Incremental Production of Urban Space: A Typology of Informal Design

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Abstract

Informal settlement is a form of incremental urban design and planning that seems set to remain a primary mode of urban development in cities of the global South. Yet, we know very little about how incremental urbanism works. In this paper, we suggest a typology of increments as a conceptual lens for understanding the emergence of informal settlement morphologies. We consider the ways residents extend and renovate buildings at micro- spatial scales and identify typical increments of 'extend', 'attach', 'replace', 'divide', 'connect' and 'infill'. We also explore the informal rights and codes that govern the ways in which some increments encroach on public space – 'rights of way', 'air-rights' and 'the right to light and ventilation'. We engage with the paradox that while every increment is a form of upgrading, informal settlements often produce slum conditions. We suggest that the most effective knowledge base for slum upgrading practices lies in a better understanding of informal settlement as a mode of spatial production.

Keywords: Informality Urbanism, Informal settlement, Upgrading, Typology, Adaptation

Introduction

Anyone who has spent much time in informal settlements in cities of the global South will notice the high levels of incremental adaptation of buildings – multiple single-room additions with verandas, roof terraces, balconies and stairways are added and subtracted as part of a continuous transformation. One of the key contrasts with a formal construction process is that the increment size is far smaller, and the number of adaptations is far larger. While each increment is insignificant, the emergent morphology and spatiality that we broadly identify with informal settlements is produced by such incremental adaptation processes. Construction is often makeshift, but there is always a spatial logic and often significant levels of design ingenuity as different forms of livelihood are supported through design and construction. While every increment is a form of upgrading, without the constraint of formal design and planning regulations, such adaptations can escalate into slum conditions. This is not inevitable – informality is a mode of production while 'slums' or substandard conditions are one possible outcome (Dovey, 2019). Since the demolition and replacement of most informal settlements is now widely regarded as both impossible and unnecessary, a better understanding of how informal settlements are designed and planned has become a high priority. This study of the forms and rules of incremental adaptation in informal settlements is a step in that direction. What is at stake here is that the livelihoods of the urban poor are intimately connected to capacities for incremental adaptation as the means through which housing is produced and upgraded. Attempts to produce replacement housing often damage such capacities for adaptation and produce dependency. Any initiative to engage in an upgrading process must first understand that incremental production is always already an upgrading process.

Informal urbanism, ranging from informal settlements to informal trading and transport, has become one of the critical global challenges, yet integral to the ways in which cities of the global South work, housing about one billion people (UN-HABITAT, 2006). Informal settlements are by no means marginal to the city (Perlman, 1976) and they are here to stay. Wholesale demolition and displacement do not work since informal settlements are located to access jobs and opportunities. With few exceptions most informal settlements can be upgraded incrementally on the same site to avoid displacement. Such processes of upgrading then rely on a sophisticated understanding of the ways the morphologies and incremental processes of change work in informal settlements. Informal settlements remain in a process of incremental change even after practices of upgrading and formalisation. In this paper we analyse micro-scale adaptation as a dynamic process and the informal codes or rules that mediate these processes of change in informal settlements. While all informal settlements involve incremental development processes, here we focus on small-scale increments of one room or less. We also seek to understand the relations of incremental change to transformational change through an accumulation of increments.

Most academic literature on informal settlements comes from social sciences, geography and planning focusing on the issues of governance, poverty, policy and socio-economic processes at the macro scale (M. Davis, 2006; Bayat, 1997; De Soto, 2000; McFarlane & Waibel, 2012; Roy, 2005; Roy & AlSayyad, 2004; Appadurai, 2001; McFarlane, 2012). The morphologies, micro-spatialities and dynamics of change have remained underexplored although there is an emerging body of research exploring the morphologies of informal settlements (Dovey & Kamalipour, 2018; Dovey & King, 2011; Jones, 2019; Kamalipour, 2016; Kamalipour & Dovey, 2018; Ribeiro, 1997). Analysing generative codes and socio-spatial patterns has been a line of inquiry in urban planning and design thinking with a focus on traditional cities and vernacular settlements (Alexander et al., 1977; Hakim, 2007, 2008, 2014). Arefi (2011) suggests that the logic of informal settlement is an implicit order, based in rules or patterns that are fluid, adaptable and not easily detectable. However, we know very little about the morphogenic processes through which informal settlements change over time.

There is also an extensive body of research on self-help housing, much of it stemming from the work of Turner who celebrated the productive capacities of an incremental architecture that is geared to the rate at which resources become available to the urban poor (Turner, 1967, 1968). There has been some documentation of the ways in which informal increments take place by exploring how rooms are constructed and extended through practices of self-help building over time (Ward, 2015, pp. 375–376; Ward, Jiménez Huerta, Grajeda, & Ubaldo Velázquez, 2011, pp. 468–470). The bulk of this research has been undertaken in the context of Latin American cities (Bazant, 2003; Peek, 2015; Peek, Hordijk, & d'Auria, 2018; Stiphany, 2019; Ward, Jiménez Huerta, & Di Virgilio, 2015; Ward, Jiménez Huerta, & Di Virgilio, 2014). Drawing on evidence from Egyptian cities, Soliman (2010, p. 136) has identified several steps in the process of incremental housing: construction of walls to demarcate plot perimeters, construction of a room to enable a *de facto* recognition of tenure, horizontal addition of extra room(s), vertical extension of existing buildings, and connection to electricity/water supply to enable a *de jure* recognition.

Thinking about the ways in which users can most effectively control the housing design, construction and management is central to Turner's conception of 'housing as a verb' (Turner, 1972). The larger questions about the capacities and limitations of self-help housing are very important (Gilbert, 1999; Wakely & Riley, 2011), however, they lie beyond the scope of this paper. We begin from a descriptive rather than a normative position – that incremental/informal/self-help is a major form of housing production. To define it as incremental implies that we study the increments. We argue that harnessing the productive capacities of informality relies on a more sophisticated understanding of how the incremental production of buildings and public space works.

In this paper, we introduce a typology of informal design and construction increments in order to provide a better understanding of the micro-spatial production and adaptation of space in informal settlements. Our focus here is on typical forms and processes across a broad range of settlements without any assumption that these are in any sense universal. We engage with three primary questions: What are the typical increments of change in informal settlements, how do they shape settlement morphologies, and what informal urban codes or rules emerge to mediate such morphological change? To address these questions, we draw on a range of evidence from multiple cities of the global South. What is at stake here is a better knowledge base, and therefore an enhanced ability to work with the productive capacities of incremental upgrading practices. We develop a typology of incremental adaptations as buildings are extended, replaced, divided, connected and infilled; and we explore the ways such adaptations are mediated by informal building codes or rules in three particular informal settlements. We also argue that a better understanding of such types and codes is critical to the success of design intervention.

The concept of urban informality has its roots in economics – the 'informal sector' as a mode of production that emerges outside formal markets (Hart, 1973). As a mode of urbanization, it has become multi-dimensional and difficult to define (Gilbert, 2004; Tonkiss, 2013). This difficulty is due to the fact that informality and formality are not binary conditions but always blurred and interrelated. Urban informality is often seen to cover the range of activities that take place beyond state control. Yet as Roy (2009) points out, informal settlement can also be seen as a form of deregulated urbanism produced by the neoliberal state; the state turns a blind eye to middle-class informality while erasing that of the urban poor. These larger issues of defining urban informality are complex and are not our focus here. However, it is crucial to what follows that we distinguish between informal settlement as a mode of production and the 'slum' as a substandard urban condition. The term 'slum', with connotations of overcrowding and poor sanitation, refers to a set of substandard conditions rather than a type of housing (Huchzermeyer, 2014; UN-HABITAT, 2010). The ways that informality may or may not produce slums is a key question we seek to engage here.

We also seek to engage with the ways incremental change is mediated by informal codes or rules – the customary rules guiding everyday design and construction decisions in informal settlements. While formal urban codes have been a key theme of study in urban planning and design (Ben-Joseph, 2005; Marshall, 2012; Talen, 2012), informal settlements have rarely been explored in this context. A key distinction in the literature is that between proscriptive or generative codes on the one hand and prescriptive regulations on the other. While a proscriptive or generative code will focus on prohibiting certain undesirable outcomes, it will leave the actual outcome open; a prescriptive code will determine or control a formal outcome (Baer, 2011, p. 279). Hakim has argued that the informal rules or codes that governed traditional Mediterranean urbanism were proscriptive or generative, enabling the huge diversity of formal outcomes (Hakim, 2014). Generative codes can be complex procedures and sequences of decisions framed by prohibitive principles (Alexander, Schmidt, Hanson, Alexander, & Mehaffy, 2008; Talen, 2009, p. 152). There is also a body of knowledge on the formation of traditional settlements through generative processes (H. Davis, 2006; Hakim, 2014). Alexander's work on socio-spatial patterns as generative codes is also seminal in this regard (Alexander et al., 1977; 1987; 2008). Our concern with codes in this paper is with the ways in which they control incremental change in informal settlements, but also with their failure to prevent an escalation onto slum conditions.

Foster (2009) has argued that the challenge of informal settlements is linked to what Hardin (1968) has famously referred to as 'the tragedy of the commons' where private interests lead to an exploitation of common resources over time. Ostrom (1990) has argued, against Hardin, that self-organization often works well. While we engage with the challenge of harnessing the productive capacities of informality, we also argue that there is a dark side to generative processes of change in informal settlements where the pursuit of private interest takes over and escalates to the point that public space becomes dysfunctional.

Methodology

This research draws on multiple examples from different cities across the global South to provide breadth of context and morphological conditions in the development of the increment types. We then focus on three case studies of consolidated informal settlements in Bangkok (Thailand), Medellin (Colombia) and Pune (India) to explore the underlying urban codes or rules mediating self-organised increments of change in particular cases, part of a broader study of informal settlement morphologies based on fieldwork in 2014 and 2015 (Kamalipour, 2017). The case study selection is based on access to settlements and aligned with what Flyvbjerg (2004) has identified as 'information-oriented' cases that reveal a broad variation of settlement context and morphology, however, this is a nascent study with no claim that these cases can fully represent the broad class of informal settlements. The characteristics of the selected case studies including their similarities and differences have been explored elsewhere (Kamalipour & Dovey, 2018, 2019).

The key research methods for identifying and documenting increments of change have been observation, photographic survey and mapping. The evidence is primarily visual and includes differences of materials, design, construction and floor size in a single building. While the increments of earlier phases of construction may no longer be evident, these are settlements under continuous construction. These physical traces of incremental change can generally be documented without in-depth interviews. Nonetheless, this is a morphological study and not an ethnography; thus, it does not explore the complexities of politics and land tenure nor the particular perceptions or motivations of the agents. This is also a descriptive rather than normative study; while a better understanding of design and construction quality is crucial, it also lies beyond the scope of this paper.

Increments of change

The typology we want to suggest is just one lens for understanding a highly complex field of design and construction practices including all building additions, renovations and service connections. We have divided these increments into six types: extend, attach, replace, divide, connect and infill (Fig. 1). We name them as verbs in order to stress the sense of desire and agency that drives each increment as a step in an upgrading process. To 'extend' is to create additions to enclosed private territory, generally one room at a time. To 'attach' is to add semi-private territory such as yards, porches, balconies or roof terraces. To 'replace' is to upgrade an existing construction from temporary to more permanent materials. 'Divide' involves a subdivision of internal space and 'infill' involves the enclosure of a pre-existing formal shell or framework. 'Connect' is the integration of a building with any service or network connection. We recognize that these categories may be fluid and ambiguous at times and that increments may take place simultaneously. It is tempting to posit a separate category for the initial increment of settlement (the claiming of land); however, our goal is to understand the process and morphology of change and informal settlement does not always begin from a vacant site. Formal buildings are often the armature from which (and within which) informal settlement grows. All informal settlement occurs in relation to some formal framework; it is within this context that we wish to explore the ways informal agents extend, attach, replace, divide, infill and connect.
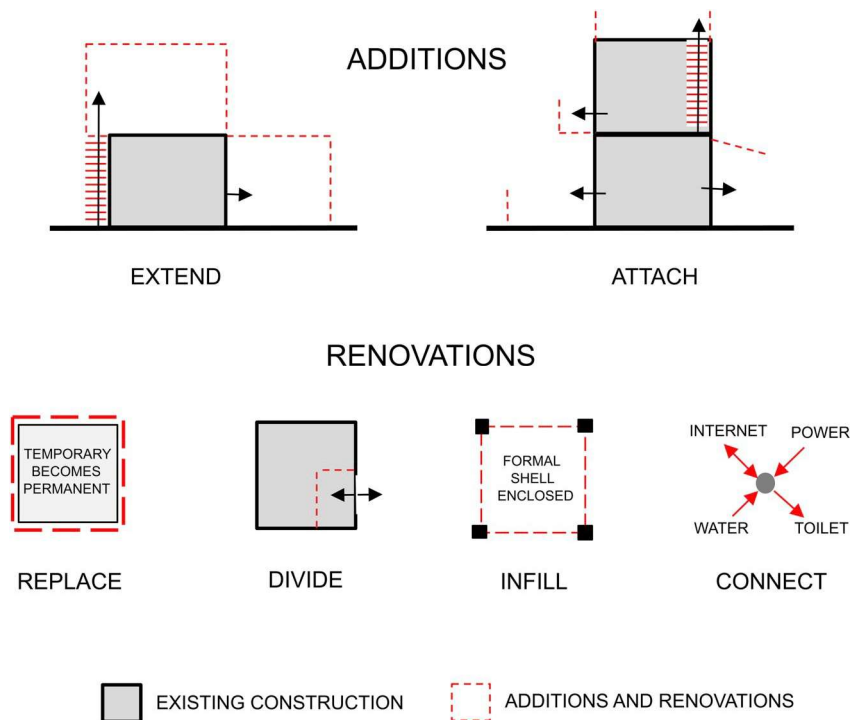

Fig. 1. A typology of incremental design and construction in informal settlements.

Extend

Extending is about pushing the boundaries of the private realm by adding more space to existing buildings. This includes adding a room or multiple rooms, horizontally or vertically over time (Fig. 2). In poorer settlements this process is generally one of room-by-room accretion where the enclosure of a single room is often the basis of a house, with further rooms added as resources permit (Dovey & King, 2011). If the upper floor room can be supplied with an external access, then it can also be more easily rented separately from the

ground floor. In such cases the addition becomes a source of income. Most informal settlements are built with the anticipation of additional rooms as soon as resources become available, often signified by reinforcing bars that project from the roof structure in anticipation of a further storey. This increment is primarily responsible for the incremental densification of informal settlements in terms of both buildings and population. It may also directly lead to a shrinkage of public space through horizontal encroachments; there is always a trade-off between private and public territories in informal settlements. In settlements that are already consolidated, extending generally takes place vertically. While vertical additions do not encroach on the area of public space, they may cantilever over public space blocking natural light and ventilation. The addition of rooms within an informal settlement can escalate to the point that public space becomes unlivable and reaches the limit of minimal access functions. The addition of rooms may also change the functional mix if they are used for production or exchange.

Fig. 2. Room-by-room extensions – Mumbai, Rio de Janeiro, Manila. Photos: Kim Dovey.

Attach

This increment describes the ways semi-public spaces are attached to buildings in the form of balconies, porches and roof terraces, changing the ways private spaces are connected to public spaces by adding an interstitial space between inside and outside (Fig. 3). This space is often highly social and productive since domestic activities spill from crowded interiors into these spaces. Attachments also have a tendency to encroach onto public space as porches extend and balconies extend into and over them. Roof terraces are generally private open space, but often become additional rooms over time.

Fig. 3. Attachments – Medellin, Pune. Photos: Hesam Kamalipour (left and right) and Kim Dovey (centre).

Replace

This is an increment of change where existing construction is upgraded through improvement or replacement of materials or construction. It is common practice in informal settlement for a temporary structure to be erected and later replaced by a more permanent one in the same location. Temporary structures

are common during the initial stages of informal settlement, allowing for a rapid process of settling on new land. This is a particular advantage in semi-organised processes of land invasion where a fast pace and scale of encroachment is a political imperative. Temporary construction can also be a means to test the tolerance of the state – there is less to lose if the state responds with demolition. In this sense, temporary structures can be considered as speculative and replacement is an affirmation of *de facto* tenure. The issue of land tenure is itself much too complex to deal with here but the link with permanent materials is a crucial one.

While replacement changes the appearance of buildings, it does not change the morphologies of informal settlements. It most commonly involves an upgrade from what are seen as more temporary materials such as plastic, canvas, earth, cement sheet, galvanized iron, timber and bamboo; to be replaced with those seen as more permanent or with higher status value: concrete, brick and glass. Improvement of existing construction often involves a resurfacing of raw finishes to be rendered and painted, from raw concrete to tile or stone finish. This increment is important because of the distinctions that are widely made between temporary and permanent construction and the ways such a distinction plays into the politics of forced eviction and demolition. The South Asian distinction between *kutcha* (temporary) and *pucca* (permanent) construction is widely used as a criterion for slums conditions and eviction policies. Such increments generally increase physical security from theft, fire, earthquake and storms; they may also increase security of tenure. Many such increments involve a change of image and place identity. In hot and humid climates, the replacement of light with heavy materials can be a problem in that it also produces a loss of climatic performance. In all cases this is a story of the temporary becoming more permanent, but also of housing becoming more secure and resilient in the face of both eviction and natural disaster.

Divide

Here we refer to the internal division of an existing space either to provide more units within a single building or a separation of internal functions. This is an intensification of the use of interior space while building density remains unchanged. Division may involve a transformation of the public/private interface and functional mix – opening a shop onto a public laneway is a typical example.

Infill

Infill is an increment of change where informal enclosure emerges within a formal structure that either remains unfinished or does not serve its planned purpose. Examples here include the informal enclosure of undercrofts and balconies of formally designed buildings; it is also seen in settlements that emerge underneath transport infrastructure or on the edges of formal structures (Fig. 4). A famous example is Torre David – a hotel and office tower in Caracas that was occupied until 2013 (Brillembourg & Klumpner, 2013). This process has much in common with the 'open building' approach initiated by Habraken (1972) with a clear distinction between 'supports' as the formal base and self-organised 'infill'. This is an ambiguous type in that it might apply to the enclosure of a formal balcony or the establishment of a new house.

Fig. 4. Infill of formal structures – Caracas, Jakarta, Mumbai. Photos: Kim Dovey.

Connect

This increment involves the interconnection of a building with some utility network - water, electricity, sewerage and internet connections in particular. Such services are often initially provided informally and become formalized over time. The reason for including them here is that these are primary increments of upgrading, and are often geared to expansions of space. This increment is also important because in many cases such connections work in synergy with materials and design to signify permanence and formality - they help to build *de facto* tenure.

Rules and rights

This typology is nothing more than a conceptual lens for understanding the incremental emergence of informal settlement morphologies. These are not the only increments that might be conceptualized but this is a simple way to understand these processes and then to ask the next question: what are the codes or rules that govern the ways in which these increments are added? It is clear that the six types outlined above are not all of a single kind; in particular the extensions and attachments encroach on public space while the others have less impact. To extend or attach requires an understanding with neighbours. While this may be a singular negotiation, it is more often an informal rule that frames the space of possible encroachment. Based on detailed morphological studies of three case studies in Bangkok (Khlong Toei), Medellin (Comuna Nororiental) and Pune (Yerawada), we now want to frame these rules in terms of three primary rights. First, is the manner in which pedestrian access is protected to all properties – generally known as rights of way. The second involves the capacity to add additional storeys framed here as air-rights. Third is the manner in which natural light and air flows are protected when additional storeys of contiguous construction are added and cantilevered over public space. Fig. 5 shows, in diagrammatic and photographic form, how these rights play out within the three case studies. Again, we underline that our scope here is limited to morphological description; the ways in which these rights and codes are negotiated is beyond the scope of this study.

Rights of way are the most fundamental of urban codes since buildings are useless without access. However, as pedestrians can squeeze through any access route over about a half metre wide, there are many degrees of access. This informal code controls both buildings and the extent to which informal extensions and attachments are permitted to encroach onto the access network. A semi-private threshold in front of buildings is typical in informal settlements but is controlled to keep the centre of the laneway open to flows. Rights of way are geared to transport modes and commonly produce a two-level hierarchy of car and pedestrian access as in the Comuna Nororiental (Medellin) case where car-based streets of at least 3 m width are combined with smaller laneways down to 1 m. In Khlong Toei (Bangkok) there is no car access and laneways are never encroached to less than 1 m - the minimum width for accommodating the slow movement of pedestrians or bikes. The further appropriation by furniture and loose parts does not occupy more than half of the laneway width. In Yerawada (Pune), the most informal of these cases, a similar code operates but some minor laneways do not allow for the movement of bikes and pedestrian access can be limited to a half metre.

Air-rights involve the right of inhabitants to use the space above their building for the vertical addition of a room or multiple rooms. While there are no building height limits in informal settlements, pre-existing conditions generally set the framework for every new room and negotiation with the immediate neighbours may be necessary. The building height in Khlong Toei (Bangkok) rarely exceeds 2 storeys while it ranges mostly between 2 and 3 storeys in both Comuna Nororiental (Medellin) and Yerawada (Pune). Beyond these heights the settlement soon approaches a natural limit for single-room additions due to a mix of upper floor access, construction safety and the protection of light and ventilation in public space.

Informal codes or rules protecting light and ventilation often work to prevent upper floor cantilevers from blocking the light and ventilation of public space; geared to building height and cantilevers on one hand and the width of laneways on the other. The wider streets in Comuna Nororiental (Medellin) allow for the addition of upper floors and 1 m cantilevers without having a negative impact on the quality of public space. In Khlong Toei (Bangkok) an informal code prevents cantilevers over public space; while awnings often project, they never completely block light and ventilation. In Yerawada (Pune) this code often fails and light and ventilation of public space have been blocked along some of the narrow laneways where the cantilevered overhangs meet (Fig. 5). This turns the access lane below into a tunnel and also blocks light and ventilation to the interiors on both sides. The prevalence of this condition shows how the right to airspace may conflict with the right to light and ventilation, producing a degradation of public space and the emergence of slum conditions.
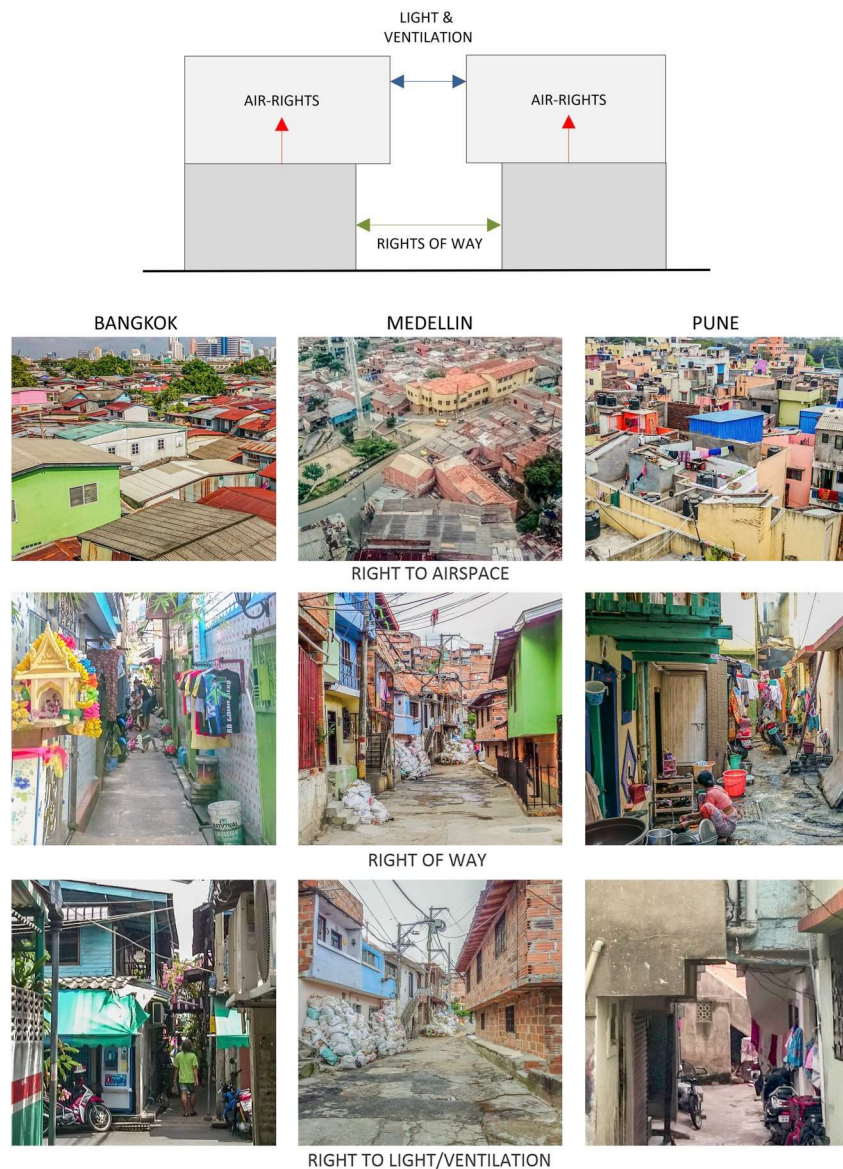

Fig. 5. Codes and rights. Photos: Hesam Kamalipour.

Discussion and conclusion

In this paper we have developed a typology of incremental design and construction, identifying typical increments of extend, attach, replace, divide, connect and infill. While our focus has been on typical forms and processes across a range of informal settlements, there is no claim here that the identified types are universal. Exploring the generalisability of this typology remains a task for future research. We have shown how these increments of change are different in terms of their spatial impacts on building morphologies, access networks and public open space. While some increments such as extending and attaching have the tendency to encroach onto public space, the others do not. These types are not archetypes and we do not seek to reduce this morphogenic process to essential components. The increments are fluid – an attachment may become an extension; an infill can be seen as an extension and many increments are enacted simultaneously. In the latter parts of the paper we have explored the underlying informal codes or customary rules guiding generative processes with regard to extension and attachment. We have outlined the ways that rights of way, air-rights and the right to light and ventilation play out in three typical cases. We do not suggest that such codes or rules always work. Most increments of change take place to meet private rather than common interests, yet the public space network is crucial to the social and economically vitality of informal settlements. We point to the contradiction between air-rights and the right to light and ventilation as each household seeks to exploit the airspace without considering impacts on public space. We also point to the conflict between the right to extend and rights of way which can become constrained to a dysfunctional level. Thus, this is research that seeks to better understand the ways informal settlements can incrementally develop into slums.

This paper raises more questions than answers and we will conclude by opening up some of these issues in a speculative manner before exploring the potential implications for practice. The first cluster of questions is about the relations between formal and informal codes: how do informal codes relate to formal codes and what are the differences between them? A key difference, first identified by Hakim (2014) is that informal codes or rules are proscriptive while formal codes tend towards the prescriptive; informal codes constrain undesirable outcomes while formal codes tend to produce more regular formal outcomes. Informal codes or rules are part of an implicit and local knowledge while formal codes are a part of the explicit and expert knowledge. The challenge is that we know very little about the ways in which informal codes or rules work in self-organised processes in general and informal settlements in particular. While informal codes or rules are proscriptive and work through negotiation and consensus, they cannot necessarily prevent the emergence of slum conditions. We have pointed to an example of this where the public space becomes dysfunctional due to the overexploitation of the airspace. The extent to which the public realm can be protected through informal codes or rules remains an open question.

This paper also raises questions about tenure and the ways in which increments become an asset to manage the conditions of poverty: what are the impacts of incremental change on tenure? How can increments of change enable resistance to eviction in informal settlements? The rights we have outlined in this paper are a part of what Bayat (2004, p. 81) refers to as 'quiet encroachment' since increments of change and generative processes work through direct individual actions to meet basic needs and desires in a relatively quiet manner. The broader patterns of informal settlement morphology emerge not only through the accumulation of increments but also through their demolition and adaptation. Increments of change in informal settlements are at once forms of upgrading and a means of resistance to demolition and displacement - aligned with what Weinstein (2014) describes as the 'right to stay put'. Informal settlements can develop from a highly self-organised production of buildings towards a more formal morphology, at times imitating the morphologies of nearby formal neighbourhoods in anticipation of formal authorization over time. Most increments work as an asset to manage the condition of poverty and affirm a *de facto* tenure. Improving *de facto* tenure security has

long been recognized as critical to slum upgrading (De, 2017; Payne, 2004; UN-Habitat, 2011). We have particularly pointed to the capacity of the 'replace' and 'connect' increments, among others, to help build *de facto* tenure. Increments of change are at once the materiality of the productive capacity of informality and the expressive manifestation of resistance and anticipation. The increments and rights we have outlined in this paper are a key part of what can be considered as property in informal settlements.

Questions of place identity and visibility are also geared to the ways in which informal design and increments of change work: what is the role of informal design in the formation and transformation of place identity? What are the impacts of incremental change on the visibility of informal settlements? In this context, we need to critically engage with formal issues as they impact on place identity and visibility (Kamalipour & Dovey, 2019). Informal settlements have negative symbolic capital, and part of the challenge is to erode distinctions of status that identify them as 'slums' (Mayne, 2017). The question of image cannot be simply ignored where increments of change have the capacity to make forms of informality and resistance visible to the gaze of the formal city. While such visibility can challenge the tolerance of the state and stimulate demolition, it can also work as an asset to transform place identity.

We now want to conclude by outlining some potential implications of this paper for practice with a focus on the role of built environment professionals in upgrading informal settlements. While design cannot solve social or economic issues, it is crucial for built environment professionals to develop their capacity to harness the adaptive capacities of informality and to sustain the dynamism that is already there. Many practices of upgrading informal settlements, especially their replacement with formal housing, are unable to deal with highly adaptive forms of urbanism (Jones, 2017). Approaches that promote incremental self-help practices often seem promising, yet are often difficult to scale up (Newton, 2013, p. 649). The challenge is to move towards evidence-based design interventions incorporating a sophisticated understanding of how informality works at the micro scale. Morphological mapping and modelling are among the key methods to unravel the dynamics of urban informality and develop a knowledge base to support design thinking. This research enables us to learn how informal settlement works as a mode of spatial production before coming to any conclusion about the ways in which we may approach design intervention.

While the simple proclamation of formal urban design codes will not work in informal settlements, it is crucial to better understand the ways in which informal codes or rules can work to prevent the escalations of private interest crowding out public interests – to avoid 'the tragedy of the commons' (Hardin, 1968). The work of Ostrom (1990) has shown that self-organization can work and that the tragedy is not inevitable, however, the task of showing how this can work in terms of informal morphology remains. While negotiation often plays a key role in resolving possible conflicts in informal settlements, the challenge of protecting common resources and sustaining the functionality of public space is yet to be critically addressed in processes of formalisation and upgrading. A first step is to understand that informal incremental adaptation will continue regardless of any rules that are imposed, even after formalisation and upgrading. It is then crucial for built environment professionals to abandon notions of a fixed and permanent formal outcome.

We need a change of mindset, not only from outcomes to codes and processes, but also from rigid to supple codes that can encompass the makeshift and temporary. Enabling the productive capacities of incremental urbanism and constraining its destructive aspects are equally important when we wish to sustain adaptive capacities of informal settlement over time. We affirm again that informal incremental urbanism is not to be conflated with the slum conditions that may or may not be one of its outcomes. The Mediterranean urbanism that Hakim (2014) has analysed is a prime example of the kind of incremental urbanism where informal codes have prevented an escalation of density into slum conditions. Many such neighbourhoods are now tourist attractions where the informal character of the urban design is protected by strict formal codes. Incremental urbanism is not new; the emerging understanding of its embodied logic is.

Acknowledgements

References

Alexander, C., Ishikawa, S., Silverstein, M., Jacobson, M., Fiksdahl-King, I., & Angel, S. (1977). *A pattern language: Towns, buildings, construction*. New York: Oxford University Press.

Alexander, C., Neis, H., Anninou, A., & King, I. (1987). *A New theory of urban design*. New York: Oxford University Press.

Alexander, C., Schmidt, R., Hanson, B., Alexander, M., & Mehaffy, M. (2008). Generative codes: The path to building welcoming, beautiful, sustainable neighborhoods. In T. Haas (Ed.), *New urbanism and beyond: Designing cities for the future* (pp. 14–29). New York: Rizzoli.

Appadurai, A. (2001). Deep democracy: Urban governmentality and the horizon of politics. *Environment and Urbanization, 13*(2), 23–43.

Arefi, M. (2011). Order in informal settlements: A case study of Pinar, Istanbul. *Built Environment, 37*(1), 42–56.

Baer, W. C. (2011). Customs, norms, rules, regulations, and standards in design practice. In T. Banerjee, & A. Loukaitou-Sideris (Eds.), *Companion to urban design* (pp. 277–287). London: Routledge.

Bayat, A. (1997). *Street politics: Poor people's movements in Iran*. New York: Columbia University Press.

Bayat, A. (2004). Globalization and the politics of the informals in the global South. In A. Roy, & N. AlSayyad (Eds.), *Urban informality: Transnational perspectives from the Middle East, Latin America, and South Asia* (pp. 79–102). New York: Lexington.

Bazant, J. (2003). *Viviendas progresivas: Construcción de vivienda por familias de bajos ingresos.* México: Trillas.

Ben-Joseph, E. (2005). *The code of the city: Standards and the hidden language of place making*. Cambridge: MIT Press.

Brillembourg, A., & Klumpner, H. (Eds.). (2013). *Torre David: Informal vertical communities*. Zurich: Lars Muller.

Davis, H. (2006a). *The culture of building*. New York: Oxford University Press.

Davis, M. (2006b). *Planet of slums*. New York: Verso.

De, I. (2017). Slum improvement in India: Determinants and approaches. *Housing Studies, 32*(7), 990–1013.

De Soto, H. (2000). *The mystery of capital: Why capitalism succeeds in the West and fails everywhere else*. New York: Basic Books.

Dovey, K. (2019). Informal settlement as a mode of production. In T. Bannerjee, & A. Loukaitou-Sideris (Eds.), *The new companion to urban design* (pp. 139–151). New York: Routledge.

Dovey, K., & Kamalipour, H. (2018). Informal/formal morphologies. In K. Dovey, E. Pafka, & M. Ristic (Eds.), *Mapping urbanities: Morphologies, flows, possibilities* (pp. 223–248). New York: Routledge.

Dovey, K., & King, R. (2011). Forms of informality: Morphology and visibility of informal settlements. *Built Environment, 37*(1), 11–29.

Flyvbjerg, B. (2004). Five misunderstandings about case-study research. In C. Seale, G. Gobo, J. F. Gubrium, & D. Silverman (Eds.), *Qualitative research practice* (pp. 420–434). Thousand Oaks: Sage.

Foster, S. R. (2009). Urban informality as a commons dilemma. *University of Miami Inter-American Law Review, 40*(2), 261–284.

Gilbert, A. (1999). A home is for ever? Residential mobility and homeownership in self- help settlements. *Environment and Planning A: Economy and Space, 31*(6), 1073–1091.

Gilbert, A. (2004). Love in the time of enhanced capital flows: Reflections on the links between liberalization and informality. In A. Roy, & N. AlSayyad (Eds.), *Urban informality: Transnational perspectives from the Middle East, Latin America, and South Asia* (pp. 33–66). New York: Lexington.

Habraken, N. J. (1972). *Supports: An alternative to mass housing*. London: Architectural Press (B. Valkenburg, Trans.).

Hakim, B. S. (2007). Generative processes for revitalizing historic towns or heritage districts. *Urban Design International, 12*(2), 87–99.

Hakim, B. S. (2008). Mediterranean urban and building codes: Origins, content, impact, and lessons. *Urban Design International, 13*(1), 21–40.

Hakim, B. S. (2014). *Mediterranean urbanism: Historic urban/building rules and processes*. New York: Springer.

Hardin, G. (1968). The tragedy of the commons. *Science, 162*(3859), 1243–1248.

Hart, K. (1973). Informal income opportunities and urban employment in Ghana. *The Journal of Modern African Studies, 11*(1), 61–89.

Huchzermeyer, M. (2014). Troubling Continuities: Use and utility of the term "slum". In S. Parnell, & S. Oldfield (Eds.), *The routledge handbook on cities of the global South* (pp. 86–97). Hoboken: Taylor and Francis.

Jones, P. (2017). Formalizing the informal: Understanding the position of informal settlements and slums in sustainable urbanization policies and strategies in Bandung, Indonesia. *Sustainability, 9*(8), 1436.

Jones, P. (2019). The shaping of form and structure in informal settlements. *Journal of Regional and City Planning, 30*(1), 43–61.

Kamalipour, H. (2016). Forms of informality and adaptations in informal settlements. *ArchNet-IJAR: International Journal of Architectural Research, 10*(3), 60–75.

Kamalipour, H. (2017). *Urban informalogy: The morphologies and incremental transformations of informal settlements, PhD dissertation*. University of Melbourne.

Kamalipour, H., & Dovey, K. (2018). Incremental urbanisms. In K. Dovey, E. Pafka, & M. Ristic (Eds.), *Mapping urbanities* (pp. 249–267). New York: Routledge.

Kamalipour, H., & Dovey, K. (2019). Mapping the visibility of informal settlements. *Habitat International, 85*, 63–75.

Marshall, S. (Ed.). (2012). *Urban coding and planning*. Hoboken: Taylor and Francis.

Mayne, A. (2017). *Slums: The history of a global injustice*. London: Reaktion.

McFarlane, C. (2012). Rethinking informality: Politics, crisis, and the city. *Planning Theory & Practice, 13*(1), 89–108.

McFarlane, C., & Waibel, M. (Eds.). (2012). *Urban informalities: Reflections on the formal and informal*. Farnham: Ashgate.

Newton, C. (2013). The peoples housing process…getting the quality in the quantity? *Journal of Housing and the Built Environment, 28*(4), 639–651.

Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge: Cambridge University Press.

Payne, G. (2004). Land tenure and property rights. *Habitat International, 28*(2), 167–179.

Peek, O. (2015). Living between desires and possibilities: Re-visiting and re-envisioning the self-help house in the "consolidated" low-income settlements of Lima, Peru. In A. M. Garland (Ed.), *Urban opportunities: Perspectives on climate change, resilience, inclusion, and the informal economy* (pp. 115–139). Washington DC: Woodrow Wilson Center.

Peek, O., Hordijk, M., & d'Auria, V. (2018). User-based design for inclusive urban transformation: Learning from 'informal' and 'formal' dwelling practices in Guayaquil, Ecuador. *International Journal of Housing Policy, 18*(2), 204–232.

Perlman, J. E. (1976). *The myth of marginality: Urban poverty and politics in Rio de Janeiro*. Berkeley: University of California Press.

Ribeiro, G. (1997). An ecological approach to the study of urban spaces: The case of a shantytown in Brasilia. *Journal of Architectural and Planning Research, 14*(4), 289–300.

Roy, A. (2005). Urban informality: Toward an epistemology of planning. *Journal of the American Planning Association, 71*(2), 147–158.

Roy, A. (2009). Why India cannot plan its cities: Informality, insurgence and the idiom of urbanization. *Planning Theory, 8*(1), 76–87.

Roy, A., & AlSayyad, N. (Eds.). (2004). *Urban informality: Transnational perspectives from the Middle East, Latin America, and South Asia*. New York: Lexington.

Soliman, A. (2010). Rethinking urban informality and the planning process in Egypt. *International Development Planning Review, 32*, 119–143.

Stiphany, K. (2019). Mutira~o. *Journal of Architectural Education, 73*(2), 258–260.

Talen, E. (2009). Design by the rules: The historical underpinnings of form-based codes. *Journal of the American Planning Association, 75*(2), 144–160.

Talen, E. (2012). *City rules: How regulations affect urban form*. Washington: Island Press.

Tonkiss, F. (2013). *Cities by design: The social life of urban form*. Cambridge: Polity.

Turner, J. F. C. (1967). Barriers and channels for housing development in modernizing countries. *Journal of the American Institute of Planners, 33*(3), 167–181.

Turner, J. F. C. (1968). The squatter settlement: An architecture that works. *Architectural Design, 38*(4), 357–360.

Turner, J. F. C. (1972). Housing as a verb. In J. F. C. Turner, & R. Fichter (Eds.), *Freedom to build: Dweller control of the housing process* (pp. 148–175). New York: Macmillan.

UN-HABITAT. (2006). *The state of the world's cities report 2006/7: The Millennium Development Goals and urban sustainability*. London: Earthscan.

UN-HABITAT. (2010). *The state of the world's cities 2010/2011: Bridging the urban divide*. London: Earthscan.

UN-Habitat. (2011). *Monitoring security of tenure in cities*. Nairobi: UN Habitat.

Wakely, P., & Riley, E. (2011). *The case for incremental housing*. Washington DC: Cities Alliance.

Ward, P. M. (2015). Housing rehab for consolidated informal settlements: A new policy agenda for 2016 UN-habitat III. *Habitat International, 50*, 373–384.

Ward, P. M., Jiménez Huerta, E., & Di Virgilio, M. M. (2014). Intensive case study methodology for the analysis of self-help housing consolidation, household organization and family mobility. *Current Urban Studies, 2*(2), 88–104.

Ward, P. M., Jiménez Huerta, E. R., & Di Virgilio, M. M. (2015). *Housing policy in Latin American cities: A new generation of strategies and approaches for 2016 UN-habitat III*. New York: Routledge.

Ward, P. M., Jiménez Huerta, E. R., Grajeda, E., & Ubaldo Velázquez, C. (2011). Self-help housing policies for second generation inheritance and succession of "The House that Mum & Dad Built.". *Habitat International, 35*(3), 467–485.

Weinstein, L. (2014). *The durable slum: Dharavi and the right to stay put in globalizing Mumbai*. Minneapolis: University of Minnesota Press.