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The Shaping of Form and Structure in Informal Settlements: A Case Study of Order and Rules in Lebak Siliwangi, Bandung, Indonesia

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Abstract. *This paper explores the nexus between order and informality by focusing on the rules by which the physical form and structure evolve and is shaped in informal settlements. Central to improved planning and management of informal settlements and the city generally is a deeper understanding of what constitutes order and the underlying rules by which the physical ordering of densely populated informal settlements takes place. This is important as the existing spatial and related patterns in informal settlements are portrayed as chaotic, dysfunctional, and unplanned, with many residents seen as a source of social problems to be 'fixed' by physical solutions. Such negative stenotypes strongly influence the nature of 'top-down' policies underpinning upgrading programs. Using a case study of kampung Lebak Siliwangi in northern Bandung, Indonesia, this paper contextualizes notions of local and 'bottom up' order by identifying the rules by which the physical order and resulting spatial patterns unfold. The notion of order as seen in Lebak Siliwangi is locally self-made, not top-down, with the layout and arrangement of the complex urban fabric defined by clear patterns of sequencing and assemblage of adaptations. In this setting, the paper identifies the contextual rules and principles that shape the form and structure of settlement in Lebak Siliwangi with a focus on settlement structure, public/private interface form types, and the nature of progressive change to housing.*

Keywords. *order, rules, evolution, form, structure, informality, informal settlements.*

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Abstrak. *Makalah ini mengeksplorasi hubungan antara keteraturan dan informalitas dengan fokus pada aturan-aturan dimana bentuk fisik dan struktur berkembang dan dibentuk dalam permukiman informal. Hal yang penting dalam perencanaan dan pengelolaan permukiman informal dan kota pada umumnya adalah pemahaman yang lebih dalam tentang apa yang merupakan keteraturan dan aturan yang mendasari dimana keteraturan fisik dari permukiman informal yang padat terjadi. Ini penting karena pola spasial dan terkait yang ada di permukiman informal digambarkan sebagai kacau, disfungsional, dan tidak terencana, dengan banyak penduduk dipandang sebagai sumber masalah sosial yang harus 'diperbaiki' dengan solusi fisik. Stenotip negatif semacam itu sangat memengaruhi sifat kebijakan 'top-down' yang mendukung program peningkatan. Dengan menggunakan studi kasus pada kampung Lebak Siliwangi di Bandung bagian utara, Indonesia, makalah ini mengontekstualisasi gagasan tatanan lokal dan 'bottom up' dengan mengidentifikasi aturan-aturan yang dengannya tatanan fisik dan pola spasial yang dihasilkan berkembang. Gagasan keteraturan seperti yang terlihat di Lebak Siliwangi adalah buatan lokal, bukan top-down, dengan tata letak dan pengaturan struktur perkotaan yang rumit yang ditentukan oleh pola pengurutan yang jelas dan agregasi adaptasi yang sistematis. Dalam situasi ini, makalah ini mengidentifikasi aturan kontekstual, prinsip dan kegiatan yang*

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membentuk bentuk dan struktur pemukiman di Lebak Siliwangi dengan fokus pada struktur pemukiman, jenis bentuk antarmuka publik/pribadi, dan sifat perubahan progresif ke perumahan.

***Kata Kunci**. keteraturan, aturan, evolusi, bentuk, struktur, informalitas, permukiman informal.*

Context

The concept of order is an important defining element in demarcating formal planned towns and cities from those deemed as informal and unplanned (Jones, 2017a). The advent of modern planning in the late 1800's and early twentieth century saw the notion of order become entrenched as a key element in the planning and design ethos of towns and cities. The complexity of the layout of old towns and cities overlain with the rapid growth of cities driven by industrialization in the nineteenth century generated a new wave of issues to be addressed. These included poor sanitation, narrow streets, adverse housing conditions, pollution, disease, and the demands of the automobile. Collectively, these all required new planning regimes to address what was then termed as town and country planning (Hall, 1988). These challenges paved the way for the rise of modern planning which symbolized new types of orders.

In a modern town and city context, order at its most basic level implies hierarchical control, geometric uniformity, aesthetic 'beauty', and repetition of consistent physical elements and patterns. An explicit physical order is generally accompanied by certainty, including development in accordance with legally approved plans and policies. A sense of permanency is enforced through public infrastructure and services, social harmony and stability (Arefi, 2011a). Whether in new suburban greenfield estates, middle ring or inner-city housing areas, the explicit order of planned settlements is reinforced by uniform housing styles and subdivisions comprising similar plot sizes. A scientific rationality underlies the hierarchy of streets and roads accompanied by consistent footpath and road reserve widths. There is a conscious desire in such patterns and layouts for geometric and visual coherency as derived from a preconceived vision of what planning and design should comprise in the modern planning era. The latter has become the domain of contemporary urban planning, management and governance in the new millennium.

On the other hand, disorder and illegality and an absence of physical and social order outside the bounds of planned systems has become a central tenet underlying concepts of informality and informal urbanism. Such views are now well embedded in mainstream urban theory and practice notwithstanding informal settlements including slums continue to increase at alarming rates. Informal settlements are a permanent and growing consequence of the urbanization process being one of the most visible signs of social, economic and physical inequality (UN-Habitat and UNESCAP, 2015a). In 2015, some 25% of the world's population was estimated to be living in slums, which equated to approximately one billion slum dwellers globally and this is expected to double by 2030. Of these one billion persons, some 881 million residents resided in slums in developing countries compared to 689 and 791 million persons in 1990 and 2000 respectively. Since the beginning of the new millennium, this represents an increase of approximately 28% in the absolute numbers of slum dwellers' despite a percentage decrease from 39% to 30% of people living in slums in developing countries between 2000 and 2014 (UN-Habitat, 2015). In the Asia-Pacific region, there has been a major reduction in the number of urban slums, from 44% in 1995 to 27% in 2014. This has occurred notwithstanding approximately 50% of the world's slum population still resides in the Asia-Pacific region (UN-Habitat and UNESCAP, 2015b). From many perspectives, informal settlements and slums continue to remain a phenomenon which modern planning continues to struggle with in terms of conceptualization, critical reflection and generally how best to manage.

It is well known that informal settlements are often perceived as chaotic and dysfunctional (Dovey, 2012a). They represent the physical manifestation of varying kinds of orders often termed organic, bottom up, and self-organizing which are nuanced and progressively fine-tuned at the local level. For these and other reasons, informal settlements have long been portrayed as a problem 'to be fixed'. They are associated with complex physical, visual and social chaos, including untidiness and 'lack of discipline' all contributing to what policy makers and academics have labeled 'dysfunctional' urban patterns (Lombard, 2014). Tenants in informal settlements such as squatters tend to occupy buildings and or build on the land first, and as such, there is little interest or appreciation of wider public needs, such as adequate infrastructure, services and circulation spaces. Individual and group needs dominate over the wider collective and higher order needs of society which are considered mandatory in the order underpinning planned settlements (Jones, 2016a).

Symptoms of settlement disorder include varying housing styles, materials, and building heights, lack of setbacks, disregard for cadastral boundaries, an absence of accessible roads and streets, and lack of formal water, sanitation and waste disposal systems. The inadequate provision of such elements conflcits with the order imposed by formal planning systems, and their omission collectively adds to an outward appearance of physical chaos and decline reinforced in many cases by poverty, law and safety issues. It is such conceptions and impressions of disorder that drive the questionable policy responses of informal settlement upgrading such as eviction and demolition. This lack of clarity is muddied by key global policy stakeholders such as UN-Habitat who make it clear in their Participatory Slum Upgrading Program that a key objective of slum and informal settlement upgrading is the adoption of a programmatic city-wide approach that aims for the integration of slums into formal planning systems (UN-Habitat, 2016). There is an explicit objective in such policy to correct disorder by bringing the condition of informal settlements and slums into line with the current suite of 'best practice' upgrading practices and approaches. These span modalities from in-situ upgrading, eviction, relocation, resettlement and redevelopment such as via tower blocks (see Figure 1).

Figure 1. Local "makeover' beautification plans and high-rise towers are part of a suite of plans by Bandung City Government for the upgrading of kampungs in Tamansari, Bandung, Indonesia.

In the context of informal settlements and using kampung Lebak Siliwangi in Bandung, Indonesia, as a case study, this paper explores the nature of order by identifying the rules by which structure and form is created and evolves. The paper seeks to gain a deeper understanding of what this

order looks like and the key underlying principles by which form and structure are shaped and are made malleable. Specifically, the paper asks: (i) what are the key factors determining settlement structure over time, (ii) what are the interface form types which encroach onto and utilize public space, and by default create new alleyway alignments, (iii) what are the typical micro-scale form changes that define the housing adaptation and renewal process at the plot level. The fieldwork for this paper was undertaken by the author from the 18th to the 25th February, 2017, and uses a morpho-typological approach to deconstruct and understand the relationship between order and rules (Moudon, 1994). The work builds on previous joint student work between urban and regional planning Masters students from the University of Sydney and the Institute of Technology Bandung (ITB) university, Bandung (Jones, 2016b).

Notions of Order in Urban Planning and Design

Implied and explicit notions of order have existed since the inception of towns and cities. The planned and unplanned city have been argued as always coexisting, with the unplanned city having its own sense of order. "The fact is no city, however arbitrary its form may appear to us, can be said to be unplanned. Behind the strangest twist of lane or alley, behind the most fitfully bounded public space, lies an order…" (Kostof, 1991). A coherent spatial and visual order as defined by the formal planning system implies stability, permanence and reflection of an overarching regime of control which in the modern planning era reflects legality and prosperity (Arefi, 2011b). With the introduction of formal order comes control, rules and regulations with the result being the planned city is underpinned by a 'formal discipline' (Kostof, 1991). This ethos became enshrined in major global policy manifestos of the twentieth century, such as the strongly influential "Charter of Athens" (1933) which resulted from the IV International Congress of Modern Architecture. This conference and resulting charter which reflected the staunch modernist views of leading architects and planners at that time such as Le Corbusier, had a major influence on design and planning in the twentieth century through the charters theme of achieving the 'functional city'. Cities were acknowledged in the charter as transforming without 'order or control' and needed to be fixed according to the principles of town planning and the "functional city" (La Charte d'Athenes, 1933).

Order and the array of tools used to achieve its objectives are major indicators of the application of formal planning systems, with a key consequence being a type of order that can be visibly and spatially identified, assessed and quantified. Geometric order in the modern city, for example, is strongly influenced by street patterns, regular placement of buildings on plots, consistent plot and block patterns and road hierarchies. The continued application of socio and physical ordering of elements at varying scales such as local, metropolitan and State jurisdictions has become the domain of modern plans, policies and the wider planning systems. In this setting, order can be defined as the arrangement, layout or disposition of objects or things in relation to each other as set down via a set of rules, sequence, or systematic method of organization. Geometric order, for example, is represented by the expression of ideal mathematical forms such as a 2D (a quarter, line or circle) and 3D (cube or sphere) as well as 'ideal' relationships such as symmetry and regularity such as parallel lines (Rubinowicz, 2000). In contrast, chaos is the opposite of these expressions as represented by the 'free transformation' and self-organization of shapes and forms as seen in informal settlements. Thus, from alleyways and housing in informal settlements to large city center commercial towers and planned shopping complexes, notions of order and disorder co-exist at varying scales through multiple interplays of social, economic and physical flows and activities in the modern city.

In the context of identifying types of urban order, Marshall (2009) made the distinction between two types, namely, systematic and characteristic order. Systematic order is that which is readily identifiable, coherent and generally discerned quickly, such as in consistent block layouts with repetitive housing setbacks, fencing heights, housing styles and heights as seen in planned modem suburban and city contexts. On the other hand, characteristic order is a type of nuanced order generated by contextual social norms and values which produces its own unique form of spatial and physical layout, such as that seen in informal settlements. Pivotal to understanding the concept of order is that of scales, scaling and hierarchy. By examining different components and modules that 'bolt' together to make assemblages such as informal settlements and the wider city, it is possible to identify local and district scale patterns and sequences that repeat themselves. At the local level, irregular block and plot patterns, for example, are most common.. Such patterns can be also observed as recurring in other informal settlements at the city scale (Kamalipour, 2016). Using theories of complex interacting systems, Salingaros (2000) postulates that every urban element is formed by the grouping of sub-elements according to geometric rules which form a hierarchy at different scales. At the smallest scale, order is created by paired contrasting elements such as windows, walls, doorways and fences which couple in a balanced equilibrium. Complementary elements are those of similar size which couple in a strong fit to become modules of the next higher order of scale, with smaller scales defined before aggregating at larger scales.

In the context of informal settlements in the Pacific, Jones (2017b) identified "self-made urban order" as the logic that shapes the morphological elements and patterns of many informal settlements. Because of this logic, namely, a set of well used principles underlying the arrangement of elements, informal settlements should not be viewed as chaotic but rather 'in place', not out of place, and 'ordered' rather than disordered. At the city scale, Jones (2017b) argued that informal settlements locate in similar spatial locations throughout the city, such as the edge of rivers and estuaries, waste disposal sites, vacant state and customary lands, and existing land-locked overcrowded villages. At the local settlement level, order is reflected in a range of outcomes such as:

1. fluid public/private space boundaries that residents transgress, contest and or negotiate in the absence of stronger local or higher order State enforcement. As a result, there is an irregularity of settlement layouts amd mix of spatial patterns especially in housing frontages, pedestrian movement and vehicular access ways;
2. patterns of occupation where the introduction of buildings and marking of boundaries comes first, followed by service networks for water, electricity, roads, plus securing of land tenure rights. This sequence of order is the reverse of modern top-down masterplan approaches which lay out the formal morphological elements of blocks, plots, circulation spaces, services and open space prior to habitation;
3. a strong reliance on local socio-cultural values and their unifying norms and protocols which gain their strength from the interplay with place, locality, land, language, kin, clan, ethnicity and social capital. Residents are linked togther in varying levels of cohesiveness by what has been termed socio-cultural orders where one element depends on the other;
4. communities that show resilience where financial capital is low and environmental and natural hazards are high. This resilience is reflected in innovative low cost housing construction, material adaptability and accessing basic services via kin networks and social capital;
5. a strong vibrant market in customary/state land dealings and house/room rentals which, for many landowners, provides financial security in the immediate and short term; and
6. the use of governance solutions based around a mix of social groupings of elders, chiefs, 'big men', committees, the church and other social groupings (Jones, 2017b).

In contrast to top-down and systematic order, the nature of "self-made urban order" reflects a less obvious sense of order in informal settlements. It is not imposed by, created or a condtion of the State (Roy, 2005), but rather a choice by residents to follow a certain way of life based on strong local socio-cultural orders (Jones, 2016a; 2017b). The perceived messiness, blurring and entropy of "self-made urban order" is compounded by diverse physical forms of similar scale and by housing change and modifications being 'works in progress'. The physical form continually changes being subject to small-scale and incremental adaptation and renewal. Housing plots and blocks are irregular in shape and are joined together by alleyways and narrow roads which display fractal geometric qualities. Arefi (2011b) examined the notion of order in the informal settlement of Pinar, Istanbul, and identified 'layers' of order which transcend common physical attributes which typically define normative assessments of order. In this case study, five realms of order were identified, namely, land use, planning, social organization, politics and conflict resolution, noting that their emergence and transformation was characterized as being flexible, dynamic and fluid.

Other researchers have looked at order from related perspectives as part of the complexity of the city and the planning and design challenges this brings. Silva and Farrall (2016) and Suhartini (2017) assert that processes and outcomes of informal systems maybe termed 'formal' and 'modern' (top–down), some 'informal' (bottom up) and many 'hybrid', noting many of these processes work together, overlap and are complimentary. Rapoport (1988) and more recently Dovey (2012b) have argued that urban structures such as informal settlements are complex urban assemblages which emerge as an outcome of various decisions that have accumulated over time comprising varying flows, parts, and dynamic processes. Dovey (2012b) highlights the importance of assemblage thinking whereby 'parts and flows' combine in multiple non-linear combinations. From a different ontology, Deleuze and Guattari (1987) make a similar observation about the nature of assemblage using the term "rhizome" to define a system of organization that "has no beginning or end; it is always in the middle, between things, interbeing, intermezzo". Such concepts are also essential to understanding informal settlements as they involve "a non-linear logic where the order of the city emerges unpredictably from the multiplicity" (Dovey, 2012b). Spatial and design thinking for planning and designing the contemporary city could benefit from incorporating these approaches.

Alexander (1965) made insightful observations on the functional complexity of towns and cities in his seminal paper *The city is not a tree* in which he argued that modernist planning and design has evolved based on simplified notions of complexity and order. As a result, planning and design has failed to achieve a deeper understanding of what gives true functionality and form to towns and buildings. In this work, Alexander (1965) attempts to formulate the principles that lead to a good built environment and which repeat themselves as patterns and design solutions in the built environment. Thus, planning and design face major challenges of replicating complexity, an observation subsequently made by Greenberg (1995) and more recently Marshall (2009).

Alexander (2002) takes a deeper intellectual approach to analyzing order and its relationship to complex systems, living structures, incremental change, transformation and the built environment generally in his acclaimed work called *The Nature of Order: An Essay on the Art of Building and the Nature of the Universe.* Alexander (2002) argues that order is an understanding of the process by which the arrangement of things occur as based on their relative positions as shaped by forces that guide their location and evolution. In other words, while understanding the multiplicity and connections of parts is important in the urban fabric, perceptions of disorder result from an inability to understand the evolutionary organizing processes and explicative paths of change that shape one configuration compared to another (Waguespack, 2010). In this setting, a major

contribution by Alexander (2002) to understanding notions of order is the need to unpack the rules for system evolution that preserve the 'orderly' and visible composition and transformation of the urban system. In other words, the built environment, whether defined as formal or informal, is produced by orders of varying manifestation, with coherency defined by its consistency or malleability and richness of diversity.

The above analytical frameworks still apply today in challenging our understanding of order and complexity. This is especially important in informal settlements where notions of context, local and place are all important in understanding the diversity and logic of the 'messy' urban fabric as it evolves. The lack of explicit visible physical and aesthetic order in informal settlements leads policy makers and the public to readily generate myths and simplistic assumptions about the inhabitants of such settlements and their socio-economic, spatial, physical and environmental conditions. As indicated in this paper, terms such as disorder, illegal and unplanned characterize generalizations on informal settlements, thus reinforcing the negative stigmatizations that flow from their lack of adherence to formal order based on minimum standards, rules and an overarching desired order. All this strongly influences the discourse on urban theory and importantly, mainstream constructs of socio-spatial marginalization and 'solutions' for informal settlements and their communities. Not surprisingly, order in informal settlements and how it can work with existing systems of planning and design remains relatively neglected and unexplored.

The Setting - Kampung Lebak Siliwangi, Bandung

Comprising a range of small, medium and large sized towns and cities, Indonesia is one of the fastest urbanizing countries in the world. Bandung, the third largest city in Indonesia and the capital of West Java, is located 150 kilometres south east of Jakarta. It has an estimated metropolitan population of approximately 10.5 million persons (2014) and has been subject to rapid urbanization. This includes containing some 38,450 hectares of 'slums' comprised mainly of kampungs which accomodate the urban disadvantaged and poorer households (Jones, 2017a). Located in the center of Bandung and divided by the Cikapundung River is the Tamansari valley and adjoining localities. The once fertile agricultural area wedged between the Dutch planned areas of the city to the east and west was settled by people from West Java following civil unrest and political struggles over Islam in the 1960's. An influx of migrants saw the agricultural based uses of Tamansari intensified with growing kampungs and population, with many original refugees and their descendants now being long term landlords (Jones, 2016b).

Located in the north of Bandung on the perimeter of Tamansari and eastern slopes of the Cikapundung River abutting Bandung Zoo is the kampung of Lebak Siliwangi (see Figure 2). In 2015, the population was estimated at 4,240 persons which comprised some 1,080 families consisting of 2,098 males and 2,142 females. Compared to the 2011 census, population growth has been relatively stable, showing a marginal decrease. While livelihoods are diverse including many home businesses, mini-stores, and array of street hawkers, the kampung is increasingly home to many university students, especially those students from the neighbouring Institute of Technology Bandung (ITB) university. This heterogeneity of population reinforces the nature of affordable housing that Lebak Siliwangi offers to "new comers" such as students, as well as longer term low income residents.

Since the influx of migrants in the 1950's, the morphology of Lebak Siliwangi has been one of buildings and alleyways coming first, and services, infrastructure and clarity of land tenure following later. Space in Lebak Siliwangi is highly utilized, sought after and mixed use, with housing construction being a mix of vertical and horizontal expansion as residents and landowners

respond to familial demands for space within the context of available social and financial capital. The labyrinth of alleyways that surround dwellings and frame the block patterns are the residual 'left over voids' from housing development, with many being the original pathways that surrounded and linked the network of rice paddies which dotted Lebak Siliwangi in the mid-1900's. Notions of form and function remain fluid in understanding the nexus between alleyways and adjoining houses as innovation in space utilization mean they are strongly intertwined and hyper adaptable being 'fit for purpose'. While formal government institutions exist and have influence in Lebak Siliwangi, for example, there are eight designated neighborhood units based around the government administrative units of *rukun warga* (RWs) and *rukun tetangga* (RTs), Government control via formal planning and design standards and approval is absent. Thus, at the local level, there is freedom from 'top down' planning, design and building controls as reflected in the multiplicity of form adaptations which respond to the particular social and economic needs of households.

Figure 2. Morphology of the urban fabric and location of Lebak Siliwangi.

Rules of Form and Structure in Lebak Siliwangi

Within the context of understanding the evolution of the planning and design order in Lebak Siliwangi, a number of key rules and principles can be identfied.

Rule: Settlement Structure is Situated within a Legacy of Past Major Development Decisions

The structure of Lebak Siliwangi is derived from a combination of: (i) natural features such as the Cikapundung River, (ii) topography including the gradient fall from east to west to the Cikapundung River, (iii) past major development decisions driven by in-migration and settlement growth, such as irrigation channels, eastern perimeter road and two pedestrian river crossings, (iv) gradual land use change from rice paddies and fish ponds in the 1950's to housing and associated small scale commercial and more recently boarding/rental housing, and (v) the progressive introduction of 'urban' morphological units, such as irregular sized plots, blocks, mosques (with their east-west orientation) and alleyways as the area has intensified and transformed from agriculture to a dense inner city informal settlement (see Figure 3).

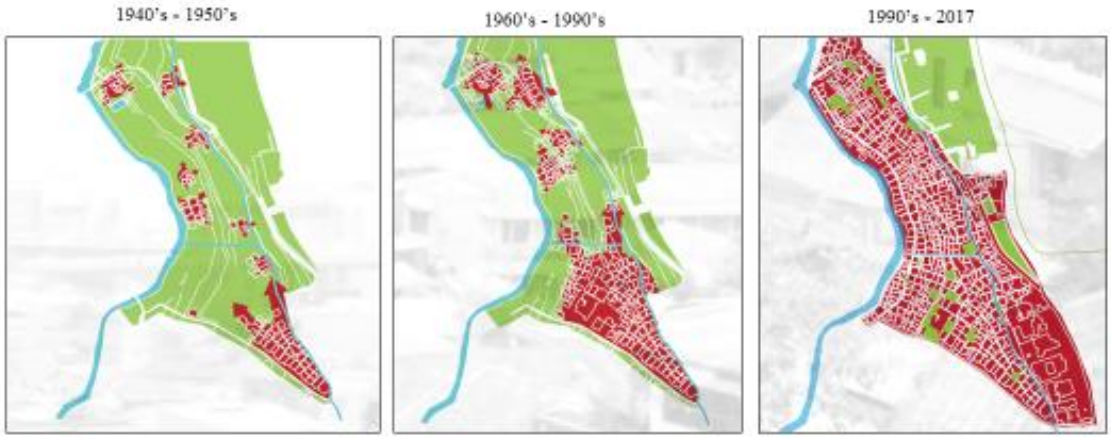


Figure 3. Spatial change through land use evolution in Lebak Siliwangi, 1940's to 2017.

The non-linear alleyways are the 'veins and arteries' of the Lebak Siliwangi structure, with the width of the alleyways providing "opportunity space" for housing to modify their interface form, including extending their edge within the alleyways. Based on functionality, width and location, alleyways can be classed as major alleyway, minor alleyways and one way (that is, 'live ends' leading to houses - not dead ends!). Alleyways which connect major desire lines and have greatest motorbike and pedestrian 'traffic' such as the north-south Gang Stone Alley adjoining the Cikapundung River, tend to have a greater proportion of economic and social/cultural land uses. Major and minor alleyways provide the means of pedestrian and transport permeability and connectivity in which the consequences of changing interface form types between the built form of the house, plot and alleyway are played out. While the overall connectivity of alleyways is set by (i) their function and permeability, (ii) the distance to the desired destination, (iii) underlying physical structure such as the Cikapundung River, and (iv) grade changes including existing terraced walls, the alignment of alleyways remains fluid and flexible due to the myriad interface form types defining the intersection of the housing frontage and alleyway (see Figure 4). Hence, the alignment of key structural elements such as alleyways and their form are in a constant state of change driven by private and communal interests.

The cumulative impact on structure of numerous individual housing form changes, such as building to the alignment and setting forward into alleyways means functions such as transportation (their size and mode), access, economicand communal activities are forced to respond and modify. The rules for form and function change, and manipulation of interface

elements appear differentiated according to the function of major and minor alleyways. For example, in major alleyways, two main forms of transport predominate, namely, walking and motorbikes, and the physical width of alleyways does not reduce below 1.5 to 2 meters to allow for the passing of motorbikes. However, in minor alleyways such as those in an east west direction which follow the gradient of the slope, the alignment has been reduced to walking width only.

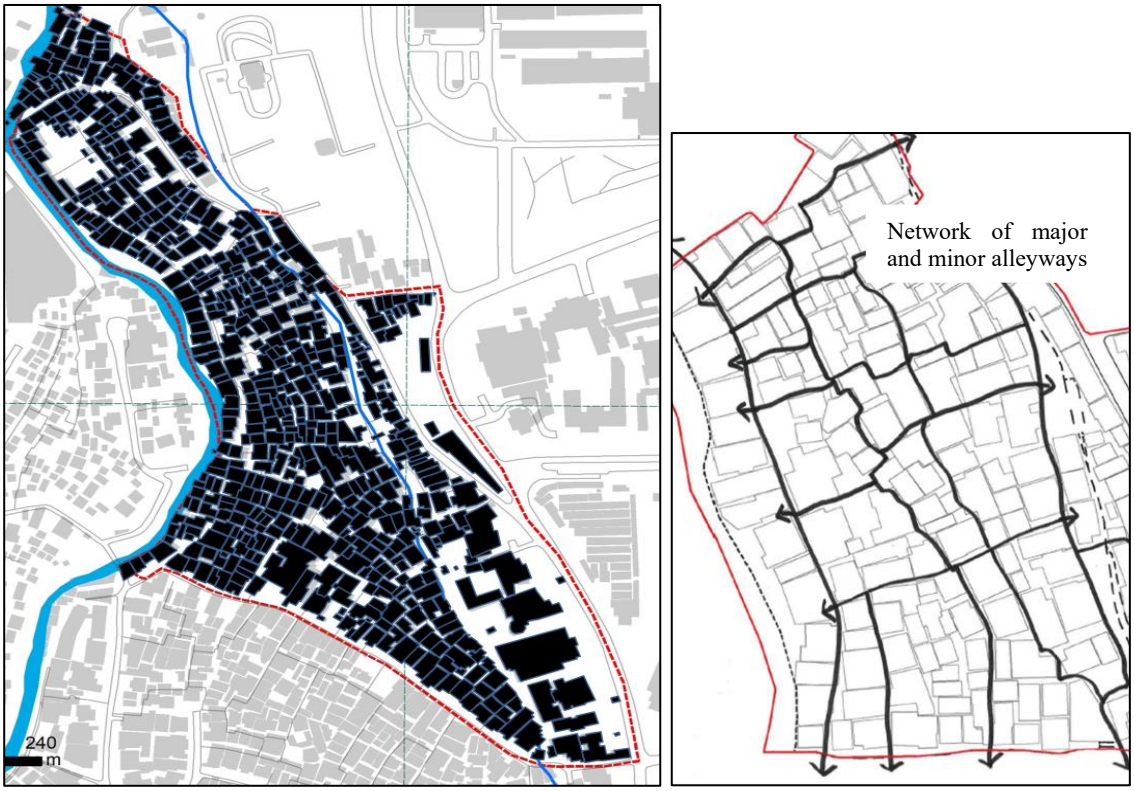


Figure 4. Block patterns in Lebak Siliwangi have evolved from the layout of the original rice fields with many terraced walls forming the network of major and minor alleyways.

In this context, the major influence on current structure and the arrangement of morphological elements are the cumulative impacts of multiple individual households sanctioned by group governance (such as RTs and RWs), rather than higher order Government led planning interventions. The exception to this is when Bandung City Government wishes to acquire land for slum upgrading and imposes the full force of the law to attain its objectives (Jones, 2017a). Modules at the smallest scale such as houses and the way they couple with topography and earlier land use patterns - such as alleyways which correspond to the perimeter walls of the terraced rice paddies, for example - provide the foundations for connecting the overarching settlement structure. Thus, settlement structure is an assemblage of informal and formal outcomes over time, with informal actions and processes at the household level now being the major determinant of manipulating structure and expresssing form.

Rule: Contestation of Public - Private Space Determines Interface Types and Alleyway Alignment

The interface has traditionally been the zone of transition that connects the private domain such as a house or commercial building to the adjoining public space and vice versa (Kamalipour, 2016). This zone has been viewed as an inter-mediatory space between the wall of the building and horizontal juxtaposition of the street and public space. In mainstream planning contexts, the concept has been used to understand types of socio-spatial transgression and human scale connectivity by examining the degree of porosity and permeability from the dwelling to the public space (Dovey, et al, 2015). However, in high density informal settlements, the edge of the dwelling invariably forms part of the "cookie cutter" alignment of the alleyway and the physical interface takes on multiple forms and functions. As such, the alleyway space and its confined edge are dynamic as houses and their varying built form and front boundaries - legal, illegal or otherwise based on varying stakeholder perceptions of social and spatial boundaries and territory control - adjoin each other in a variety of configurations to frame the alleyway. The variable width and alignment of the alleyway created by this unregulated "interface creep" determines the subsequent functions and form responses of the alleyway (see Figure 5). This impacts on the movement of people, trading of goods and socialization.

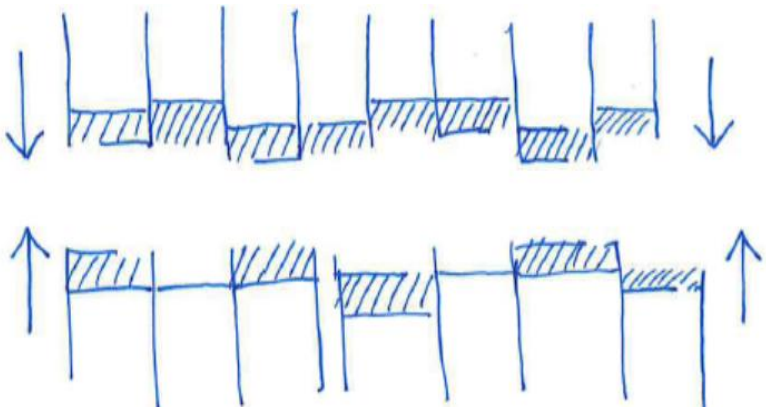
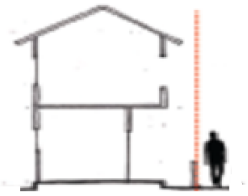
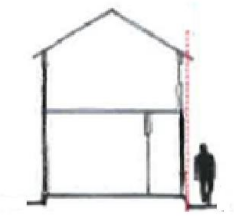
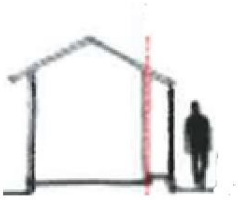
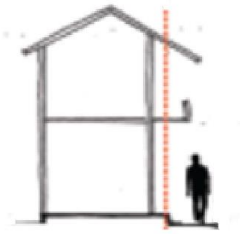


Figure 5. "Interface creep" as instigated by resident's changes to housing boundaries impacts on block shapes as well as alleyway alignment and shape.

In this micro-scale environment, it is possible to identify the interface form types by which residents 'push' their boundaries while concurrently shaping and reconfiguring the nature of the alleyway. Set against contested notions of what is private, public, communal, semi-public and shared, four primary interface types are identified, namely, setback, aligned, set forward, and set above. These are summarized in Table 1. Other interface form types adapt from a combination of these primary types, for example, edges defined by both setback and aligned, and both aligned and set forward. Within each interface form type, elements such as doors, windows, part or full walls, and fences couple in varying combinations to provide varying levels of human scale accessibility, visibility and socialization between the house and alleyway and vice versa. They also provide the opportunity for economic activities within the interface form types. For example, a window could be turned into shop front, a setback or part setback could be used to accommodate a mobile food stand, or stairs introduced as access for upstairs room rental within the setback or set forward. Thus, the greater the setback and associated permeability and visibility, the more flexible the opportunities to meet the functional needs of the household (see Figure 6).

Table 1. Primary interface form types - Lebak Siliwangi.

Type and Description	Elevation	Image Example
1. Setback: A semi-private transition space between the front boundary and dwelling entry. The transition space may include a green area, covered porch enclosed by a full, part or no wall at the alleyway edge.		
2. Aligned: The front face and entry to the main dwelling is aligned on the front boundary. There is no transition space between the front boundary and the main dwelling entrance. Can combine with Setback or Set Forward types.		
3. Set Forward: A dwelling which transgresses the property boundary and or dwelling edge into the alleyway. The form of the set-forward could be a room, porch, seating, ramp or the like. Can combine with Aligned/Setback.		
4. Set Above: A dwelling whose second and additional storey extensions, including a verandah, extends over the front ground level boundary of the alleyway.		

The cumulative impact of numerous individual form changes at the household level, such as aligning to the boundary and setting forward into alleyways means functions such as transportation modes and street hawkers plying their carts are forced to respond and modify. For

example, hand pushed trolley carts delivering water bottles are replaced by motor bikes with bottles stacked behind the driver. The geometry of diverse interface form types and alleyways is further altered by the placement of style elements, such as seating, 'urban agriculture' such as plants, plus ramps, steps, drainage, different textures and materials. At larger scales, the interface forms are disconnected, fractured and diminished due to the introduction of new larger scale elements such as the perimeter Tamansari Road and the Pasupati Freeway Bridge.

Figure 6. The public/private interface reflects an innovative range of multi-functional and temporal adaptations.

Rule: Change in Housing Form is Progressive by Small Scale Adaptation and Renewal

Housing in Lebak Siliwangi expands horizontally and vertically within or over plot boundaries to attain greater floorspace coverage (Jones, 2017c). Housing and their elements such as walls, floors, roofing, balconies, windows, doors, materials and interface form types are gradually modified at the local level based arguably in response to changing social, economic and cultural drivers. Multiple individual actions and varying processes, such as agreeing, modifying and affirming the development change, plus the timing of works and the method and materials of construction, for example, means the spatial form is diverse and in a continual state of "becoming" (Dovey, 2010). What is reflected in the transformation of Lebak Siliwangi is a collation of human scale actions at the scale of individual houses, plots and alleyways which form the whole. The accumulation of small scale actions of adaptation and renewal in housing are progressively "added on" and contribute to a high degree of diverse visual coherence. While not achieved in the sense of conventional processes, visual order in Lebak Siliwangi is attained by:

1. diversity of built housing forms within an overall spatial envelope of 2-4 storeys (notwithstanding one - two exceptions where plots have been amalgamated and redeveloped);

Table 2. Main tools of housing adaptation and renewal - Lebak Siliwangi.

Change Tool	Image Example		
1. Vertical Extension by Adding Floor/s			
2. Insertion of External Access Stairs			
3. Plot Amalgamation and or Subdivision			
4. Material Replacement and or New Services			
5. Verandah Add-Ons			
6. “Attached” Temporary and Mobile Form Elements			
7. Horizontal “Interface Creep” of Housing and Plots into Alleyways			

2. an irregular grid pattern over most of the kampung connected by permeable alleyways of varying widths, functions and grade;
3. diversity of materiality, construction approaches and housing types from which patterns and types can be identified;
4. patterns comprising differing block sizes and shapes - that is, clustered, grid, linear, and curved linear - are all defined by elements at a human scale.

Table 2 summarizes the main change tools that collectively reflect the ongoing processes of housing adaptation and renewal in Lebak Siliwangi. In addition to the renewal driven by interface form types which occur primarily at ground level, 6 main types of housing adaptation and renewal are identified. These are (i) vertical extension by adding floors, (ii) insertion of external stairs, (iii) plot amalgamation or subdivision, (iv) renewal via material replacement or new services, (v) adding of verandahs, and (vi) "attaching' temporary or mobile form elements such as hand carts and food stands within a setback and or at the front of the dwelling whether aligned or set forward. The progressive change to housing collectively results in settlement densification through additional floorspace, rising population and change of use. Through this process, housing is modified and transitions from one type to another, albeit slowly.

Over time, settlements intensify by adding built form and increasing their populations, and at some point, settlements and their communities are adversly impacted by the loss of light, decline in infrastructure and service quality, ongoing "interface creep" into public spaces, and general environmental degradation. In this context, there is a basic relationship between height of the housing, design features and alleyway width and the amount of light and air circulation. As a rule, meandering alleyways or parts thereof which have 'adequate' daylight and air circulation have a ratio of 1 alleyway width to 2-3 storeys of housing as set to the alleyway boundary. On the other hand, non-linear and irregular alleyway patterns defined by narrow alleyways and 3-4 storey plus housing modules with balconies, overhangs, and irregular roof tops also receive light and air due to their local configuration. This includes punctuation with small open spaces, gardens and through unobstructed house orientation to sunlight.

Discussion and Conclusion

The systems of organization and arrangement by which Lebak Siliwangi manifests itself continue to evolve. Compared to the arrangement of the urban fabric shaped by prescribed 'top-down' formal planning rules and resulting morphology as seen at a larger scales in Bandung, the order in Lebal Siliwangi is less apparent and not as discernible (see Figure 7). Using a morpho-typology analysis reveals a specific set of rules and principles by which a 'hidden' order as expressed in form, structure and transformative processes of adaptation is shaped and continues to evolve. These rules involve the dynamic relationship in kampung space between plots, block patterns, housing mass, alleyway shape, the process of "interface creep", vernacular architecture and the deeper socio-cultural values of the residents and their goveranve systems.

In respect of structure, the key determinants of topography and earlier major land use decisions provide the framework within which housing and related economic and social activities evolve. It is the edge and boundaries of key structural elements such as blocks and narrow plots whose form is most visibly manipulated at the ground level by interface form types. These 'step by step' incursions driven by the process of "interface creep' subsequently define the alleyway shape and alignment. There is a clear sequential primary order of interface form types from setback, aligned and set forward which occur in multiple form configurations and continually realign the edge of

both private (housing) and public (alleyway) realms and the subsequent social and economic utility of space.

Figure 7. Is this physical disorder in Lebak Siliwangi? Key elements of order such as non-linear alleyways can be explained by the sequencing and configurations of interface form types.

On the other hand, vertical housing change and claiming of space occurs by a multitude of adaptation strategies. This includes adding floors and verandahs, inserting external stairs, and renewing materials. Due to the diversity of both horizontal and vertical change, small scale lines and curves are arranged in their own geometries as reflected in the irregular massing of housing modules, oblique block patterns, varying combinations of interface form types, and non-linear alleyway alignment. Style elements such as seating, hanging flower pots, multi-functional window spaces and mobile food carts further accentuate the mix of eclectic form defining the private/public interface and alleyway character generally. As a general observation, order proceeds from small to large within the context of earlier larger scale infrastructure and land use decisions, combined with topographical constraints and opportunities afforded by the evolving morphological patterns. As indicated by Alexander (2002) in his fundamental theory of order, empirical rules do exist for developing and explaining the urban fabric (Salingaros, 2000). More recently in the Asian setting, Chalana and Hou (2016) reaffirm through a range of case studies that seemingly messy and disordered urban landscapes do possess a hierarchy of order that challenges our conceptions of city making.

In Lebak Siliwangi, form change reflects a constant ongoing process of housing renewal and space adaptation where notions of physical boundaries and territory are contested through encroachment. The phenomena of "interface creep" which defines the nature of social and economic interaction as well as the alleyway alignment reflects the fact that despite the questionable legal and quasi-legal status of plots, residents will 'push' their boundaries to create new physical alignments. Concepts such as cadastral boundaries and agreed land ownership arrangements have little relevance in this ground level urbanism setting where some plots are surveyed and registered, while some alleyways remain under private and family ownership despite their public use. In this context, alleyway space is seen by many residents as a communal and potentially private commodity as long as adequate public space remains for access depending on the functional hierarchy of the alleyway in question. There exists a reiterative process of form shaping and alteration which continually produces new interface configurations and alleyway alignments. The rhythm of the alleyway strongly depends on and responds to this form shaping process in combination with residents including their temporal activities. As such, connective

social and economic forces imprint themselves on local nuanced geometry, creating unique patterns of informal settlement morphology. Order therefore emerges as a combination of; (i) resident actions, (ii) the process by which housing extends and adapts, and (iii) the local urban governance and socio-cultural context within which this happens.

Within an urban governance setting, the main determinant of form and structure is individual and group decisions which occur within a community framework defined by consensus and group (neighborhood) and or household agreement. Governance at the local level is prominent with much community outreach based around the low-level governance units comprising the RWs and RTs. These are strong in social capital and bind the neighborhoods together through locally based activities including provision of primary schools, health clinics and local security surveillance. As a rule, lower order agreement and governance does not necessarily require higher level hierarchical governance such as the city level. As a result, when there is a dispute on the introduction of changes to current housing such as balconies, additional rooms, and or set forwards, households may make use of the RT and RW leaders and if necessary the police to mediate disputes. Otherwise, changes to built form are made and controlled at the household level.

In conclusion, labelling informal settlements as unplanned and dysfunctional masks the reality that locally there exists an underlying respect for community, including a humanitarian need for maintaining a semblance of local social and physical order. For example, RWs in 2017 painted broken white lines on both edges of the main Gang Stone Alley to indicate that it is not desirable for residents to further encroach their dwelling edge via "interface creep' into the alleyway space (see Figure 8). This reflects a validation of local order via the enforcement of controls to ensure local public interest issues are maintained and respected in public and community used spaces. It follows that the identification of rules and principles by which form and structure are developed means notions of order, complexity, and chaos in informal settlements need to be recalibrated as they have major implications for the scope and approach of informal settlement and slum upgrading policy and programs. Major questions of social organization, power sharing and resulting typical physical form types and processes such as "interface crep" need further public debate in the deconstruction of relations between order and informality. Such moves would assist in exposing the shallowness of current urban planning and design theory which relegates informality, informal urbanism and critical reflection of upgrading practices to the margins of planning education and practice.

Figure 8. Local rules and protocols as reflected in the white painted lines framing the alleyway edge indicate that the boundary of the contested private/public interface is not to be further encroached.

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