Evolvable Multi-Storey Housing

Allowing changes and expansion in housing in a dense urban setting

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Introduction

Incremental self-help housing has been used as a way of achieving affordable housing mainly with a focus on reducing costs. Since the user is involved in the building process this approach at the same time opens up opportunities for the end users' actual needs being reflected in the design. Incremental building has however mostly been used in projects consisting of single-family and single-storey houses. Applying this approach in a dense urban situation with a need for multi-story construction reveals new challenges that need to be addressed in order to be successful.

This paper discusses briefly the background of the self-help housing paradigm and expands upon the implications of incremental housing using the concept of levels as described by N. John Habraken. The paper discusses the levels of the built environment in relation to different practical examples. The intention is to reach a better understanding of the conditions for continued incremental development when used in multi-storey and mixed-use buildings.

Background

Self-help housing and incremental housing

As described by Jenkins et. al. (2007) the capacity of the state to provide low-cost housing in urban areas in developing countries was hopelessly limited in the 1950s and 1960s compared to the rapidly growing demand. The growing gap between supply and demand of *formal* housing was instead filled by an increasing amount of *informal* housing forms. In the late 1960s John Turner challenged the prevailing view of squatter areas as something "to be done away with". Instead he recognized the potential of self-development found in these areas and promoted the concept of self-help housing as an alternative approach. This approach included concepts such as 'site and service' and 'core houses' where the beneficiaries are provided a base – developed to varying degree – upon which they continue the development themselves. These ideas were increasingly acknowledged and in the mid-1970s this approach was supported by the World Bank and accepted as the official alternative to conventional housing for low income groups in developing countries.

In the 1970s and 1980s the use of this approach was being criticized for, amongst other things, being economically unfavorable and unable to involve the private sector. The problem of 'downward-raiding' – that higher income-groups acquired the houses originally intended for the poor – was also acknowledged. Rod Burgess has been an important critic of the self-help paradigm, opposing some of the ideas of Turner. Burgess argued, from a Neo-Marxist perspective, that "self-help housing was effectively a form of double exploitation" (Jenkins et. al., p. 164) and that the wider political economic context has to be considered when dealing with housing. Jenkins et. al. (2007) however also conclude that "more political aspects of self-help housing development which they [Abrams, Turner and so on] advocated – i.e. dweller control and political evolution – were not promoted" (p. 163). The different opinions expressed by Burgess and Turner in a series of publications from the late 1970s to the early 1990s has been known as the 'self-help housing debate'. Since this debate and the Neo-Marxist critique did little to provide solutions it was eventually by-passed in the late 1980s.

Incremental housing revisited

In an article prepared for World Urban Forum 5 Wakely and Riley (2010) argues that the current inability to provide for housing for the urban poor gives reason "to revisit the 'incremental housing' approaches of the 1970s-1980s". They identify six arguments supporting participatory incremental housing strategies. First, they conclude that while governments lack the resources to facilitate housing "people [every day] demonstrate their own ability to house themselves even if they cannot afford to do so in the formal housing market". Secondly they establish that even the poor households are able to invest significant amounts of money in their housing provided that the security of their investment is guaranteed. Third, they note that "the basis of incremental housing is that government does what households cannot effectively do […] and households do what governments cannot do efficiently". In this way they argue that the efficiency of urban management and services can be improved by delegating control to the most appropriate level and actors. Forth, they point at the potential of incremental housing in regulating informal areas. "By planning areas of legitimate low-income housing development as part
of an integrated urban development strategy, governments are able to set strategic priorities for an entire urban area". Fifth, the participation of the users in the governance of the housing area is identified as an important way in which a sense of ownership and pride is mediated amongst the users. Finally, they establish that the housing process can work as a catalyst to social and economic development by bringing participants together in a common cause.

Just like Turner in the 1970s Wakely and Riley (2010) recognize that the engagement and capability of the users could and should be seen as part of the solution rather than the problem. They also importantly establish that while early incremental housing projects confined their support to provision of land and infrastructure a wider range of issues need to be taken into consideration to be sustainable and effective in providing housing. Wakely and Riley establish for instance that land acquired at a low price – often in remote areas – is not necessarily a good solution when taking into account the social and economic consequences that such a location often brings about.

Another important topic is the need for planning bylaws and building controls to facilitate an incremental construction processes. According to the authors "there are strong arguments for a shift from the concept of official development control to 'development

promotion' and the establishment of planning and building advisory services […] that provide technical guidance on good practice" (Wakely & Riley, 2010, p. 5).

Levels of the built environment

The wide spectra of participants in housing development, as proposed by the incremental self-help housing approach, brings forward the importance of understanding the coexistence and collaboration between these actors and their respective areas of impact. Habraken (1998, 2002) uses the concept of levels to discuss the relation between physical form and control and as a means of reaching a better understanding of the built environment. The basis of his theories is that the built environment can be described as a hierarchal set of levels where the properties of a higher level sets the conditions for the lower. As Habraken points out the asymmetrical relations between these levels becomes evident if we think of the consequences of changes in the physical environment. Within a plot a building can be changed without requiring a change of the overall street network. If on the other hand the street layout is redesigned all affected buildings will have to be adjusted accordingly.

In his paper for the Unesco seminar in 1988 Habraken (2002) uses five levels as a formal representation of the model (Figure 1). In this model the *urban structure* level is the level of "major roads and infrastructure of the city" whereas *tissue* is the level of "streets and related urban elements on the scale of the neighborhood". The *building* level represent the building parts, such as load bearing walls or the foundation, that are not possible to change without affecting other parts of the building.
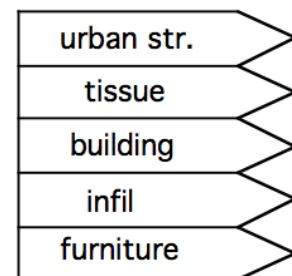

Figure 1. Five level model. (Habraken, 2002, p. 8)

The building parts in the *infill* level, such as partitioning walls or kitchen equipment, could on the other hand be changed without necessarily forcing change upon other parts of the building but might definitely affect the *furniture* level. This analysis clarify the impact of higher level design over the possibilities of incremental self-help building.

Habraken describes how control is distributed over the different levels depending on the type of project. Figure 2 shows a conventional housing project where two different professional groups are responsible for all levels except the furniture level which is in the hands of the user. Figure 3 instead shows what this this distribution looks like in the case of a 'core house' scheme.
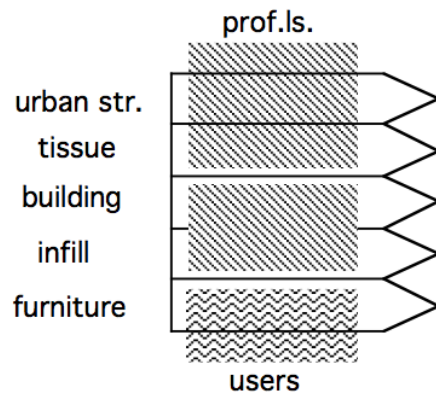
Figure 2. Control distribution in a conventional building project. (Habraken, 2002, p. 9)
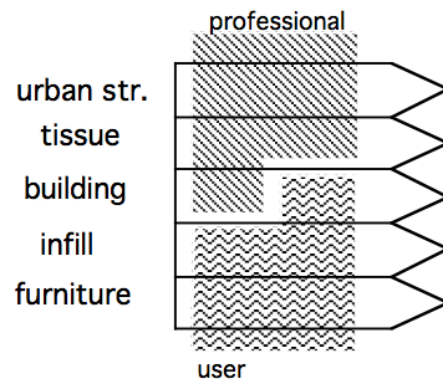
Figure 3. Control distribution in a 'core house' scheme. (Habraken, 2002, p. 10)

With this concept of levels in mind informal settlements or squatter areas can often be described as a flat hierarchy where the lines between tissue, building and support levels are vaguely defined. In such an environment where each and every part depends equally on each other the consequences of any changes are hard to predict and plan for. In a rural context with generous space this is not necessarily a problem but in a dense urban context the more general levels are crucial in making the city work efficiently as a whole.

Housing and Time

The incremental approach brings (back) the time aspect into housing. By seeing housing as a process developing over a longer period, rather than something provided at one moment in time, the participation of the users can be broadened. The ability to adapt and evolve over time is often essential for the long-term outcome of a housing project. In the case of housing for slum dwellers this is especially important since social and economical development is mutually dependent on developing housing standards.

> Housing projects and neighborhoods must grow and develop over time. There is no such thing as a [sic.] instant environment. What is good today is insufficient tomorrow. Many housing projects that were built in Europe in the fifties , and were considered examples for other countries to follow, are now obsolete. […] Being built in concrete these projects are extremely expensive to be renovated or to be demolished. (Habraken, 2002, p. 3)

Wakely and Riley (2010) similarly stress the time aspect as important when *evaluating* the success of self-help housing projects. In their paper they make the

point that "[m]any projects that were 'evaluated' only one or two years after their start were (erroneously) judged to have failed, whereas revisiting them a decade or two later attest to their success" (Wakely & Riley, p. 1). In photographies and short descriptions they show how three different housing areas (in Colombia, Sri Lanka and India) have been developed over time. The message is clear – something that starts out as meagre shelter can develop into a valid part of the city given the right conditions, support and a fair amount of time.

Analysis and Design Suggestions

The aim of this paper henceforth is to further discuss the above mentioned conditions and its possible impact on design solutions in a dense urban context which require use of vertical space.

Levels and distribution of control

As brought forward by Wakely and Riley (2010) the power and responsibility of the different parts of the built environment should be in the hands of the right people. This inevitably brings up the questions of who should be in control of what and how this is reflected in planning and design. Using the five levels proposed by Habraken the knowledge and skills needed to deal with the overall organisation of an urban environment gives that the level of *urban structure* should be under professional control. Professional actors in this levels should provide for the stability needed to support continued development in lower levels. The *tissue* level is easier to grasp since it is dealing with the neighborhood rather than the city as a whole. Stability and planning could however still be crucial on this level requiring organized collaboration if control is to be shared among stakeholders. Parts of this organized work could probably be done for instance in the form of home owners' associations but would probably still demand the competence of professionals to be included as well. In the lower levels of *building* and *infill* a multitude of both professional as well as non-professional actors can take part which make these levels especially interesting when considering incremental growth.

Habraken argues that even elements of the infill level can be important in what is perceived as *building* and therefore later names the building level as *support level*. This also clarifies that the central aspect of that level is to act as a supporting structure for the infill level. Habraken suggest and describe how a separation of the *support* and *infill* levels

can be a way to offer freedom to the users while also achieving efficiency and flexibility in building.

> The support could be built in rigorous repetition as a single project. But on the level
> of the infill each unit can be different. (Habraken, 2002, p. 12)

It could possibly be said that the support level thereby more easily can contribute with stability to the tissue level without imposing too much rigidity on the infill level. Facades could for instance be used deliberately to define the space between buildings but still allow for great flexibility in the interior. The support level could in this way be seen as a communal interest whereas the infill level could be left as a more private concern.

The separation of building and infill will however rarely occur automatically or unintended, as evident in many squatter areas. Instead this is to a large extend a design issue that requires professional skills and knowledge. The inclusion of a professional actor in an incremental process could be done in many ways, for instance in the form of technical assistance in the building process or as pre-designed core houses.

Allowing expansion

By considering expandability on infill level in the design on tissue and support level this can be allowed without conflicting other interests. In a dense urban situation, if such evolution is not considered beforehand it will essentially either not occur at all or it will conflict other interests by breaking the rules of higher levels or by forcing change upon other actors on the same level.

Figure 4. Quinta Monroy as initially provided. (Elemental)

Figure 5. Quinta Monroy with incremental development. (Elemental)

The chilean architect firm Elemental has shown how the concept of core houses could be developed in a way that considers the future development of not only the housing units but also the entire neighborhood as a whole. In their Quinta Monroy project (Figure 4 and Figure 5)

they through the design of the buildings direct where and how incremental growth is allowed to continue. By leaving space between the built volumes on the second and third floor the housing units can be expanded without increasing the building footprint. The strong dependency to the support level ensure that the expansions remain in the infill level even though the self-built expansions (considered infill level) in this case are given as much space as the pre-built core parts (considered support level). In this way the support level maintains its role in organizing the overall development. If the same expansions would have been built on the ground next to the building this dependency would have been lost. In the Quinta Monroy project it also becomes evident that the support level can be deliberately designed to create opportunities for expansion in the infill level. To allow for infill level expansion in more than one floor the support level need to lead the way and if the support level structure was not already there it would have been necessary to expand that first, before the infill is able to expand. The design of a higher level is thereby not only setting the *limits* of lower levels but can also *provide for acting space*.

In a presentation of his research Harper (2013) emphasizes how left-over spaces are of great importance in the evolution of a housing area. When such spaces are not provided areas for livelihood activities tend to grow at the expense of residential areas. On the other hand, if this kind of spaces made are available and part of the formal buildings they can develop in accordance with the changing needs of the users. Habraken (1998, p. 34) similarly points out that relations between objects in the same level, for instance between different sets of furniture in a room, are unstable. Higher level organization, such as dividing the room with a partitioning wall, might then be a way to avoid or solve spatial conflicts and allow objects and activities to coexist. Deliberately working with multiple levels in the design of a building can thereby create flexibility and allow for changes without sacrificing stability and predictability.

Results similar to the one in Quinta Monroy could in theory be achieved with even less pre-built components by constraining these to pure support level elements such as pillars and beams. Since the provided building facades are strong actors on the higher tissue level such a change could however interestingly be argued to have an impact on the overall neighborhood. With an awareness of which elements are important actors on each level, and which are not, it is possible to design in a way that gives a maximum of freedom in the infill level still retaining the structure of the higher levels. It could for example be found

that a facade facing the street is important on the support and tissue level while a facade facing a private court yard could be considered infill level.

The Quinta Monroy project also importantly shows how materials can be used in relation to levels. By deliberately using concrete in higher level structures and lighter materials in the infill elements changes and continued development is directed and encouraged accordingly.

To expand vertically

One common form of vertical expansion is to build a new support level structure on top of an existing house or building. This can however be technically hard to follow through unless this is prepared for in the design of the support system. Structural integrity is often a problem when trying to expand or upgrade informal settlements or the like. If this expansion is not planned for in advance this type of expansion can also affect the higher level organization and character of a neighborhood negatively.

Another approach which is common also in formal housing areas is to expand the floor area *inside* the housing unit by adding a mezzanine or loft. Without really expanding the housing unit per se this has the advantage that vertical space can be used to a greater extend. If this is not thought of in advance and reflected in the initial ceiling height there is however a risk that the vertical space when divided becomes too small. On the other hand, it could be argued that if the ceiling height is raised too really take another floor level into account a large amount of space would be inaccessible and useless until that loft is built. Considering the decisiveness with which many users take on the development of their housing this could nevertheless be an efficient way to allow for improvements inside the housing unit.

In the case of Quinta Monroy vertical space is used for expansion but the actual expansion is however still horizontal, originating from the walls rather than the roof or floor of the existing. To make true vertical expansion possible free space need to be available right above or below the room that is to be expanded. In a multi-story building this is generally only the case in the uppermost floor. Regardless of in which direction the expansion is to be made – horizontally or vertically – the question is how space can be made available *within* the building but in-between the separate housing units.

One way to achieve more vertical space is to lift the building from the ground freeing up the space beneath (Figure 7). Houses on stilts is actually a common traditional housing
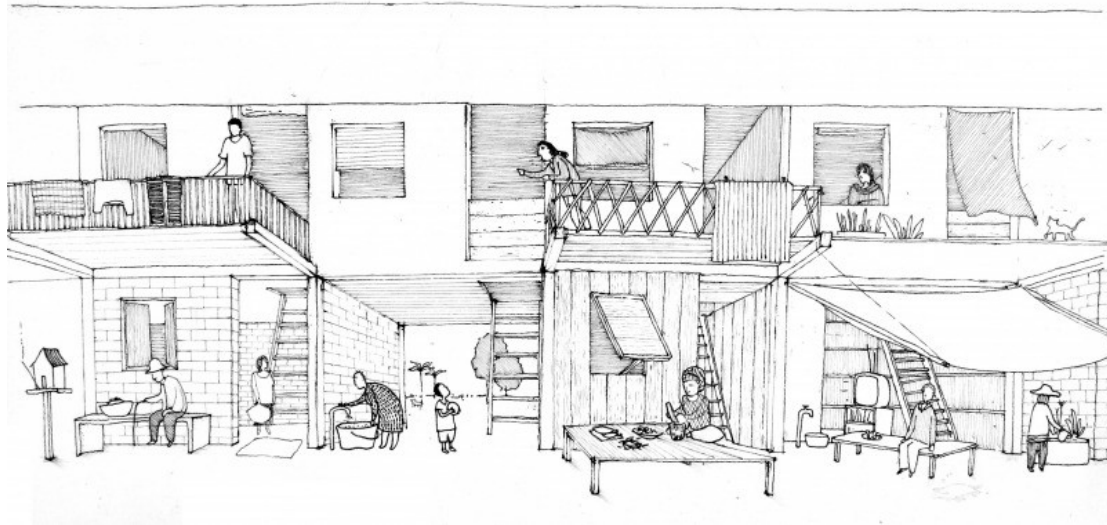
Figure 6. Sketch of incremental collective housing in Cambodia. (Architecture In Development)

typology in many parts of the world and have been used in new developments as well. Using this approach for instance The Community Architects Network in Cambodia (Figure 6) is able to reduce the construction costs by providing walls only in the second floor. Since the structural integrity of the building is already accounted for the open ground floor is easily developed incrementally by the users according to their needs and assets. Looking back at Quinta Monroy it is quite easy to see how a similar downward expansion approach could have been

Figure 7. Downward expansion.

Figure 8. Upward expansion.

applied even in that case. In an urban context the ground floor areas are well suited as premises for livelihood activities.

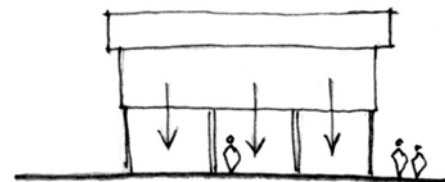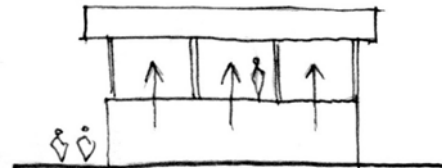Another approach "opposite" to the one mentioned above would be to allow for expansion upwards (Figure 8). This could be done by simply raising the roof and adding a second floor in-between. Such a space on top of the ground floor level might however be quite different compared to the downwards expansion approach. Since the provided housing unit is situated between the provided space on top and the supposedly public areas on the ground this space is more or less bound to be used for more private purposes.

In a dense urban setting it would be desirable to build more than two-story buildings and allocate space for incremental development even on higher floors. A scenario where the approaches mentioned above are used even on higher levels could be considered, alternating built and unbuilt stories. Access to each "ground floor" or base could be common whereas access to the second floor could be individual. Even if extensions are made on each such base floor they could be limited to provide common spaces as well. In that way even these extensions could be allowed to fill other purposes than purely individual and residential.

When expanded according to any of the above mentioned vertical expansion schemes the resulting housing unit would consist of more than one floor. This could be considered a good quality but might also be undesired in some cases. It could then again be worthwhile to revisit the concept of horizontal expansion. By combining the horizontal expansion as found in Quinta Monroy with the concept of common bases and vertical expansion as discussed above a multitude of new possible configurations are reviled (Figure 9).
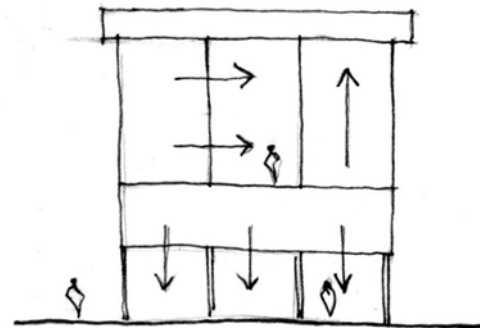

Figure 9. Different expansion approaches combined.

There are no simple answers to the question of how incremental construction is to be allowed in multi-story houses. Through the examples above it is however evident that architectural design has an important role in guiding continued development.

The Role of Architects

As a professional actor in the building sector the architect is often the one responsible for distributing control in the levels mentioned earlier. This is done partly by design of the physical structures that are to be built but might also include "designing" the organizational structures that make the project come through and live on. Working as an architect is thereby in many ways about creating a framework to which present and future generations will have to relate in some way. In the case of housing for the urban poor, where houses need to be built rapidly and in great numbers, the resulting living conditions are by necessity often constrained to a bare minimum. The circumstances that make these

solutions necessary are however not to be considered constant and ever-lasting! If such a housing area is not allowed to develop and improve over time it means that its inhabitants are similarly stigmatized and unable to improve their circumstances of life. Allowing the built environment to change over time is from that perspective of great importance and the architect plays an important role in doing so.

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