

Toward the open city: design and research for emergent urban systems

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Abstract The “open city” has recently been theorized as the urban condition which best accommodates difference, incorporates unpredictable changes and fosters adaptation. In this respect, the present paper highlights how the open city behaves as an emergent system whose overall form cannot be predicted in advance nor determined by an a priori intention. Although open urban systems have been increasingly identified as the best fields for flourishing resilience and city diversity, the current practice of planning and urban design focuses mainly on master plans, which tend to behave as closed systems, pretending to predict and overly control the future development of pre-defined bounded areas. By exploring this contradiction, the present paper attempts to frame a design and research approach that can steer emergent changes in positive directions without trying to formally predetermine their final outcome.

Keywords Design · City · Emergence · Open systems · Complexity · Self-organisation

Beyond the master plan

The recent theory of planning and urban design highlights how healthy, vibrant cities or neighbourhoods behave as open systems (Sennett 2013; Christiaanse et al. 2009), whose main characteristic is the ability to incorporate change and adaptation and to permit the emergence of

unpredictable social and environmental situations. Sennett (2013) defines this kind of urban environment as an “open city”: a city which is “incomplete, errant, conflictual, non-linear”. He highlights the contrast between open and closed systems: an urban system is open when it emerges from unexpected interactions between physical creation and social behaviour, when it allows “jerry-built adaptations or additions to existing buildings”. Instead it tends to become closed when a regime of power of any kind, which wants order and control, aims to over-determine both the city’s visual forms and its social function.

Rieniets (2009, p. 13) associates the concept of the open city with the word “coexistence”, highlighting how a city behaves as an open system when it allows the unprogrammed congregation and encounter of different people and “provides all of its inhabitants access to the concentrated multitude of opportunities they have at their disposal”. Christiaanse (2009) stresses how through the concentration and interaction of people from different backgrounds, the open city stimulates economic growth, innovation and cultural emancipation.

All these authors highlight the need to apply the concept of the open city to urban design practice (as well as the difficulties in doing so). Christiansee (2009, p. 31) stresses how the open city “is not a clear-cut urban vision, but a volatile situation, a precarious balance between the forces of integration and disintegration”. Sennett emphasises the fact that every attempt to over-determine a city’s visual form contrasts with its non-linear unpredictable nature and tends instead to produce a closed system.

The contrast between top-down planning and the unpredictable emergent nature of cities was already highlighted by Jane Jacobs (1961, p. 14), who observed that city vitality was “something that the planner or planners alone, and the design and designers alone, can never achieve”.

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She argued that the city was a problem of organised complexity and that modern planning was destroying diversity in American cities.

In recent years, the advances in theories of complexity, emergence, self-organisation, assemblage, adaptation (“[The Emergent Nature of the Open City](#)”) have informed an increasingly sophisticated understanding of the city as an emergent system (Allen and Sanglier 1981; Portugali 1999, 2013; Dovey 2010).

Nonetheless, it is still the case that urban design practice often fails to transform this fine understanding into strategies and actions capable of addressing urban complexity and cooperating with open urban systems. In fact, it is still widely based on master plans, which present themselves as finished projects designed from the top-down, aiming at pre-determining the final outcome of a transformation within a pre-defined site. Master plans often tend to overlap a new overall form—considered more healthy and efficient—over an existing reality considered problematic or obsolete. In their best examples they are driven by a sincere intention to produce a regime of urban complexity capable of generating diversity. Nonetheless, they remain external interventions in an otherwise spontaneous and non-linear transformation, thus they cannot cooperate with open urban systems, which are instead emergent phenomena, to a certain extent unpredictable and in a constant state of becoming.

In this respect, even the city proposed by New Urbanism, apparently shaped on Jacobs’s arguments, is based on the idea that an a priori top-down designed spatial configuration—characterised by concentration and a hybrid programme—can generate diversity. New Urbanism elaborates a new model of the metropolis, rather than focusing on upgrading and updating the everyday experience across the urban fabric of American suburban sprawl, which it tends to reject and replace (Porqueddu 2015). While the aim is laudable—to face the problems linked to urban sprawl and to upgrade the everyday experience of these places, which are in fact often desolate and lacking in diversity—this approach is still based on the modern illusion that the problem can be entirely fixed by external agents, designers and planners, who apply a new and a priori designed spatial configuration to an existing context.

In this respect, the New Urbanism approach is not entirely consistent with that of Jacobs. In her studies, Jacobs basically shows that diversity cannot be the direct result of human design, because it is an emergent property of the relation between people and their physical environment, rather than the mere consequence of a peculiar spatial layout or of a certain density of pre-defined functions (Porqueddu 2015). Her approach frames objects as components of complex living systems: she highlights how a “good city sidewalk” (1961, p. 50) entails the

development of a complex order consisting of movement and change. She defines it as an intricate ballet which “never repeats itself from place to place, and in any one place is always replete with new improvisation”. For Jacobs, this unpredictable “urban ballet” is neither disembodied from the urban fabric nor determined by it, but emerges in the immanent interaction between subject and object in space and time (Porqueddu 2015).

A few years later, Christopher Alexander (1965) similarly highlighted the need to understand the dynamic relationship between the physical components of urban space and the activities of people across them. In his description of a street corner in Berkeley, a bunch of heterogeneous elements—a drugstore, a sidewalk, a news rack, people passing by—work together as a living system following the alternating red and green traffic light rhythm. For Alexander, the physical units—the traffic lights, the sidewalk, the display—were just scattered elements of a potential living system (dance) emerging in the presence of its changing parts: people, newspapers, money, electricity.

Both approaches underline how open urban systems reside in immanent, unique and unforeseen combinations of particular elements. The two “urban ballets” at the micro-scale of a street corner or a sidewalk reveal the ambiguous nature of objects—their potential to become part of different networks according to everyday practices and rhythms. In open urban systems, this endless performance is crucial, if a large range of unofficial and unforeseen plans, ideas and opportunities is to emerge. Thus, it is fundamental if diversity is to flourish and develop.

Jacobs’s and Alexander’s observations highlight how the physical elements displayed in space set the conditions for open systems to emerge, but their emergence cannot be controlled, depending as it does on events and interactions which cannot be predicted or determined a priori. Although Jacobs’s observations regarding the characteristics of Greenwich Village are highly valid, that specific urban form becomes part of an open system due to the presence of other dynamic conditions which belong to that specific place at that specific time. It would therefore be misleading to expect that a similar effect could be obtained by reproducing (from the top down) these physical characteristics somewhere else.

Although learning from existing open systems is probably the best training for designers, the findings of specific observations cannot be directly used to generate abstract spatial models or coded urban formulae. In fact, every a priori over-determination of the city’s visual form and social functions generates closed systems (Sennett 2013). An entirely top-down designed city or district, whatever the proposed physical layout, follows to a certain extent the modern logic of the Plan Voisin, based on the assumption



of a linear deterministic relationship between physical form and social life. If the open city, as an emergent phenomenon, cannot be reduced to any urban form, what is the relationship between urban design and open systems?

In order to enhance our capacity to practice urban design in an open-ended manner, the present paper (1) highlights the emergent nature of the open city in light of the recent theories of complexity, adaptation and assemblage; (2) presents two projects where an open-system approach has been used; (3) describes two research approaches designed to uncover the latent capacities that set the ground for such design approaches.

The emergent nature of the open city

The following section illustrates how the current advance in theories of complexity, adaptation, assemblages and self-organisation supports a deeper understanding of the emergent nature of the open city and suggests a new role for designers and planners.

Actually, complex systems have been widely explored in disciplines which are not directly linked to urban studies. Non-linear systems and chance event management have been investigated by biologists, mathematicians and physicists; by ecologists such as Gunderson and Holling (2002) and Walker and Salt (2006) and by social scientists such as Miller and Page (2007). Their theory of complex adaptive systems (CAS) incorporates ideas of emergence and self-organisation (Johnson 2001). Complex adaptive systems are characterised by diversity and redundancy of heterogeneous parts, where no single part is crucial to the success of the whole system (Dovey 2015). This enables the system to endlessly adapt to unpredictable situations by re-organising itself into emergent inter-connections.

In philosophy, open systems resonate with assemblage theory, which explores how self-organised wholes emerge from dynamic interactions between parts—including people and things, subjects and objects (De Landa 2006; Deleuze and Guattari 1980; Dovey 2010). Assemblages are not sums of things, but provisional clusters of interconnections. Assemblage theory and CAS theory have been applied to urban studies by Dovey (2012), who draws them together into the concept of complex adaptive assemblage, which allows the exploration of places as dynamic socio-spatial territories in a continuous state of becoming (Dovey 2010) and the conception of cities as emergent systems (Johnson 2001).

Emergent systems such as flocks and swarms have also been investigated by artificial life theorist Craig Reynold, who creates a computer programme that simulates the flocking behaviour of birds (Waldrop 1992). In the programme, agents simulating the birds follow simple rules

which are entirely local, none of them being directly oriented to generating a flock. In fact, the overall patterns of flocks are dynamic and unpredictable because they emerge from local iterations rather than being determined by an a priori intention. Such systems are resilient, because disturbances can be accommodated by fluid adjustments: new local interactions modify the whole, which is in a constant state of becoming.

While these theories widely support an increasing understanding of the city as a complex system (Portugali 1999), the question of how to apply this understanding in design practice remains. While non-linear complex systems have been thoroughly investigated in planning theory (Moroni 2015; De Roo 2017), the relationship between design and emergent urban systems remains underexplored.

In this respect, the research of Italian performers Effetto Larsen (2013) offers interesting insights. In fact, their work endeavours to reproduce the dynamic of flocks with groups of people (Fig. 1). The relevant thing here is the relationship between the director Matteo Lanfranchi and the flock: Lanfranchi mainly focuses on shaping and maintaining the conditions which enable the emergence of the flock rather than trying to master its overall form or behaviour from the top down. Once the flock has emerged, it works as a collective intelligence, which spontaneously escapes every attempt at top-down control and has the ability to effectively self-organise.

Although this experiment is not directly related to urban design theory or practice, it shows how emergent systems can be intentionally generated, but also how they require a peculiar kind of direction. In this respect, this work offers useful insights into exploring a design approach which does not focus on overall predetermined forms and pre-defined outcomes, but works instead on the specific conditions and micro-interactions which can activate the self-ability of places to behave as open systems. The examples shown



Fig. 1 Stormo Revolution. Photo © Pablo Muñoz Montaner. Courtesy Matteo Lanfranchi—Effetto Larsen



over the next few pages illustrate how this attitude is crucial in shaping every design strategy which aims to direct emergent urban changes rather than master them.

These theories also show how open systems can spontaneously veer toward their self-destruction and turn into closed systems. In this respect, CAS theory and resilience theory highlight how complex systems can fall into cycles of decline (Gunderson and Holling 2002; Walker and Salt 2006) and how it is necessary to understand these cycles in order to prevent negative evolutions (Porqueddu 2018). Again Jacobs (1961) anticipated how the same forces which nourish city diversity can often contribute to its destruction (self-destruction of diversity).

The examples will show that, on the one hand, open systems require a kind of design which sets the initial conditions for their emergence. On the other, it is also necessary to monitor their evolution in order to prevent their transformation into a closed system.

Working with existing resources: fostering emergent open systems

The following design strategies are very different and operate at different scales, developing in very distant geographical areas and concerning very different urban situations. Nonetheless, they aim at working with existing and place-specific emergent phenomena rather than proposing comprehensive solutions based on abstract theories or previous design experiences. They emerge from a fine understanding of places and of their unique socio-spatial dynamics. Furthermore, these projects are intended to incorporate time, along with its unpredictable outcomes, into the design brief. They do not claim to offer a comprehensive vision of the future. Instead, the process becomes part of a product which is never meant to be completed. Such an approach involves a consideration of how places are or could be used over time and demands that control regarding the final outcome of the project be relinquished. Both strategies veer away from the logic of the all-inclusive master plan in favour of a more project-oriented, site- and client-specific, incremental, catalytic intervention (Ellin 2006) which allows things to happen—things that might be unforeseen. These projects endeavour to design the essential spatial conditions which enable the system to remain open, diverse and adaptive. The strategies consist of fixing certain elements, whose position and configuration guarantees a future open evolution: an evolution which emerges from local existing resources and which requires the incremental and unpredictable intervention of multiple individuals.

In this respect, although they do not directly refer to the open city or to Jacobs's ideas, they are presented here as good examples of an open-system approach.

Medellin Metrocable

The first project concerns the realisation of the Metrocable network in Medellin—as part of the PUI (Proyecto Urbano Integral, Integrated Urban Project), a complex programme of city transformation promoted by the Medellin municipal government and coordinated by Alejandro Echeverri (Echeverri and Orsini 2010). The Metrocable can be considered as a significant example of an open-ended design strategy, as it sets the base for an incremental upgrade of the existing informal settlements rather than overlapping comprehensive plans over their territories.

The Metrocable basically aims at reconnecting and reintegrating the poorer areas of Medellin with the rest of the city through selective intrusion into their social system and minimal damage to their existing structures. This kind of intervention recognises that, beside all the problems related to extreme poverty, these informal settlements have a peculiar and vital network of micro-connectivity. On the one hand, this walkable micro-network creatively supports the social everyday life on a local scale. On the other, its intricate, labyrinthine structure needs to be inserted into a network of fast connections on a wider scale, which could support exchanges with other places and foster emergent diversity.

Despite their well-known problems, these settlements behave as open systems on a micro-scale, but the excessive growth of their intricate structure across the steep terrain of the mountains prevents a fluid connection with the metropolitan territory. Therefore, on a wider scale, they behave as a closed system. The Metrocable aims to build fast connections which can enhance rather than damage the existing slow micro-connectivity. In this respect, these new connections enhance the ability of these areas to behave as open systems and reduce the risks for the self-destruction of the open city.

In actual fact, by improving the spatial connectivity, the Metrocable affects local movement patterns, which consequently affect commercial patterns: the strategic position of the stations “provides a focal point for the neighbourhood where the majority of residents move towards or coming from, providing reliable locations to position commerce, both formal and informal, which would not be possible with a current bus system, that stops wherever the users request” (Goodship 2015). In this respect, the construction of the Metrocable's lines brought a new energy to the urban economies in their area of influence: some indicators of economic activity improved during the decade



following the launch of the first Metrocable line K (Coupé and Cardona 2013).

Furthermore, the Metrocable was just one of the components of the incremental process of urban improvement. This process was also fostered by complementary projects all based on a very detailed social–spatial analysis, which was intended to identify the crucial points for such interventions. A variety of new cultural spaces and sports facilities were clustered in the areas around the stations, which became hubs that could partially compensate for the notable lack of such services in these settlements (Fig. 2a, b). Moreover, the PUI structured a series of micro-interventions designed to upgrade the local micro-network of connections through the construction of sidewalks and small plazas along the existing streets and lanes (Fig. 3).

In this respect, the major feat in Medellín was the ability of the municipal branches to coordinate all initiatives in a myriad of projects (Samper 2013): these high-quality infrastructures, stunning examples of architecture (libraries, schools, public spaces, etc.) and local micro-interventions were not treated as individual projects, but as components of a complex integrated urban strategy (Fig. 2a, b). This ability to go beyond individual interventions (without producing an overall comprehensive plan) created the conditions for area-wide improvement. A comparison of what has happened around different Metrocable lines highlights that “integrated parallel coordinated strategies of interventions generate far greater benefits than the sum of independent, diffuse and sequential projects” (Coupé and Cardona 2013).

The idea of using an established technology—generally associated with ski and tourist sites—as a means of public transport was particularly effective in Medellín for two other reasons. The first was symbolic: the Metrocable has a strong visual impact. Its high visibility brings attention to the settlements which were previously perceived as being disconnected from the city. In this respect, the Metrocable becomes a symbol of inclusion. Furthermore, its kinaesthetic experience offers a stunning panoramic view over the whole city (Fig. 4). The Metrocable also nourishes awareness of the potential beauty and efficiency of these districts, thus stimulating trust in the communities inhabiting the place. In this respect, steepness becomes a means for discovering the beauty of the landscape. A conventional road and bus system may have the capacity to move a higher volume of passengers, but they do not have the visual and aesthetic appeal of the aerial cable cars (Brand 2013).

The second reason is economic: the Metrocable reduces social and economic costs. In fact, building new streets to accommodate public buses would have meant demolishing a large number of dwellings and would have required more time and greater economic and social costs. Compared with

other urban transport systems, cable cars can be built over a relatively short period of time and at a comparatively low cost, as they require little in the way of land acquisition. Furthermore, the Metrocable is far more economically sustainable in a country which produces electricity. Finally, the incorporation of a high-density neighbourhood into the metro system’s area of influence, hitherto served only by buses and taxis, meant a significant increase in the number of passengers for a then under-utilised system (Brand and Dávila 2011).

It should also be noted that the ability of planners and designers to coordinate a complex assemblage of micro-project would be useless without an institutional frame, which made it possible to transform these innovative ideas into real actions. In Medellín, the city administration played a central role, by channelling human, financial and political resources into this project. This urban transformation was possible thanks to the presence of solid political institutions and public companies: technically efficient, economically profitable and well coordinated around urban development policies (Brand and Davila 2013).

Quinta-Monroy incremental housing

The second project concerns Alejandro Aravena’s social housing for a community of nearly 100 low-income inhabitants in central Iquique, a desert city of 200,000 people in northern Chile. Aravena’s incremental housing is the innovative answer to some new questions generated by a new policy—Dynamic Debt-Free Social Housing—in 2001 by the Ministry of Housing and Urban Development. The most important innovative aspect of this policy, operating through the Housing Solidarity Fund, consisted of reforming the makeup of the voucher to release families from mortgage obligations: it raised the direct subsidy amount and eliminated the mortgage, and thereby the debt. In this way, the final cost of the home including projects and technical inspection was fixed at \$7500 (Aravena and Jacobelli 2012). This transformation presented a new challenge: buying land, creating infrastructure and building homes with a smaller final amount. Seeing as the Chilean construction market, with this amount, finances the construction of around 30 m², the beneficiaries had to assume responsibility for gradually transforming their basic housing into a home (in most cases the process stops when the houses reach around 70 m²). In this respect this policy opened up new questions concerning the problem of incremental housing.

The initial problem was that the construction market tried to answer the new questions with old solutions: it continued to operate in the same way, only with fewer resources and this led to poor standards. The first reactions were: (1) to reduce the size of the units, without really



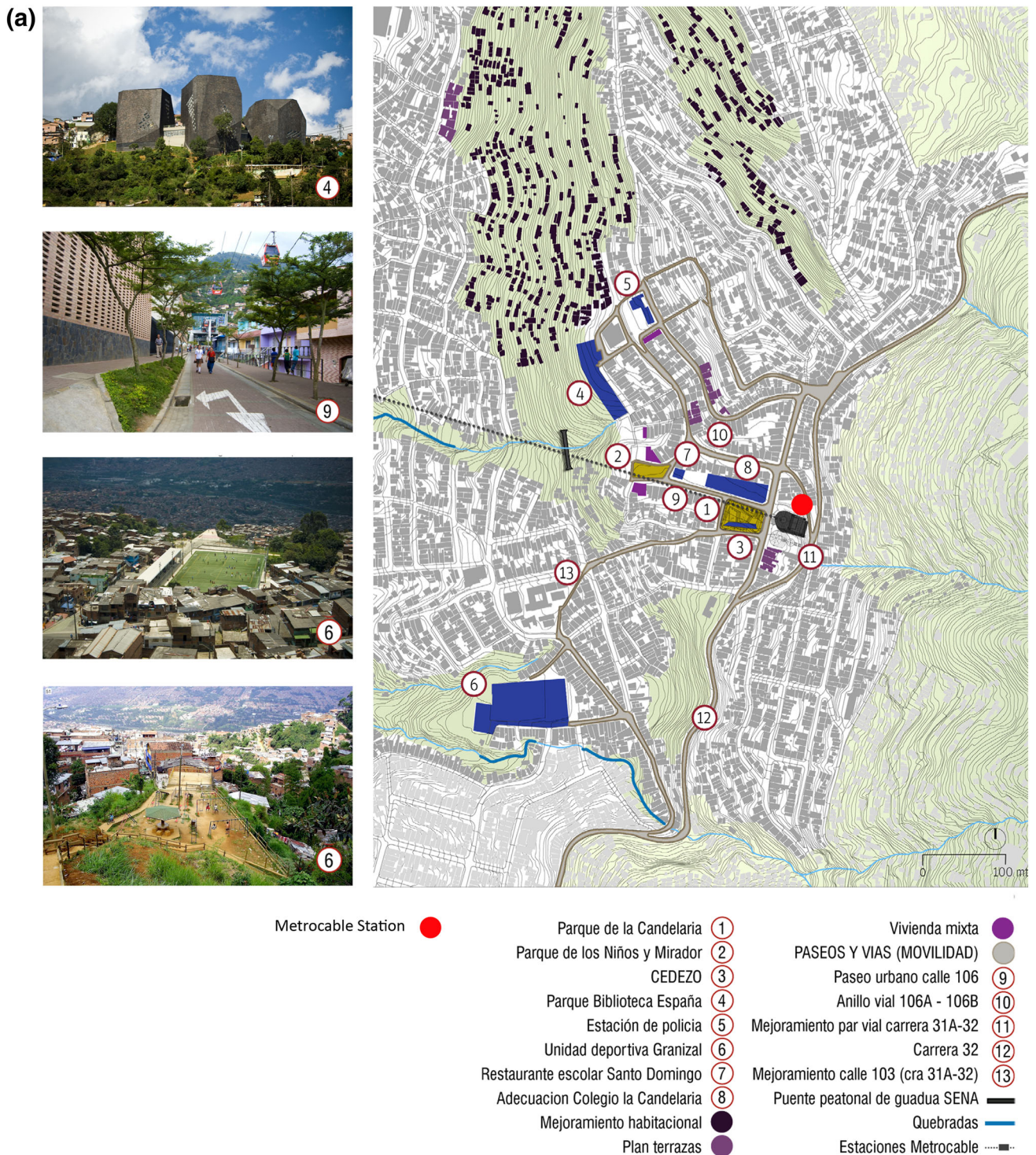


Fig. 2 Medellín. Projects around Santo Domingo Metrocable station (PUI North-East Area). **a** Materials from EDU re-assembled by the author. *Source* EDU, 2006 (graphic team EDU – urban EAFIT).

Photos 4, 9, 6 © Diana Moreno, EDU. *Courtesy* Juan David Hernandez. **b** *Photo* © Carlos Tobón. *Courtesy* Carlos Tobón. Numbers and captions inserted by the author according to Fig. 2a

thinking in terms of incremental housing (the self-construction process ending up being expensive, difficult and unsafe); (2) to build the new settlements in the underserved

peripheral areas where land was cheaper, creating major social problems on account of the segregation from opportunities (Aravena and Jacobelli 2012).



(b)



Metrocable Station ●

- | | |
|-------------------------------------|--|
| Parque de la Candelaria ① | Vivienda mixta ● |
| Parque de los Niños y Mirador ② | PASEOS Y VIAS (MOVILIDAD) ● |
| CEDEZO ③ | Paseo urbano calle 106 ⑨ |
| Parque Biblioteca España ④ | Anillo vial 106A - 106B ⑩ |
| Estación de policía ⑤ | Mejoramiento par vial carrera 31A-32 ⑪ |
| Unidad deportiva Granizal ⑥ | Carrera 32 ⑫ |
| Restaurante escolar Santo Domingo ⑦ | Mejoramiento calle 103 (cra 31A-32) ⑬ |
| Adecuacion Colegio la Candelaria ⑧ | Puente peatonal de guadua SENA — |
| Mejoramiento habitacional ● | Quebradas — |
| Plan terrazas ● | Estaciones Metrocable — |

Fig. 2 continued

In this context Elemental took the design challenge of exploring a new architectural solution capable of transforming incompleteness into an opportunity to provide houses which could grow in quality over time. The main idea was to re-consider social housing as an investment rather than as an expense: for the beneficiaries of the subsidy, who in Chile become the owners of the property, the house had to act as a capital able to gain value over time. The priority then became to find a solution which allowed the beneficiaries to remain in Quinta Monroy—the central area where they had previously squatted—close to all the job and education opportunities that this central area provides. Since the site cost three times more than what social housing could normally afford, Elemental had to

work on a project which (1) enabled high density to pay for the land, (2) avoided overcrowding and (3) incorporated expansion processes and self-construction. Incompleteness was also seen as an opportunity to include diversity and personal expression in a niche that was historically destined for monotony (Aravena and Jacobelli 2012).

The proposed architectural solution was called parallel building: a hybrid between a house and collective building. By combining the potential for expansion of a house with the potential for density of a collective building, the parallel house generates a low-rise density settlement that is able to grow without overcrowding. The density is achieved by the superimposition of two units (two families per lot): a house on the ground floor with an apartment on





Fig. 3 Medellín. PUI North-East Area: example of a street improvement (materials from EDU re-assembled by the author). *Source* EDU (2005) (graphic team EDU—urbam EAFIT). *Courtesy* Juan David Hernandez



Fig. 4 Medellín Metrocable: Panoramic view from a cabin. *Photo* © Camilo Montes Gutierrez

top, both of which can be expanded in parallel, one on top of the other and both with direct access to the ground (Figs. 5, 6). This proposal was immediately welcomed by the inhabitants, who had spontaneously developed the same strategy of densification decades previously. The Elemental team simply found themselves being asked to do what the inhabitants had been unable to do spontaneously: take care of the quality of the whole and coordinate the operations that required collective sense (Aravena and Jacobelli 2012). The main role of architects in this case was to provide those things that individual interventions can hardly guarantee, such as safe structural frames, well-lit and properly ventilated rooms and high-quality common spaces.

In this respect, the harmonious development of the urban complex over time was crucial: families would construct about 50% of the built space and this could cause the neighbourhood to deteriorate. The challenge was then to provide a structure capable of containing and rationalising individual interventions, without the need to control

the development of every single addition. The parallel building was then designed as a porous structure capable of supporting improvised expansions and limiting the possibility for chaos: the structure alternates built segments with an equally sized void (Fig. 5). All the houses were designed so that the expansion occurred within the initial volumes. The dimension of the void between units was planned to the measurements of middle-class standard rooms, yet small enough to allow for simple, low-tech construction (Aravena and Jacobelli 2012).

This unfinished architecture encourages each family to expand the unit by filling the voids through heterogeneous surfacing, personal colours, textures and uses over time according to ever-changing needs and possibilities. Aravena defines this building as a “diversity organiser”: a basic shell, an outline providing plumbing, stairs and openings, which need to be gradually transformed by the residents, according to their individual ways of dwelling and their personal taste for colours and decoration (Fig. 6). The regularity of the building, beside responding efficiently to cost factors, accentuated the individuality of each home: the systematic serialisation of the industrial construction process could be employed without the risk of monotony.

The houses are grouped into dense clusters of 20–30 units creating four courtyards and social spaces outside the boundaries of each dwelling. The courtyards are larger than the family lots, but smaller than the whole site. The square shape allows cars to be parked while leaving space for children to play (Figs. 6, 7). This collective space also provides place for “the extensive family”, an intermediate level of association which helps the network survive under fragile economic conditions (Aravena and Jacobelli 2012).

During the whole process Elemental engaged in a dialogue with residents and gave guidance on how to create long-lasting expansions. During the design phase, households were informed about the restrictions which limited their options. They were also involved in the process of



Fig. 5 Elemental: Quinta Monroy: basic structure. *Courtesy* Elemental





Fig. 6 Elemental: Quinta Monroy: incremental transformation. *Courtesy Elemental*

establishing priorities regarding what was crucial and what could be done later. For example, people agreed on having all the structure, including the kitchen and the bathroom installation, whereas the policy initially gave priority to the construction of the bedroom.

More than 50% of the families financed the expansions with their own savings and all of them preferred to stay and continue improving their homes, instead of selling them. The result was a \$20,000 home—this being the value families could ask for on the open market, if they so wished. In this respect Elemental succeeded in maximising the use of public resources to create a value far greater than the sum of its parts: the equation \$7500 (public investment) + \$750 (family investment) = \$20,000 was strongly based on the location within the city (Aravena and Jacobelli 2012).

This intervention is far from vernacular spontaneous architecture or deregulated self-construction. On the contrary, the physical layout sets conditions and limits for a balanced expansion without determining its final outcome. This kind of open-ended design requires considerable financial and building capacity. The crucial resource for developing such projects “is not money, but coordination:

Fig. 7 Quinta Monroy: courtyards. *Courtesy Elemental*



the sum of individual performances, even if each of them is of certain quality, does not necessarily guarantee the collective quality of the common good. An overall view is therefore necessary to channel in a positive direction the enormous quantity of individual energy that informality contains” (Aravena and Jacobelli 2012, p. 17). In this respect informality does not simply mean leaving a construction unfinished, but rather it needs to be designed. The initial form has to anticipate how self-construction will allow families to achieve a high standard, which can possibly improve the quality of their everyday life and increase the value of their house.

The Quinta Monroy project also shows how design practice can have a crucial role in transforming policies into effective strategies. On the one hand, designers cannot do much without innovative policies and effective regulation frames. On the other, policies are sterile without the creative proposal of designers: the construction market alone in this case was not able to channel creative energies around the new policy. Furthermore, this design experience helped to adapt the policy to the real situation of the construction market: since the final cost was more than \$7500, the policy was subsequently modified, and the subsidy was increased to \$8300 (Aravena and Jacobelli 2012).

In this respect, this case study shows how designers can become the missing link between innovative policies, the construction market and the needs of people, and how the emergence of the open city requires interaction among institutions, designers and citizens.



Learning from places: detecting latent and emergent open systems

On the one hand, the projects presented highlight how an open-ended design strategy is necessarily unique as it creatively responds to immanent conditions (social, spatial, economic, political, environmental, etc.). On the other hand, these projects also highlight how such strategy requires research methods and approaches able to question places in order to detect the risks for the self-destruction of the open city and to uncover the latent capacities for its emergence. The following section presents two research approaches designed to shape such methods of inquiry.

The first approach is proposed by Porqueddu (2018), who argues that, in order to frame the appropriate type and scale of a design intervention, it is necessary to understand place-specific complex adaptive cycles across scales. Indeed, although it is very common to become focused on the specific scale of the project (a building, a plaza, a block, a neighbourhood), it must be borne in mind that the scale we are interested in is connected to—and affected by—what is happening at the scale above and below, both in time and space. It also needs to be understood that the linkages across scales play a major role in how a complex adaptive system is behaving (Gunderson and Holling 2002). This is increasingly valid in the contemporary metropolis, where the rise of mobility and communication technology has brought about a network of exchanges between discontinuous places—opening up new possibilities for interaction and exchange far beyond the traditional

relationship of proximity (Harvey 1990; Massey 1994; Castells 1996; Amin and Thrift 2002; Boelens 2009). Since open systems cannot be understood by focusing only on one scale, Porqueddu shapes a Multi-Scale Atlas as a tool for understanding the cross-scale effects of emergent transformations. The Atlas combines a multi-layer analysis with a multi-scale mapping in a matrix, which makes it possible to explore the links between people's behaviour, activity rhythms and the physical layouts that support them at multiple scales (Fig. 8). The Atlas amalgamates the data collected through interviews, through a behavioural photographic survey, data analysis and multi-scale mapping. The maps facilitate the study of specific micro-spaces in relation to a wider network of relationships. In this respect, the Atlas can help frame the scale and type of problem, by highlighting the multi-scale social-spatial dynamics in which specific places are immersed. Furthermore, since complex urban problems cannot be addressed by focusing on just one discipline, the Atlas is also intended to be used as a cross-disciplinary tool: it is itself designed as an incremental open structure able to intersect heterogeneous data from different fields of expertise.

The second approach is proposed by Dovey and Wood (2015), who explore the relationship between open systems and public-private interfaces. Public-private interfaces are types of borders, and borders have long been considered fundamental for the development of open systems, mediating the relationship between disparate situations, people, activities and ecologies. They can therefore encourage—or block—emergent diversity (Sennett 2013). In urban design, planning and architectural design borders have long been

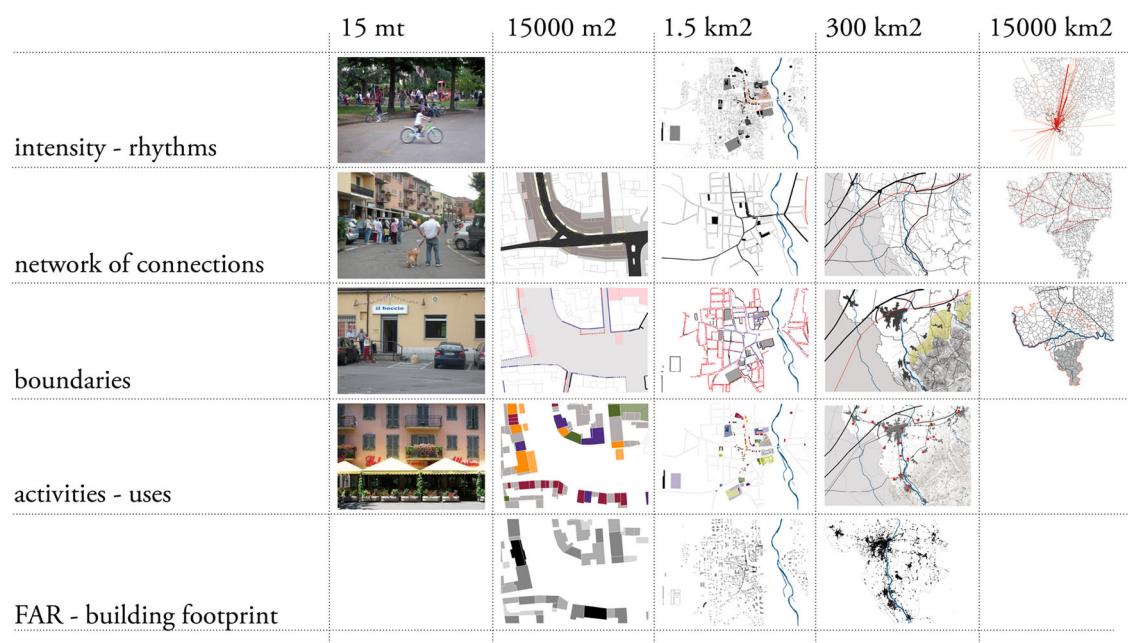


Fig. 8 Multi-scale atlas. Layers and scales matrix. (Porqueddu 2015, 2018)



studied because they also frame the multiple ways in which the transition between public and private, individual and social space is shaped and negotiated (Gehl 1987; Gehl and Gemzoe 1996).

In this respect, Dovey and Wood's study is innovative because it shifts the focus from interface types toward their dynamic development in time, according to rhythms of flows, activities and uses. After setting a series of six complex twofold interface types, they map their diverse fine grain mix and they explore the endless slippage between them.

Their study shows how urban neighbourhoods behave as open systems when private–public interfaces are heterogeneous and responsive, adapting endlessly to individual private initiatives and reacting to ever-changing situations which develop in public space. In spatial terms, the unpredictable individual action stimulates a change in street life, while emergent street life endlessly influences private behaviour. In this respect, their study prompts us to rethink rather than minimise the role of urban designers. It suggests that their focus should be shifted from searching for the ideal interface types and mixes to designing multiple, responsive, reversible interfaces, which are capable of adapting easily to unpredictable situations and unforeseen individual and collective needs.

The other big shift concerns the urban design codes and regulations. Indeed, while they have often been conceived to guarantee a certain consistency of interfaces, this study highlights the value of their diversity and their endless capacity to change. In this respect, their study also highlights the urgent need to reorient urban regulations, so that they can (1) encourage an endless interface adaptation and, at the same time, (2) prevent the self-destruction of their dynamism and diversity in time.

The “Flock City”: design and emergence

This paper emphasises how cities become closed systems whenever they lose their ability to adapt to a continuous state of becoming, whenever the relationship between people and the space they inhabit cannot be updated to emergent unpredictable conditions, ever-changing needs and behaviour. In this respect, design practices and urban codes risk fostering closed systems every time they try to over-determine and crystallise the relationship between form and social function. Instead, they might nourish the open city by stimulating the adaptations necessary to constantly update and upgrade our everyday experience of urban space. Since not every kind of adaptation is positive for the emergence of open systems, urban designers and planners have the fundamental role of directing the

emergent changes in positive directions without trying to formally predetermine their final outcome.

If the city starts to be truly considered as a complex living system, planners and urban designers could be better defined as the “guardians of the unpredictable”, like the gardener described by Clément (1991), who needs to become increasingly acquainted with the vegetal species and their behaviour in order to make more efficient use of their natural capacities to maintain and increase biological diversity (which represents a source of wonder and a guarantee for the future). This idea disrupts the established concept of designers and planners as the people who produce architectural plans on a drawing table, and promotes a different attitude which induces designers to observe more and design less.

This attitude highlights the importance of the context analysis across the design process. In this respect, the present paper shows how open-ended projects are based on a fine understanding of the place-specific socio-spatial dynamics across different scales. The action of designers rises therefore from a preliminary activity of mapping, data analysis, interviews and behavioural survey, which is designed to identify the latent potential for the open city and the risks for its self-destruction. In this respect, Porqueddu (2018) highlights how these potentials and risks increasingly operate on a multi-scale level and she proposes the multi-scale atlas as a tool for exploring this complexity. In Medellín and Iquique, accurate preliminary analysis led to a series of coordinated actions which can (1) activate an incremental process of regeneration, (2) foster the emergence of the open city and (3) prevent its self-destruction. A crucial aspect in this respect was also that citizens were considered active components in the project and building development: planners and designers shaped their action on a deep knowledge of their social–spatial relationships and could thus identify their ability to contribute to the transformation.

Such an approach to urban design is intended to direct rather than master the change. In this respect, the present paper suggests that designers aiming to become the caretakers of the open city should behave as if directing a flock. The flock director of Italian performers Effetto Larsen keeps joining and leaving the emergent flock of people during the improvised performance. By being simultaneously part of it and an external observer, he can identify and highlight the relational micro-dynamics which encourage and discourage its emergence. During this activity he never attempts to prefigure a certain intended action or a future overall form, but re-directs (from the bottom up) the individual behaviour which prevents the flock from flying off.

As flock directors, the designers who try to cooperate with the emergence of the open city behave as diversity



organisers: they contribute to channelling the enormous quantity of individual initiatives—which every city contains—in a positive and open direction. In this respect, the case studies analysed show how open-ended design makes it possible to increase the quality of individual (unpredictable) performances, by coordinating them and directing them toward the collective interest.

The projects presented show how the spatial layout is crucial in this process: the Elemental architectural proposal as well as the physical interventions in Medellín, were fundamental in facing financial and social problems. On the one hand, these case studies show how architectural and urban design plays an essential role in transforming the general principles and strategies indicated by the policies into open architectural and urban structures. In fact, in Iquique, the new policy, before Elemental's creative design solution, was lowering the quality of social housing settlements. Moreover, the new spatial experiment not only shaped a social-spatial upgrade, but it also contributed to verifying and improving some aspects of the policy. On the other hand, the case studies presented show how design alone can do nothing, if not combined with policies and sets of regulations aimed at open city development: these projects were possible thanks to political support and available budget. In this respect, the projects analysed show how crucial the experience and ability of the administration is in managing this kind of open incremental multi-scale project.

Another relevant aspect highlighted by the paper concerns the economic advantages of an open-ended design. The equation of Aravena ($\$7500 + \$750 = \$20,000$) highlights how such an approach makes it possible to do more with less, thus showing how an open design process can lead to a profitable result. The same observation can be made for the Metrocable project in Medellín. This potential for profit is certainly crucial in transforming public expenses into public investments, but it can also become appealing for private developers, who could start shifting their interest from master planning toward open-ended design processes.

By searching for strategies and rules which encourage and embrace emergent changes, designers and planners can become increasingly capable of fostering the open city. If the open city works as a provisional cluster of interconnections (where every component always retains the freedom to interact with the other components on multiple scales), the present paper highlights how it is possible to modify the behaviour of a single component without changing the component itself, but by inserting it into a new network of relationships. In this respect, the paper frames several possible design strategies, which could be defined as relational. They are, namely as follows:

- *Tracing new connections between existing elements.*
The Metrocable project in Medellín does not completely change the informal settlements, but it works as an element which is able to incorporate them into a new system of relationships. The PUI tries to upgrade the existing urban fabric rather than design a new one: it shapes the minimum structure which can turn informality into a complex system.
- *Transforming definitive boundaries into adaptive responsive borders.*
Investigating the set of rules and the design strategies, which (1) enable public-private interfaces to adapt to unforeseen situations and (2) prevent the self-destruction of their diversity.
- *Working with incremental adaptive structures.*
The houses designed by Aravena shape a basic structure, capable of (1) supporting a constant adaptation and improvised expansions and (2) limiting the possibility for chaos.
- *Exploring cross-scale effects.*
The research of Porqueddu and the illustrated projects show how a social-spatial multi-scale understanding makes it possible (1) to frame the correct scale and type of intervention and (2) to avoid designing everything from the micro to macro scale.

Finally, a place which behaves as an emergent open system is able to preserve its identity though it keeps changing its shape like a flock (which remains a flock, though the relationship between its single components is unfixed and its overall shape is in a continuous state of becoming). In the “Flock City”, the diversity of single individual components and their provisional interaction nourish an identity which is provisional and unfixed (Massey 1994) and foster an idea of “place as becoming” (Dovey 2010).

If the open city is a fertile ground for flourishing resilience and city diversity, if it represents the common ground between individual expression and collective interest, this paper highlights the urgent need to orient the design research and practice toward its emergence. By exploring the complexity which lies between over-control and deregulation, between order and chaos, a renovated design approach will hopefully open new unforeseen possibilities for the heterogeneous landscapes of our everyday life and their emergent states of becoming.

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