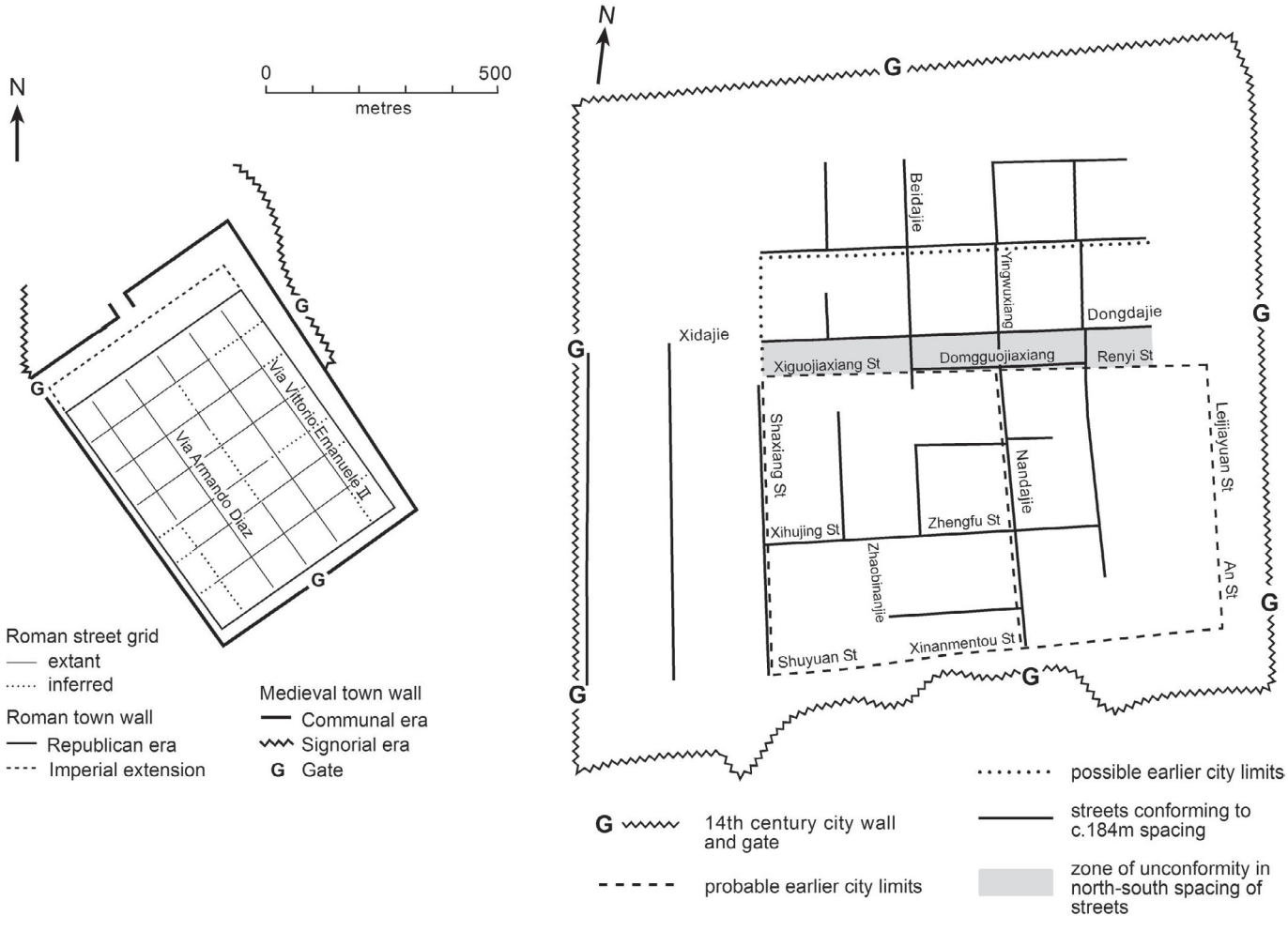

Figure 1. Morphological frames and fixation lines in Como (left) and Pingyao (right).

(Xiguojiaxiang–Domgguojiaxiang, Nandajie, Shuyuan Street–Xinanmentou Street, and Shaxiang Street). Having been developed along a fixation line, these are *consequent* streets (Conzen, 1969, p. 124). These streets and those following the lines of two subsequent city walls inside the present city wall are shown in Figure 1. The present city walls and many of the lines of former walls constitute significant morphological frames that give a historical grain to the city. Some of those farther from the present commercial core are associated with scattered remnants of fringe belts (Conzen, 1969, p. 125) or, in the case of the zone immediately outside the present wall, a continuously surviving fringe belt (Whitehand *et al*., 2011). Institutions, many of them religious or quasi-religious, are frequently located within fringe belts, having started as prominent elements of a zone of spacious plots at the rural-urban fringe but later embedded in the growing urban area. In the south and east of the present walled city, a number of large institutional sites associated with the presumed previous edge of the city are not clearly distinguished from the pronounced fringe belt associated with the present wall, which is in large part extramural.

That the original western city wall continued to mark the edge of the city as late as the mid-fourteenth century is supported by a documentary reference in 1349 to the fact that the area west of Shaxiang Street was still outside the wall (Du, 2002, pp. 40–1). The suggested alignment of the northern wall at this time is the only continuous line of streets between the

previous city limits and the present wall, but the layout of streets and plots at the eastern end of the alignment of streets provides no indication of how it might have joined up with the eastern wall.

Much of the glacis fringing the present wall survives as various types of open space. The intramural component of this fringe belt, consisting of a mixture of quasi-agricultural plots, institutions and factories, is much less continuous. Unlike in Western cities of this size, substantial areas of intramural agriculture existed well within living memory, reflecting *inter alia* Pingyao's recent arrival in the industrial era. They were extensive in the north-west, but also significant in the north-east (C. Zhao, personal communication). By 2007, the road just inside the wall had become an almost continuous, paved ring road – another consequent street.

Como: topography, Roman grid and successive city walls

The compact frame of Como's Roman and medieval city (Figure 1) was influenced strongly by its position in the foothills of the Alpine mountains, fronting the southern tip of Lake Como. The walled city occupies nearly all the available flat ground between mountain slopes aligned parallel to the long axis of the city's plan (Caniggia, 1963, plate IX).

The city owes its existence to its function guarding access to and the supply of one of the key Alpine passes established in Roman times between Italy and northern Europe. Its long axis is precisely aligned with the Via Regina, the great road connecting Mediolanum (Milano) with Brigantium (Bregenz), which ran outside the long south-west wall of the city.

The initial Roman city was divided into square, or nearly square, street blocks. The phases of development and the position of successive perimeter fortification walls have been much debated (Butti 2008, fig. 24; Caniggia, 1963). Many medieval streets, constructed piecemeal, deviated in minor ways from the rigour of Roman straightness, and in a few places a street has been inserted within a Roman grid square. However, the essential street grid of the first phase of Roman development has largely endured.

As the city revived during the medieval period, the interior spaces were recolonized and a stouter fortified stone wall was built (Figure 1). So strong was the Roman 'frame' that the new wall was placed outside the Roman perimeter, but was clearly 'fixed' by the previous wall alignments. By the fourteenth century, the harbour front had developed considerably to serve the trade of settlements that developed along Lake Como, and the last extensions of the city's fortifications were made to include it. However, the westerly of these last extensions occurred in the very location of most active future commercial expansion, so that by the nineteenth century – by which time it was clear that medieval wall defences were unnecessary – it succumbed to redevelopment as the city sought to forge a modern central business district (CBD) between the waterfront and the main railway station to the west. Yet, strikingly, elsewhere the massive tenth-century stone-built city wall, with its huge stone towers, proved too costly to remove, thereby maintaining its preeminence as the city's most powerful fixation line. As such, it has influenced the formation of Como's inner fringe belt, including a tree-shaded, extramural boulevard park, and a second railway line in the shadow of the north-eastern wall (Conzen, 2010; Conzen *et al*., 2012).

Streets and street systems

Pingyao: generations of streets, pseudo-streets and agricultural legacy

A major feature of much of the layout of Pingyao within its present walls is a predominantly square grid of narrow streets. The only extensive areas where this is not the case are the later developed northern and western extremities. Most of the grid is characterized by main streets spaced about 184 m apart. The approximately square street blocks may well

Figure 2. Morphological hierarchy of streets in Pingyao. Based largely on an unpublished plan prepared in *c*. 2000 by Shanxi Research Institute of Urban and Regional Planning and Design, with subsequent changes to principal streets recorded in field surveys by the authors up to 2011.

have been *fangs* until the seventeenth century, the *fang* having been the basic administrative unit in Pingyao until that time (Compiling Committee for Pingyao Gazetteer, 1999, p. 69). In many Chinese cities the *fangs* were walled until early in the Song dynasty (907–9) (He, 1996, pp. 600–2). Such square street blocks are absent within an elongated area immediately north of Xiguojiaxiang–Dongguojiaxiang–Renyi Street, reflecting the existence of the northern fortification zone of the city here until the late-fourteenth century. There are few deviations from orthogonal street lines (Figure 2).

Pingyao's streets may be grouped according to the traditional, albeit sometimes somewhat artificial, three-part analytical hierarchy of axial streets, through streets, and alleys and culs-de-sac. In the course of city extensions, some consequent streets have become major axial streets lined by shop fronts, notably Xiguojiaxiang–Dongguojiaxiang and Nandajie, which have become the major commercial streets within the walled city. However, several axial streets have become reduced in significance as extensions to the city have brought into existence new ones. A notable example of this is Yingwuxiang, which has long ceased to lead to a gate in the northern city wall and no longer has much significance even within the most local pattern of vehicular movement. The present northern and southern gates are not connected by a single straight axial street. The asymmetry in the street plan associated with this is another common feature in Chinese cities (Chang, 1970, p. 78).

Over practically the entire walled city, culs-de-sac are numerous. Within the oldest areas regularities in their pattern are few and many of the culs-de-sac appear to have developed piecemeal as the interiors of street blocks became subdivided: alleys, initially private but eventually becoming public rights of way, were created to provide access. Thus in the interiors of street blocks there has developed what M. R. G. Conzen (1969, p. 129) termed a pseudo-street system, much of which is made up of culs-de-sac. At the end of a cul-de-sac there is frequently either a stele bearing the inscription '*taishanshi gandang*' or a stone lion, this being a remedy for the inauspicious street end (Du, 2002, p. 57). Otherwise a dead end to a street is incompatible with *fengshui* – namely 'the art of adapting the residence of the living and the dead so as to co-operate and harmonize with the local currents of the cosmic breath' (Chatley, 1917, p. 175).

The essentially north-south orientated rectilinear street plan in the north-eastern corner of the walled city contrasts with the square grid that predominates elsewhere. It is most likely that this area was undeveloped until well after it was encompassed by the fourteenth-century wall. Here, in contrast to the older, square-gridded areas, the culs-de-sac are mostly integral to the original layout. The rectilinear street pattern has similarities to that in a smaller area just inside the wall towards the south-west corner, although there the alignment of streets is predominantly east-west. The three parallel north-south streets in the north-eastern corner originally had gates at their ends (Song, 2000, p. 25). This arrangement was characteristic of agricultural villages in the vicinity (Song, 2000; Zhang and Song, 1996).

Como: Roman streets, medieval piazzas and industrial-era modifications

The greater part of Como's circulation system within the walled city has provided public rights-of-way for 2000 years. Yet while the morphological frame established by the Roman street system is simple, the full pattern of the present street network is not quite so regular. In the Roman module main streets were spaced about 84 m apart, with a slight variation in the southern portion of the walled area. Subsequently, convenient short-cuts, particularly quasi-diagonal paths that crossed terrain not yet rebuilt following the post-Roman urban collapse, were added, and became permanent streets (Figure 3). At the same time, some links in the former grid fell into complete disuse, leading to a few discontinuities.

It is informative for comparative purposes to employ the same traditional, three-part

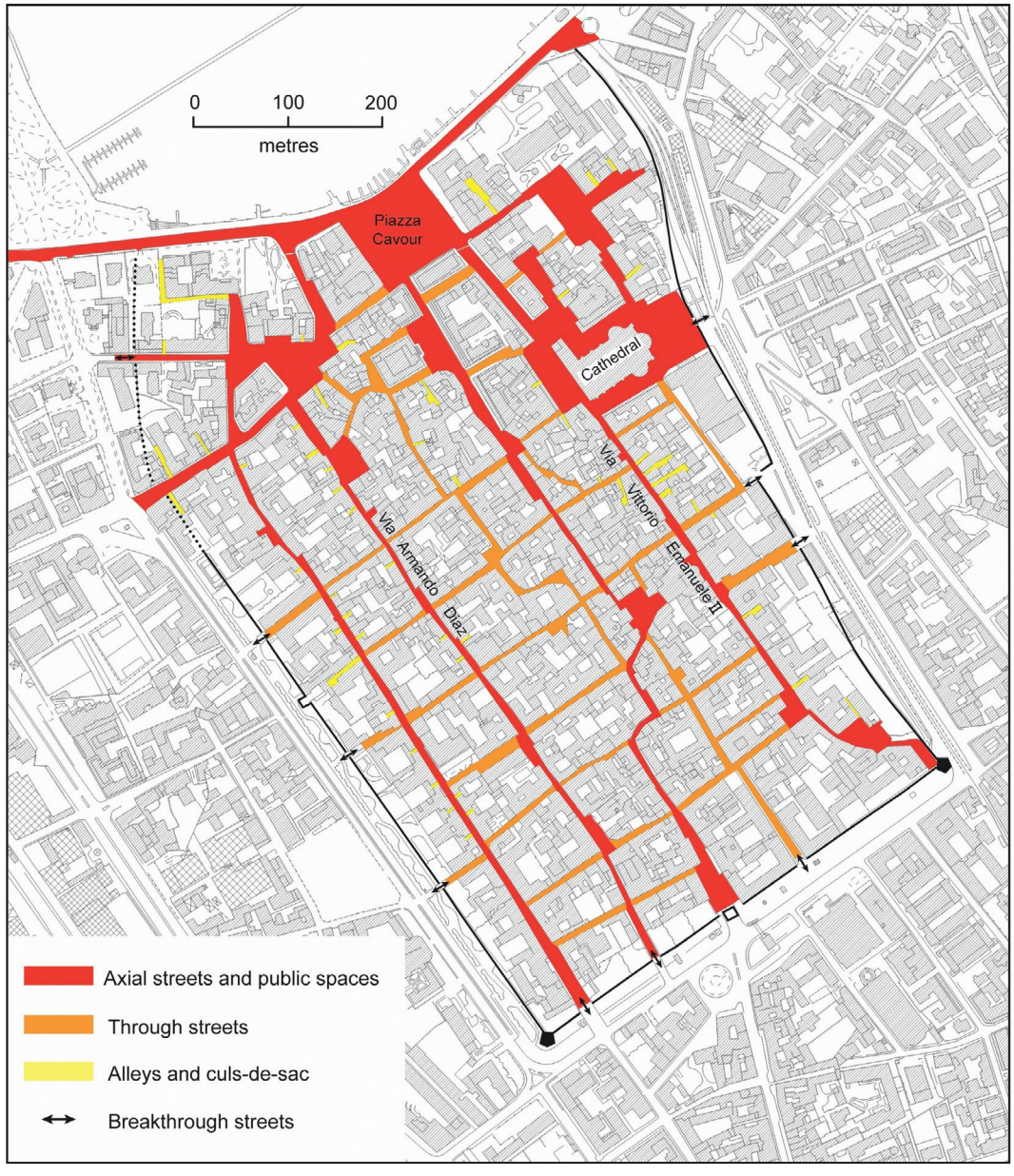

Figure 3. Morphological hierarchy of streets in Como. Based on Commune di Como, urban cadastre: Città Murata, 1994, updated.

analytical hierarchy into which the streets of Pingyao were grouped. Most of the parallel main streets on the long axis qualify as 'axial' because they provide direct links between the city's commercial centre near the lake and the major regional exit route beginning at the southern end of the walled city. The axial streets in the commercial centre near the lake connect highly-frequented locations, several of which are large open spaces, such as piazzas (city squares) and market places. However, unlike the almost perfectly straight axial streets in Pingyao, all the axial streets in Como contain deviations, some of which are pronounced. The axial street that deviates most from a straight line is the sometimes narrow combination of street segments leading from Piazza Cavour at the lakeside to the main southern gate, Porta Torre. Lined with shops and service establishments of all kinds,

it is the major pedestrian and commercial thoroughfare of the city's historical core.

The through streets, largely aligned north-east to south-west, connect locations of lesser importance. In contrast to Pingyao, a relatively small proportion of the street pattern consists of open-air alleys. This is in part owing to Como's fine-grained street grid, which, in conjunction with archway entrances to courtyards in many street blocks, makes separate alleys little needed. A further contrast with Pingyao is the importance of large open public spaces: this accords with the prominence of community spaces in European cities more generally. Some public squares in Como are old, such as Piazza del Duomo in front of the cathedral, and Piazza San Fedele (formerly the Grain Market), three blocks to the south. Others are artifacts of unco-ordinated fringe development, such as Piazza Volta, and still others are products of later planning, such as Piazza Cavour, which occupies the site of the late-medieval harbour (Cani and Monizza, 1994, pp. 25, 29, 60).

During the medieval period and for centuries after, the walled city's internally integrated street system was accessed by only three city gates. Between 1856 and 1933, with the onset of factory industrialization – at first particularly concentrated in the extramural inner fringe belt – no less than ten breaches were made in the thick stone wall to create 'break-through streets' that extended the reach of the walled city's old 'through' streets and turned some of them into effectively axial ones.

Plots

Pingyao: degrees of modification and the influence of fengshui

The recognition of three categories of plot in Figure 4 – ranging from the essentially intact or orthomorphic (that is, in its original state) to the hypometamorphic (slightly changed) and metamorphic (that is, transformed by such processes as amalgamation, division and truncation) – follows the typology recognized by M. R. G. Conzen (1962, pp. 402–10; 1969, p. 127). In Pingyao, plots are mainly metamorphic in the central and southern parts of the walled city (Figures 4a and 5), consistent with the very long time-span over which these areas have been exposed to forces for change. An extensive exception to this is in the street blocks created in the zone of former northern city fortifications immediately north of Xiguojiaxiang–Renyi Street, where hypometamorphism is characteristic (Figure 4b). Here the strong influence of the more recent

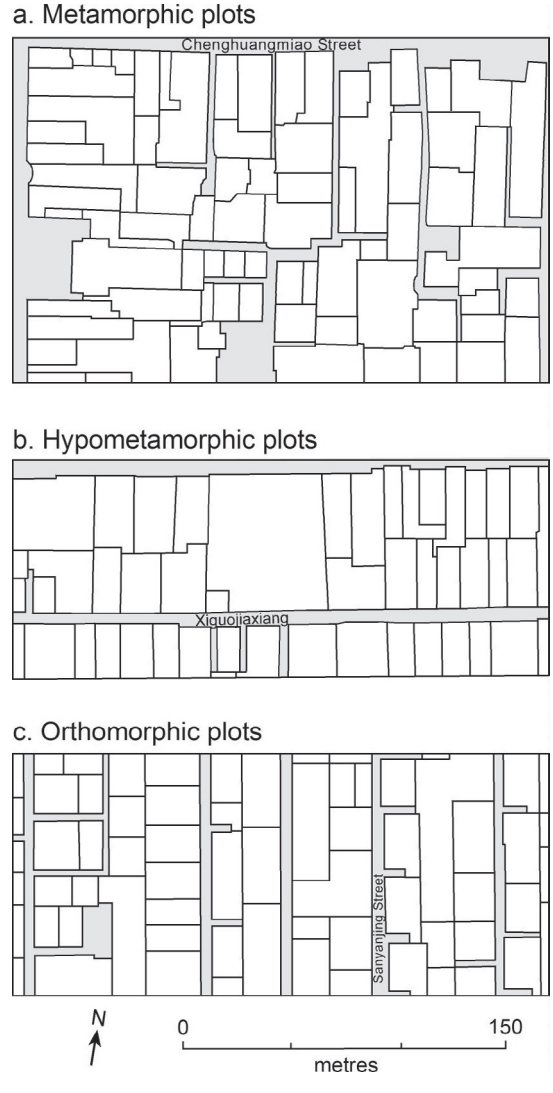

Figure 4. Plot types in Pingyao. Based on Whitehand and Gu, 2007, pp. 101–2, figs 7–9. Plot boundaries and streets derived from an unpublished plan prepared in *c.* 2000 by Shanxi Research Institute of Urban and Regional Planning and Design.

laying out of planned series of plots along the consequent streets that were constructed after the fortifications were demolished is very evident.

Adjacent to long stretches of the present wall in the north-eastern corner of the city and in smaller areas in the vicinity of the western wall, plots are predominantly orthomorphic and, to a lesser extent, hypometamorphic (Figures 2, 4c and 5). The greater regularity of the plots here, especially in areas remote from gates in the wall, corresponds broadly to greater regularity in the street system. Orthomorphism is particularly evident within a broad zone inside the eastern half of the northern stretch of the wall.

According to *fengshui*, a south-facing orientation of plots and buildings is especially auspicious, being most in harmony with the 'cosmic breath'. The large majority of plots and the courtyards that occupy them are orientated north-south (Figures 4 and 5). Most entrances are at the southern end of their plots. On north-south orientated streets, it is not uncommon for plots to have a long side to the street. In such cases, there is often a minor east-west orthogonal street, usually a cul-de-sac, giving access to a south-facing courtyard entrance. Such culs-de-sac are predominantly on the east side of north-south streets (Figure 4c). Hence west-facing entrances are fewer than east-facing ones: this is particularly evident in the areas of rectilinear street systems just inside the northern stretch of the present city wall (see also Whitehand and Gu, 2007, p. 102, fig. 10).

Among the relatively few stretches of street in which there are significant series of east-west orientated plots are those in the three principal north-south consequent streets (Shaxiang Street, Nandajie and Leijiayuan Street–An Street). In many of these cases, including practically every plot in Nandajie, commercial premises front the street. For the walled city as a whole, south-facing entrances are the most numerous, followed by east-facing, west-facing and north-facing entrances in decreasing frequency. This accords with the view that *fengshui* is an influence on the city's layout (Liu, 1995). However, in a sizeable settlement, especially one in which many plots contain shop fronts, there are practical obstacles to achieving a layout that complies in its entirety with the principles of *fengshui*.

Straight boundaries between series of plots that back on to one another are rare within the part of the city that was developed before the fourteenth-century wall was constructed. Practically the only cases are where plots were laid out along consequent streets. In contrast, many straight boundaries between plot series exist within those parts of the city that were developed between the mid-fourteenth century and late-nineteenth century (Compiling Committee for Pingyao Gazetteer, 1999, pp. 74–7). The highly irregular plot boundaries in the oldest areas of the city are probably a reflection of the susceptibility of the large square street blocks in this area to various types of plot subdivision and the lengthy period during which processes of change have been at work here.

Como: Roman legacies, and later adaptations and additions

In European cities, rectangular plots, with their short sides facing the street, have a long tradition, with no particular concern for their orientation to the cardinal points of the compass. Como's plot history illustrates this tradition, while at the same time demonstrating the processes by which lateral property accumulation could transform linear plots into approximately square ones large enough to permit the formation of courtyard assemblages and serial aggregations. Plots vary in the extent to which they diverge from a regular rectilinear form, probably reflecting in almost all cases the degree to which the boundaries of plots have been modified since they were originally laid out. However, in Como the distinctions between the three plot types recognized by M. R. G. Conzen are less sharp than in Pingyao, and orthomorphic plots are comparatively rare (Figure 6). The degree of metamorphism is mainly a reflection of the amount of plot amalgamation that has occurred over time (rather than subdivision, since buildings

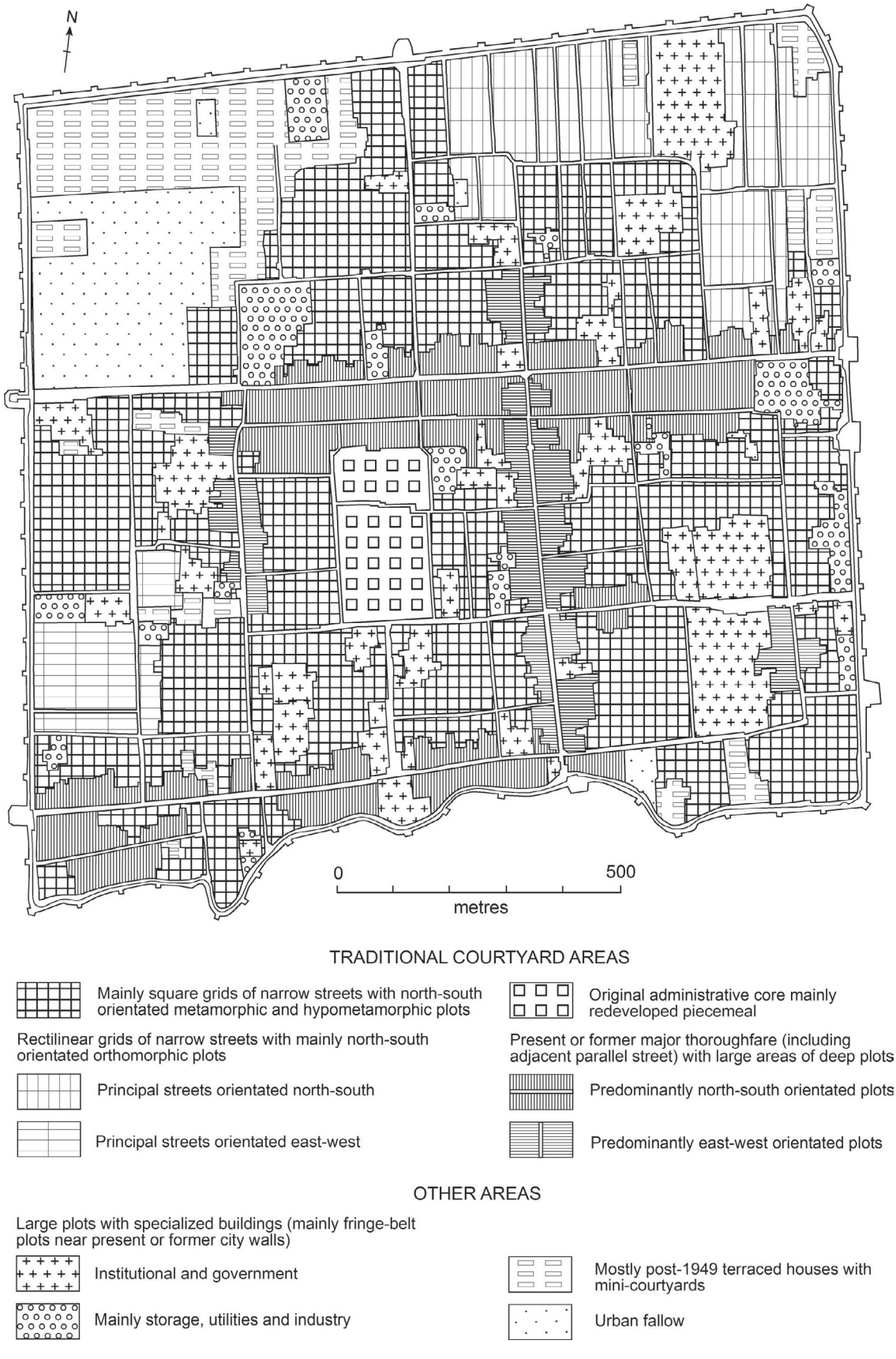

Figure 5. Plan elements in Pingyao. Based on an unpublished plan prepared in *c.* 2000 by Shanxi Research Institute of Urban and Regional Planning and Design, and field surveys by the authors 2004–11.

of stone, once constructed, are less easy to retrofit with additional access points than wooden ones). Straight boundaries between series of plots that back on to one another are even rarer than in the oldest parts of Pingyao.

The plot pattern along Via Vittorio Emanuele II includes remnants of ownership boundaries first defined in the medieval period, and thus suggestive of orthomorphic survival. But these are intermixed with numerous plots that have undergone change (Figure 6c). The plot series in Via Alessandro Volta contains many amalgamations. These created opportunities for full courtyard development, producing a hypometamorphic pattern (Figure 6b). In contrast, the plots between Via Giulio Rubini and Via Giuseppe Garibaldi mainly display a metamorphic pattern full of reconfigurations (Figure 6a), which coincides with the creation in the late-nineteenth century of Via Giulio Rubini as a new breakthrough street. In setting this typology within the context of the walled city as a whole, a more complex pattern is evident (Figure 7). The plot typology recognized here draws in part on concepts developed in the Italian typomorphological school, particularly the foundational work of Caniggia on Como itself (Commune di Como, 1970). From this it can be deduced that a slight majority of Como's core city blocks evolved into traditional courtyard areas, either in simple serial aggregations along the street or composed of large properties with a central, internal focus. These two plot types are well distributed throughout the zone of the Roman grid. Almost as numerous are two other plot types: linear serial aggregations, with or without merchant quarters. Those without are scattered widely, whereas the commercially-oriented plots show a distinct ordering, mainly along the key central axial street route and in parts of what has become the modern CBD. Religious and governmental sites have tended to cluster in relatively peripheral large plots. Not surprisingly, modern redevelopment has occurred near the lake, where growth of the CBD resulted in major changes of plot boundaries.

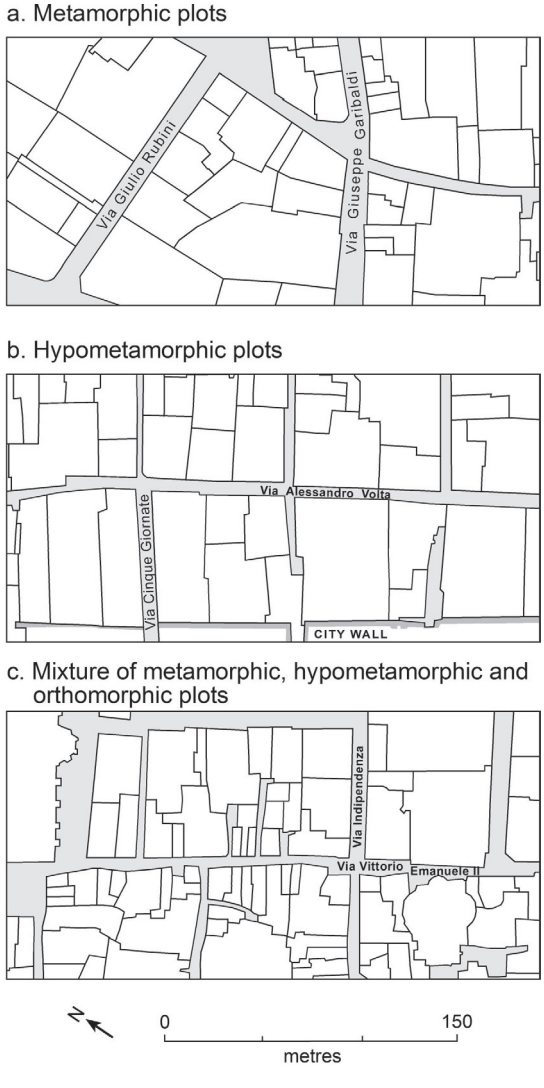

Figure 6. Plot types in Como. Based on Commune di Como, urban cadastre: Città Murata, 1994, updated.

While evidence of cosmological concerns is scarce in Como (but see Lilley (2009) for a discussion of European urban cosmology), most of the city's intramural churches are in plots that permitted, as far as practicable, the altar to be situated at the eastern end of the structure – illustrated by the rounded apse of the cathedral.

Courtyards and building coverage

Pingyao: courtyard design, south-facing entrances, and modern redevelopment

With the major exception of parts of the northwest corner of the walled city, much of which

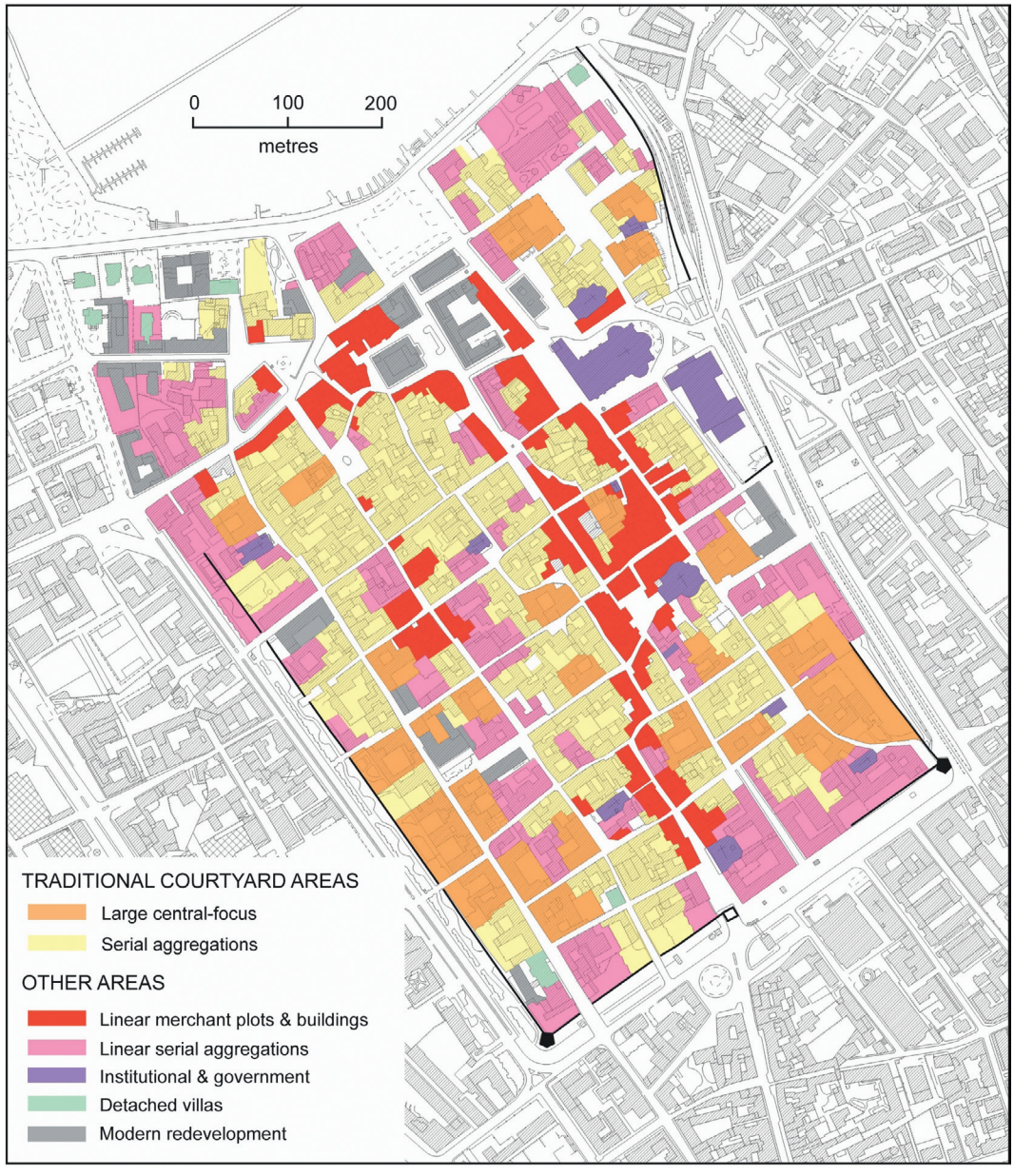

Figure 7. Plan elements in Como. Based on Commune di Como, urban cadastre: Città Murata, 1994, updated.

remained in some form of cultivation until after the Communist Party came to power in 1949, the walled city of Pingyao is, like the traditional parts of most Chinese cities, very largely occupied by courtyards. These are constructed so as to afford a high degree of privacy and separation from the street. Whereas in Europe the contrast in building block-plans between the fringe belts and the large majority of housing areas is marked, inside the city wall in Pingyao it is less evident. Courtyards are characteristic of both types of area. Both tend to have little vegetation. As in Europe, however, the fringe-belt sites (many of them influenced by their being, or having been, occupied by institutions) are generally of much greater size. The physical form of Pingyao's institutions towards the end of the nineteenth century has been captured in a number of drawings (Wu and Wang, 1883,

Tukao, pp. 3–33) (Figure 8). In the case of the housing areas, information about their physical character is largely dependent on fieldwork in conjunction with recent plans. Unlike in the West, where observations from the street are a major source of information about the characteristics of buildings, in Pingyao, as in Chinese cities generally, the plain relatively undifferentiated exteriors of courtyard buildings, which lack windows on to the street, reveal very little about what exists behind the street frontage. Furthermore there has been a very low survival of property records. Oral histories and fragmentary information in the possession of the present occupiers of sites are thus of especial value.

In this light an area of six courtyard dwellings at the junction of Shaxiang Street and Xiguojiaxiang investigated by Whitehand and Gu (2007, pp. 104–6) is particularly valuable, allowing changes of building block-plans and ownership boundaries to be reconstructed between the end of the nineteenth century and the early twenty-first century (Figure 9). Courtyard houses were apparently built in the area between 1736 and 1795 (Compiling Committee for Pingyao Gazetteer, 1999, pp. 756–7), but, in view of the favourable location of this part of the city at the time, it is most unlikely that these were the first such houses to have existed here. In the second half of the nineteenth century, the owner of one of the banks purchased all six courtyards, and undertook major rebuilding (Du, 2002, pp. 123–4), although the existing building block-plans apparently remained largely unchanged (Figure 9a, b). The courtyard houses, which like most buildings in Pingyao were mainly single storey, mostly retained their existing form until the 1960s, when they were taken over by the government. Four of them were occupied by a total of 22 families, mostly those of factory workers, by the early 1990s (G. Cheng, personal communication). The

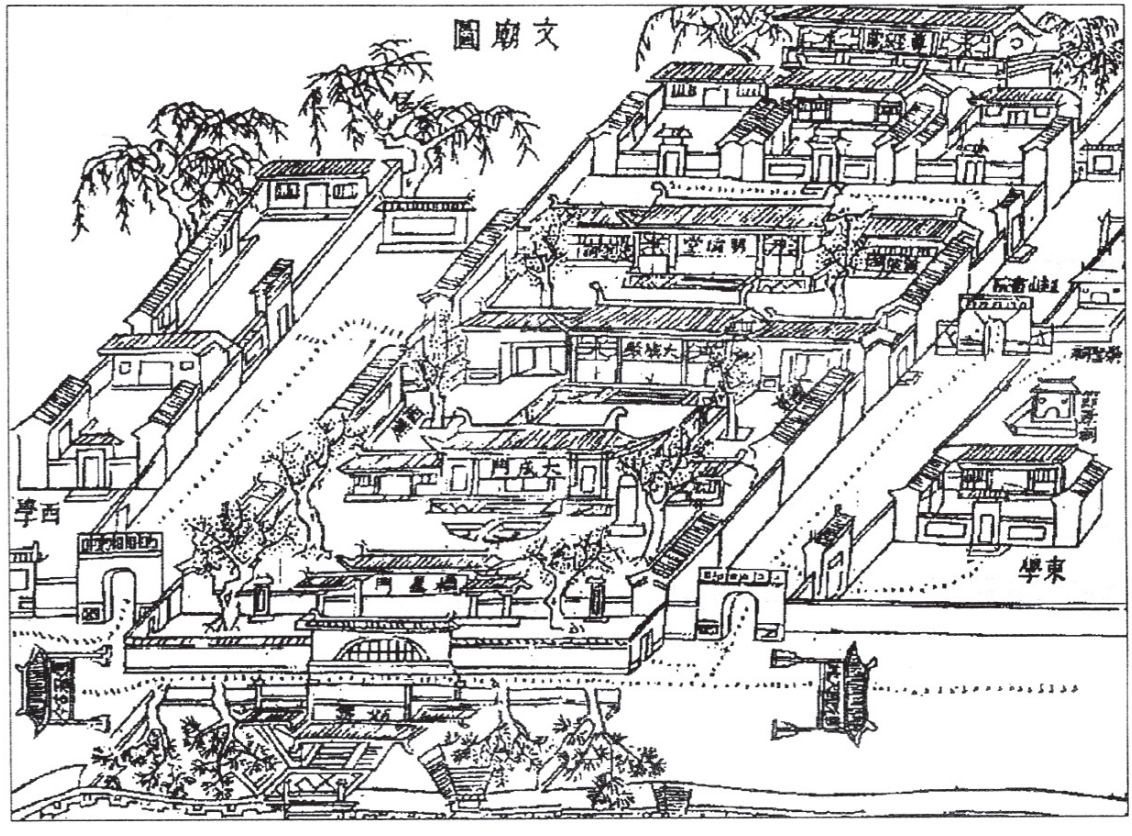

Figure 8. Wenmiao, Pingyao in the Qing dynasty. Reproduced from Wu and Wang, 1883, Tukao 10.

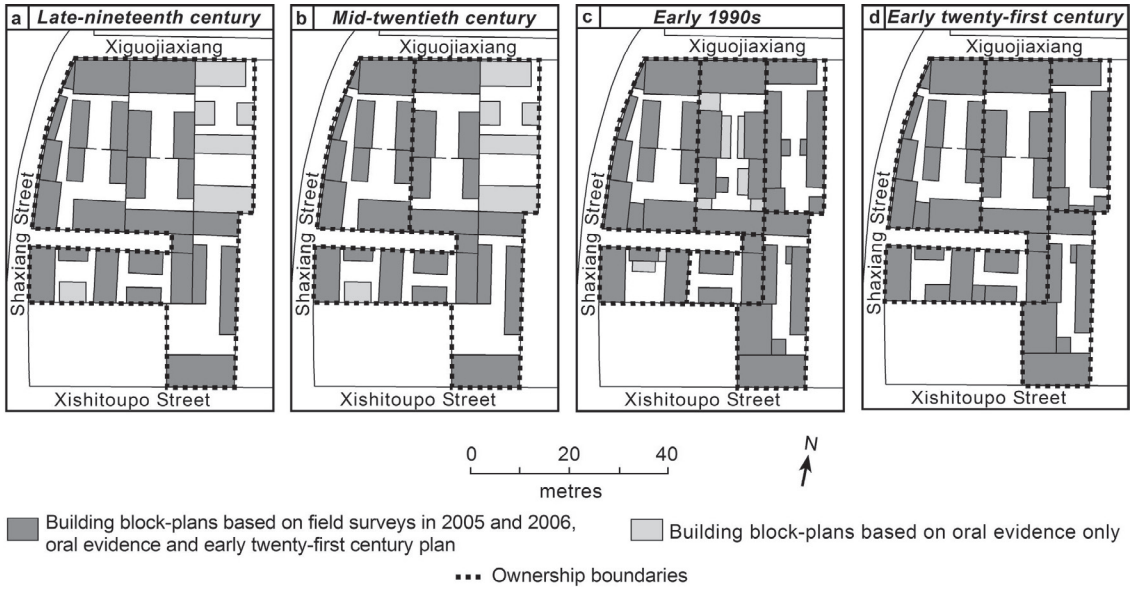

Figure 9. Changes of ownership boundaries and building block-plans in Hou's courtyards, Pingyao. Based on Whitehand and Gu, 2007, p. 105, fig. 13.

new occupants sought to remedy the woefully inadequate space within existing buildings by improvising structures within the courtyards (Figure 9c). This was a process reminiscent of that in the cores of many traditional British cities in the nineteenth century (Conzen, 1960, pp. 65–9; 1962, pp. 400–7), although in plan the result was markedly different, reflecting in particular the major differences of building type. However, whereas site clearance followed by redevelopment frequently terminated the corresponding process of repletion in Europe, in the Pingyao case the tourist potential of these traditional courtyard buildings was recognized during the economic recovery that began in the late 1990s. Renovation of the principal buildings and clearance of the buildings that had been constructed in the courtyards by the previous occupants (Figure 9d) provided the basis for a hotel business by a new owner.

A key feature of the transformation of Pingyao in accord with the ideology of the new Communist China after 1949 was the creation of *danweis*, or work units (Compiling Committee for Pingyao Gazetteer, 1999, pp. 253–7; Xie and Costa, 1991, p. 280). Within the walled city a number were redevelopments of existing fringe-belt sites. These were often the sites of temples, many of whose buildings had been demolished or fallen into disrepair. As in China more generally, each *danwei* had a separate identity emphasized by its physically enclosed form and supervised entrance gateway or gateways. Normally these were walled enclosures. Each contained a workplace, such as a hospital, school or factory and, except in the case of particularly small *danweis*, each generally had its own social services, often including a communal dining hall and ablutions. The closest to an earlier equivalent, either in China or in other countries in which fringe-belt studies have been undertaken hitherto, was an institution, such as one with an educational or military function, in which family residential accommodation was included within the same plot as the principal function.

The highly organized industrialization that underlay the construction of *danweis* was strongly influenced by the example of the Soviet Union (Xie and Costa, 1991, p. 281). Their enclosed, gated form, however, had antecedents in traditional Chinese courtyard layouts and in the gated communities of which the physical relicts still exist in the

north-eastern parts of the walled city (Song, 2000, p. 25). The influence of the traditional courtyard layout is perhaps most immediately evident in the presence in the large majority of cases of a *zhaobi*, usually across and just inside the *danwei* entrance. This is a substantial screen, often decorated, constructed so as to obstruct a direct view and straight-line access into the courtyard. According to the precepts of *fengshui*, it afforded protection against evil spirits (Yan, 2006, p. 57).

Como: building placement, courtyards, repletion cycles and palazzi

The building fabric of Como's walled city exemplifies the geographical diversity and long European history of urban construction in stone. The early emergence and widespread occurrence of multi-storey structures gives a dense, built-up appearance to the typical streetscape. Equally distinctive, especially in comparison with Chinese traditions, is the high frequency of windows, doorways and arched vehicular entranceways allowing easy access to the interior of plots.

Also typical of Como, as of much urban fabric in Europe before the industrial era, is the placement of the main dwelling structure (often including a workplace) of each resident family at the head of the plot, at the street line. Over time, as households increased in number and size, and space needed for commerce and crafts grew, rear areas of plots were built upon (cf. the *burgage cycle* articulated by Conzen, 1960). Thus, what began in earlier centuries as simple buildings at the street front evolved into courtyard complexes occupying varying amounts of the plot, usually through the addition of rear wings, and ultimately by joining the wings with a connecting structure at the rear to form an enclosed courtyard. Acquisition of adjoining properties could further complicate the arrangement of buildings and plot boundaries. Such changes often occurred in Como's past as wealthy families acquired neighbouring structures.

Figure 10 illustrates this process in essentially residential blocks in the southernmost part of the walled city near the Porta Torre. The earliest reliable cadastral reconstruction of these blocks based on tax records dates from 1615 (Gianoncelli and Della Torre, 1984), and suggests that Roman plots once stretched from Via Volta to Via Cantù in a single series, each plot fronting both Via Giovio and the next parallel street to the south, Via Parini. By 1615, many of these original plots had long since been subdivided, some longitudinally (creating narrower street frontages), and some laterally, creating shorter plots fronting either Via Giovio or Via Parini (Figure 10a). Already the kernel of a palazzo had begun to take shape at the western end, facing Via Volta, through the acquisition of a courtyard property by the Mugiasca family. By 1861, some consolidation of plots and backyard infill had occurred (Figure 10b). The Mugiasca palazzo had been enlarged considerably, and a second palazzo, owned by the Somagliana family, had taken shape facing Via Volta. By 1933, changes included further infill and the partial break-up and subsequent re-consolidation of another palazzo, fronting Via Cantù, owned by the Martignoni family (Figure 10c, d).

This example demonstrates a pattern of slow change in plot ownership and the related creation of courtyard building complexes over time. The only large open space remaining was the garden belonging to the Mugiasca palazzo, which in modern times passed into the hands of a bank that rented much of the complex as office space (Cani and Monizza, 1994, pp. 107–9). Smaller courtyard properties nestle among larger ones, most serving as residential rental space. In 1906 the Semigliana palazzo was taken over by the Como Chamber of Commerce, a typical transition to institutional use for one of the many private palazzi in this city. Although street blocks closer to the CBD by the lake have sometimes undergone more radical transformation of plot structure and building coverage – and in a few instances undergone complete redevelopment – the street blocks shown in Figure 10 do mirror a characteristic pattern of historical building configuration in this city.

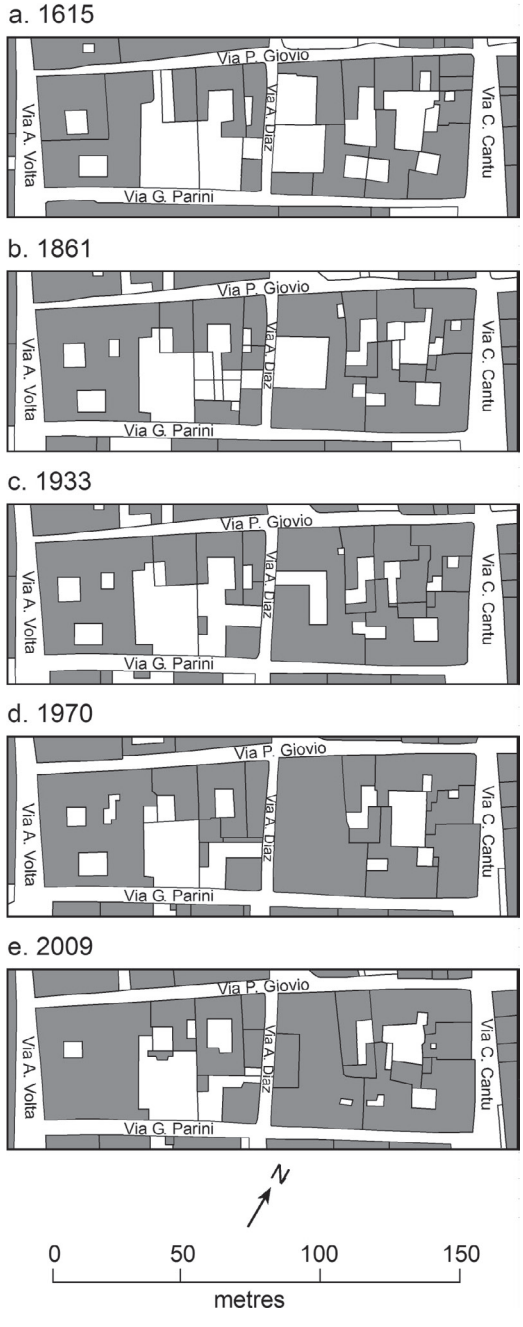

Figure 10. Courtyard formation and street-block repletion near the Porta Torre, Como. Sources: for 1615 and 1861 – Gianoncelli and Della Torre (1984, pp. 372–6, 385–8); for 1933 – Prada (1933); for 1970 – Commune di Como (1970) cadastral base map, updated to 1970; for 2009 – Commune di Como (2009). Database: Aera Pianificazione e Valorizzazione del Territorio – Settore Pianificazione Urbanistica, Censimento Unità di Minimo Intervento, Zone A1: Città Murata – S. S. Annunciata, records 426 and 445b.

Comparative assessment

Morphological frames. Both cities exhibit the long-term influence of ancient morphological frames in shaping the macro-scale lineaments of the built environment. In each case the application of a modular grid to the site regulated the spacing of streets and therefore the size and shape of street blocks, with profound lasting effects. A major difference between the cities is in the role topography has played. In Como, the proximity of steep mountain slopes exerted a critical influence in limiting the orientation of the grid frame and resisting its spread. In Pingyao, the flatness of the urban site allowed grid extensions to occur with urban growth, though the modular specifications varied over time. The siting of successive city walls followed ancient planning principles of rectilinearity, but with slight departures from strict orthogonality.

With regard to fixation lines, in Como, the Roman city wall directly 'fixed' the placement of its medieval successor, reinforcing the original grid frame's influence on the street system. In Pingyao, it was not mountains but the nearby river that served as an effective fixation line, defining the irregular and unusually meandering course of the city's southern wall. Como's water margin exerted a weaker overall influence.

Streets. Aside from the obvious contrasts in the scale of their walled areas, the two cities share similarities in the importance of their axial and through streets, particularly in their relation to city gates, and their narrowness. The placement of gates in the city walls in both cases elevated some streets to axial status, and left others with less importance. But here the similarities end. In Pingyao, a full, three-tiered street hierarchy exists, which includes numerous alleys, many of which are culs-de-sac. In the northern, especially north-eastern, part of the city, nearly all these alleys were part of the original *fengshui* planning to give access to the southern sides of plots. In Como, the finer-grained street grid and much tighter spatial development of the site reduced the need for all but the shortest of additional alleys, and therefore pseudo-streets

are comparatively rare. A number of the 'off-grid' through streets in Como find an echo in some of Pingyao's alley networks.

A notable contrast between the cities is the frequency and size of public squares at the meetings of major streets. At least ten squares in Como, some of them large, combine the roles of market and ceremonial gathering place. In Pingyao wide street segments on the major thoroughfares are rare, though there are many street widenings in the interiors of street blocks that have only very minor significance for the wider street network.

Plots. There are three respects in which the plots of the two cities differ appreciably. In Como the proportion of very small plots that deviate significantly from rectilinearity is larger. This reflects the greater number of streets that have roughly diagonal or irregular courses. However, the largest difference in plot structure concerns the influence of *fengshui* on Pingyao and the absence of anything comparable in Como. Plots in Pingyao have been configured to allow a south-facing entrance where possible, and many rectangular plots have their long side to the street. In Como nearly all plots have their short side to the street, unless they have become more or less square through plot amalgamation.

At the scale of the walled cities as a whole, plot types and modifications in structure over time show certain similar patterns of variation. In both cases there is a tendency for axial routes to attract the narrow fronts of plots where commercial uses have taken root. But there are also contrasts. Though both cities have plots geared to commercial uses lining key axial routes, only Como has plots profoundly altered by commercial development. In Pingyao, not only has the rise of a modern CBD been a comparatively recent phenomenon but in the past 2 to 3 decades it has largely occurred outside the walled city. At the same time the traditional commercial core has become increasingly tourist oriented. The much later arrival of the industrial era than in Como, combined with the fact that a much larger proportion of the walled city continues to be predominantly residential, accounts for the far greater proportion of orthomorphic and hypometamorphic plots that have survived.

Courtyards and building coverage. Courtyards are characteristic of both cities. In Pingyao, this arrangement appears to have deep cultural roots. In both cities a significant minority of plots contain more than one courtyard. This has generally resulted from the slow process of building additions and plot amalgamations. Direct evidence of progressive increase in building coverage is very largely limited to comparatively recent times in Pingyao, but there is no doubt that this process has been common to both cities.

Both walled cities can be described as 'dense', and many structures of one property abut those of another to the extent that dividing courtyard walls are often not necessary. However, the biggest contrast lies in the building fabric and house types, which in this paper have been considered only incidentally to the principal focus on plan analysis. Pingyao's walled city is predominantly of single-storey buildings, very largely constructed of wood, brick and related materials. Como in contrast is very largely stone-built within its city walls and three or four storeys predominate. This difference offsets somewhat the great disparity in the areal extent of these two walled cities, and Como's built fabric has been able over the centuries to accommodate higher population densities than Pingyao's.

Conclusion

What can be drawn from this comparative examination of these two historical walled cities in their distinct cultural settings? In physical form the cities display more differences than they share similarities, but not for cultural reasons alone. Both share broadly similar morphological frames, shaped according to super-grids: an ordering principle in human settlements that has proved attractive to most urban cultures at one time or another. These defined orientation on the ground and the consequent street systems. Topography played a role in specific details. Both cities developed elaborate street systems and considerable

density of built forms, but with distinct resulting landscapes.

The principal cultural factors underlying the many contrasts considered here concern values based on cosmology, and differing perceptions of how public and private spheres in urban society are to be reconciled within the spatial constraints of the urban landscape. The concept of *fengshui,* for example, is essential to understanding urban form in Pingyao, but there is no counterpart in Como, save for the mild Christian impulse to orient church altars to the east. The significance attached to public space in Como's physical development, however, reflects the importance of differences in the ways that individuals relate to community, to modes of urban governance in shaping the city over time, and, ultimately, to forms of power-sharing (or concentration) in taking decisions about the efficacy and sustainability of the urban habitat.

Through a systematic analysis of aspects of the morphological composition of these two cities' historical cores this paper has shed additional light on the part that the built environment plays in answering such larger questions. More immediately, it has identified features of urban form that contribute significantly to the heritage of these historical places. Herein lies the basis for more informed decisions about their conservation – particularly in light of the pressures that historical cities like Como and Pingyao are experiencing from the rise of intensive tourism and its impact on the physical fabric. This is not only a question of urban economics but of the survival of cultural authenticity.

Half a century ago, M. R. G. Conzen set out fundamental morphological bases for the management of urban landscapes, especially in respect of their conservation. These were founded particularly on a combination of detailed mapping and the conceptualization of historico-geographical processes. In this paper we have sought to build on those foundations, in an academic and practical environment that shows signs of becoming more congenial to such an approach than the one in which Conzen was working. By applying a systematic approach to uncovering fundamental aspects of the historico-geographical structure of cities, notably by identifying and mapping unitary areas of plan elements, a contribution has been made to the necessary morphological basis for decision making concerning the conservation of major types of inherited assets. Doing this in relation to urban forms that have developed in markedly different cultures has helped to illustrate the generality of the approach. Not least, it has shed light on important aspects of a task for research and practice that lies ahead.

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