DESIGNING OPEN BUILDING FOR SOCIAL HOUSING: LIMITS AND POSSIBILITIES

Denise Morado Nascimento
Professor at Architectural School of Universidade Federal de Minas Gerais, Researcher of Morar de Outras Maneiras - MOM (http://www.mom.arq.ufmg.br/)
Rua Paraíba 697, 30130-140, Belo Horizonte, Brazil
dmorado@arq.ufmg.br

Thais Mariano Nassif Salomão
Undergraduate student at Architectural School of Universidade Federal de Minas Gerais, Researcher of MOM
Rua Paraíba 697, 30130-140, Belo Horizonte, Brazil
thaisnassif@gmail.com

Laine Hardy
Graduate of Taubman College of Architecture and Urban Planning at University of Michigan (Bachelor of Science), Voluntary researcher of MOM
2128 SE Belmont Street, Portland, OR 97214, USA
laine_hardy@hotmail.com

Abstract
The main focus of this article is to demonstrate the limits and possibilities of designing Brazilian social housing based on the concepts of Open Building. The results are drawn from research on Open Building in relationship to present housing production systems in Brazil. The article shows three comparative architectural studies between open building social housing proposals and the model of the local authority, Urbel, in Belo Horizonte. Nevertheless, it is not the aim of this article to demonstrate or provide “the solution” for the housing crisis, but rather to criticize the generic, repetitive, and rationalized typology that has been applied by the local authority. These three different projects cannot be understood as the only correct answer for the Brazilian housing scenario or even as a new typology to be reproduced. Instead, they should be seen as an important alternative mode of production where dwellers would be part of the decision process. The limitations faced in these projects are due to the Brazilian building industry, whose products have historically favored mass production logic, and are also due to the local authority, which resists accepting the spatial diversity and social autonomy promoted by the Open Building approach. In conclusion, the design and production of Open Building social housing is not only possible, but also valuable and relevant to Brazilian housing production systems. However, we must bear in mind that much work still needs to be done in order to implement Open Building strategies within housing policy.

Keywords: social housing, housing project, Brazil.
HOUSING IN BRAZIL

Considering the built environment as a transforming process continuously subject to human interventions, the architect N. John Habraken (1979) argues that architects need not only understand the values of mankind, beyond the meaning of time and change, but also develop projects based on flexibility, participation and empowerment of dwellers. The value of Habraken’s research (1972) is mainly related to his belief that users should be part of the decision-making process in the place where they live.

Years passed since the theory of Habraken and the architecture field still asks: why should the users also decide about the changes to their physical environment? Or, in other words, does the user’s impact matter to architects?

Let’s see. Part of the buildings in Brazil is produced exclusively by a small group of people - architects and technicians, designers, entrepreneurs or construction entrepreneurs. Within this logic of production (capitalist), the design and building processes are determined and controlled by few. On the other hand, there is housing production, present in peripheral lots and favelas where information and knowledge from the immediate empirical experience of users and/or builders is the determinant factor. In survey by Booz Allen Hamilton, commissioned by the Brazilian Association of Industry of Building Materials (Associação Brasileira da Indústria de Materias de Construção – Abramat; Ministério das Cidades, 2007), it is estimated that of the total housing units produced, expanded or reformed in Brazil, whether formal or informal, 77%, on average, are done through self-management without participation of specialized professionals.

The architect Erminia Maricato stated in interview with the Brazilian program Sem fronteiras (2009) that the housing issue should be strongly addressed, primarily on two fronts: (1) the application of the social function of property and of land and property regulation, and (2) the private sector (currently restrained as a luxury product) learning about how to produce low-income housing. Beyond the statement from Maricato, statistical studies warn about the need to address the production of low-income housing in academic investigations. The same survey by Booz Allen Hamilton shows that 84% of building materials are sold to individuals who build their homes on their own. Indisputably, the autoproduction universe configures itself as a market opportunity for entrepreneurs from the construction industry.

Along with the subsidized housing provision by the State, there is an important slice of the residential construction represented by users who make their decisions on the housing processes in an isolated manner, without interference or participation from those who have knowledge, be it either technical, legal, social and environmental, historical, political, or economic and cultural.

There is no way someone can deny the capacity of poor families, rejected by the processes of formal housing construction, to develop means to overcome the challenges of production through their own resources. Since the beginning of the twentieth century, public policies and investments have not been widely and consistently applied to addressing the housing problem, especially with regard to programs focused on access to land and infrastructure services. Despite this, low-income workers have created alternatives for access to housing. Autoproduction in Brazil, be it a favela or a self-venture based on peripheral site and self-construction, exploded in the late 1940s. The dweller buys or occupies the land, traces a schedule of construction without technical support, enables the acquisition of materials,
guarantees the labor (free or informally paid) and then builds the house (Bonduki, 1998) - a domestic non-capitalist production process.

The mass provision of housing controlled by few and the strong injection of capital from the government and the construction industry have historically proven not to be effective (Hamdi, 1991). Surprisingly, it is still the dominant practice of housing policy in Brazil. One reason for this scenario, according to Maricato (2000), is the misinformation on the huge illegal occupation of urban land not only by the municipal authorities responsible for project approval and city planning, but also by the universities.

According to Farah (1996), the refocusing of thematic research on the housing production processes tends to be relevant as a contribution to the search for alternatives for the provision of housing. The author notes that the emphasis of research has not been the analysis of production per se, but the analysis of processes of distribution and consumption of the built environment with the State as the responsible party for meeting the workers needs.

In this sense, this article intends to show the challenge of the research proposal to understand and critically examine the principles of an Open Building approach in order to mobilize architects (as well as local housing authorities, technicians, designers, developers or construction entrepreneurs) because of their potential role in the social housing production. Or, in other words, we intend to check the possibilities of bringing architecture closer to the coherent housing (auto) production processes where dwellers autonomously decide about the design, building and use of their dwellings, usually linked to a strong sense of community no longer found elsewhere.

THREE POSSIBILITIES OF OPEN BUILDING

The aim in this research is to provide some comparative study between an Open Building approach to social housing and the model of the local authority, Urbel, in Belo Horizonte. To do so, three housing schemes were designed (but not built), as an effort to attest that Open Building could be an answer to social housing in Belo Horizonte. A closer analysis has revealed that the actions of the housing local authority (Urbel) are still far from being capable of promoting people’s autonomy and ability to effectively interfere in the housing production processes. Urbel still insists on presenting models derived from an unchangeable design that has resulted from the formal, constructive and technical determinations of the building sector or of the formal city. In other words, it is not understood that social housing dwellers do not demand ready-made products without the possibility of absorbing social and physical changes over time (Morado Nascimento, Nassif, 2008).

Taking the area of Granja de Freitas as a case study, some important information was analyzed in order to sustain the proposals: contour lines, environmental reports, the Work Plan and the Master Plan developed for the area by Urbel, urban legislation, geological studies, research reports about the occupation history and the local community practice and also local newspapers.

The housing scheme for Granja de Freitas, developed by Urbel, is part of the municipal program called Vila Viva, which generally aims to reorganize the housing, sanitary, environmental and road systems of the informal settlements in Belo Horizonte. In this case, the families to be settled in Granja de Freitas came from risk areas around it. In a 28,000 m²
site, Urbel plans to build fourteen blocks with 216 housing units of 2 bedrooms (47 m²) or 3 bedrooms (52 m²), seven blocks for waste recycling and three community centers.

Figure 1: Urbel’s model for social housing in Belo Horizonte

The buildings are usually set on artificial plateaus (the steep topography and geography of each plot are underestimated) and are built with structural concrete block walls, 3 x 4 m prefabricated concrete slabs and repetitive components (windows and doors) which form unchangeable rooms. Wide streets are designed as they are in the formal city.

The area
The first step was to investigate the place in which the design scheme would be developed. Granja de Freitas is located in the east side of Belo Horizonte, six kilometers away from its center and is bordered by the municipalities of Nova Lima and Sabará and neighbored by Taquaril and Alto Vera Cruz districts.

Figure 2: Map of Granja de Freitas, Belo Horizonte
Occupation of the area began around the 1920’s and was primarily by migrants from the center and north of the State of Minas Gerais but also from the south of the State of Bahia. The whole area was divided into plots of 2,500 m$^2$ each, which were gradually subdivided into smaller ones. The community was dedicated at that time to rural activities, especially those associated with mud block production and subsistence agriculture (some surplus, such as yams, rice, cassava and vegetables, in addition to pigs and chickens, was sold at the center of the city; Meneses, 1998).

For a long time, Granja de Freitas remained a rural area characterized by a good cover of vegetation. Environmental degradation arose due to the irregular occupation around the area and the presence of fragile houses with inadequate foundations. Since then, the stream responsible for the area’s water supply – *Cachorro Magro*, has been polluted by sewage and garbage, including the contamination coming from the housing development built by Urbel, in the 1990’s. Nowadays, Granja de Freitas is considered a critical area because of the geodynamic processes, essentially due to its geological and geotechnical characteristics (slopes and phyllite soil). The area is characterized by a steep indentation basically because of the significant altitude (795 m to 1040 m); there are valleys in “V” forms especially near the headwaters, which extend downstream (Lopes, 2006).

**Strategies**
After collecting and analyzing all the data above the project strategies for the site were defined.

<table>
<thead>
<tr>
<th>URBEL</th>
<th>ATTRIBUTES</th>
<th>RESEARCH GROUP</th>
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<tr>
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<td></td>
<td>divisions</td>
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<tr>
<td>216 units</td>
<td>quantity</td>
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*Figure 3: Strategies for designing*
Using the theory of Habraken (1972) and his Margins and Zones method, the proposals were developed with the assumption that the Support would be provided by Urbel while the Infill would be the responsibility of each family (working together with Urbel). However, no specific modification of the bureaucratic administrative procedures of Urbel was proposed in order to make any of the design proposals happen. This is understood as a possibility to continue the research.

**The first design scheme**

The first scheme is comprised of 28 housing modules containing 6 double-store units each, for a total of 168 units. Each unit has 60 m² plus 12 m² of expansion area. Additionally, there are 2 community centers (as part of Support) and one parking space for each 3 housing units (according to the municipal legislation).

Although our density results are lower than that of Urbel, it is important to note that the units are expressively bigger and include expansion areas. If we do not consider the expansion areas we could have 43 modules with a total of 258 units of 60 m² each, which represents a higher density (still, the units would be bigger than that of Urbel).

Such density could only be achieved because of the occupation strategy adopted. Beyond the slope preservation, it represents a significant economy in regards to earth movement and also allows a legal possibility of having a fifth floor with no need of an elevator. The buildings are comprised of up to 4 modules arranged linearly in order to minimize cutting and filling the site.

As Support we have: the bathroom and the plumbing wall (water pipes, drain and vent piping, electrical wiring and gas pipes). As Infill we have: internal divisions and the facade closure. The building system is the same adopted by Urbel: structural walls and 3 x 4 m prefabricated concrete slabs.

*Figure 4: First housing scheme*
The second design scheme
There are four important differences between this second proposal and the first one: (1) the expansion area is uncovered; (2) commercial areas are presented; (3) a lower density is proposed; (4) housing units are arranged in “L” form with larger ventilation and illumination areas.

The housing units are settled in linear plots similar to the first proposal. There are 129 housing units, distributed in 43 modules, with 48 m$^2$ each unit (36 m$^2$ plus 12 m$^2$ of uncovered expansion), and 43 commercial units of 12 m$^2$ each.

As Support, we again have: the bathroom and the plumbing wall (water pipes, drain and vent piping, electrical wiring and gas pipes). In this case, the density is considerably lower than Urbel, which forced us to derive another project.

Figure 5: Second housing scheme

The third design scheme
In this third proposal, we adopt an approach that is not limited by Urbel’s restrictions. We escape the linear arrangement, in favor of one much more consistent with the informal housing arrangement in Brazil (such as favelas) and its social logic of production.

As so, a grid of hexagons of 6 meter in diameter is used as a strategy to adapt the units to the slope, functioning as a carpet and allowing a non-orthogonal arrangement. Four aspects are considered – the median level of the contour lines, the declivity, the wind channels and the insulation. Each aspect is layered and overlapped in order to guarantee adequate occupation of each hexagon.

Some guidelines are established: (1) hexagons with more than 30% of declivity between them are not occupied; (2) pedestrian streets are up to 4 meters wide, located along the areas with gradual and regular declivity and orientated toward the wind direction; (3) each housing group measures no more than 20 meters in width (4 hexagons perpendicular to the plot declivity) and no more than 40 meters in width parallel to the plot declivity; (4) upper floors are added only if they do not alter the insulation and ventilation of lower floors; (5) within units, the floor level difference shall not exceed 1 m; (6) all units have direct access to public circulation; (7) access stairs to upper floors are public; (8) if the level difference is less than 40 centimeters, between two hexagons inside an unit, the level is equalized at the median point; (9) if the level difference is between 40 and 60 cm, between two hexagons inside an unit, the ceiling level is equalized to benefit the second floor; (10) the clear ceiling height of each unit is 2.80 meters minimum and 3.40 maximum; (11) each hexagon of each unit shall access ventilation; (12) windows at facades are located to north or east; (13) the units shall be: 2 hexagons = +/- 48 m$^2$; 2 hexagons + 1 expansion hexagon = +/- 72 m$^2$; 3 hexagons = +/- 72 m$^2$; (14) expansion areas on the first floor are located at the west side of each unit; (15)
expansion areas are uncovered at the Support stage and are located on the same level or lower than the house; (16) the housing group shall not exceed 4 floors; (17) each unit shall have a single plumbing wall; (18) Infill components are internal divisions, facade closure, service connections to the plumbing walls; (19) all the internal spaces utilize elevated or clerestory windows to allow better ventilation; (18) Support includes structural walls, covering, plumbing wall (water, electricity, gas, sewage) and elevated pavement.

Figure 6: Third housing scheme

This housing scheme proposes 200 housing units, being 114 units of 48 m², 82 units of 48 m² + 24 m² of expansion, and 4 units of 72 m². However, the density and the arrangement for the site is flexible due to the hexagonal logic. Parking spaces or garages were not considered since we attest that the demand for parking is not significant since the streets along the whole plot are wide enough to provide parking.

LIMITS AND POSSIBILITIES

The approach of the Open Building for social housing is not a common practice especially if one considers the social, economic, political and cultural conditions as they are in Brazil; however, it seems particularly opportune in the Brazilian context. The nature of improvisation and of constant transformation of the so-called informal production in Brazil favors the approach of the Open Building movement since its potential users are familiar with the decision making processes for their houses. Similarly, the fact that this population is characterized by the informal coexistence between private and public spaces and by the habit of community living brings the dwellers closer to the “natural relationship” described by Habraken.

Conversely, the attempt to use an approach to social housing that allows low income people to change their houses is met with great resistance from some officials of the local housing
authority and even members of the academic community from the architectural school who are all aware of the three design schemes presented here. Their response is “this will end up like a slum.” We observed that irregular or diverse occupation is perceived as something chaotic and indirectly related to violence that is, unfortunately, present in Brazilian slums. Even this comment becomes relevant, if the disordered occupation means environmental damage (poor lighting, ventilation, drainage and erosion) or society does not accomplish spatial diversity as a natural consequence of social diversity.

Nevertheless, a major difficulty is to reach a maximum of freedom in a space meant to be minimal. How to provide space that would be able to meet the most variable needs? Generous dimensions don’t necessarily result in good solutions. However, designing minimal spaces requires extreme care in placing each support element since there is no chance for further correction. In this context, it is essential to study the possibilities for layout, identifying adjustments for openings (doors and windows) and for diverse furniture due to diverse families.

Regarding the definition of what would be support as the local authority’s responsibility, the fact that we choose more flexible infrastructure system is significant in the third scheme. Although case studies show the possibility to achieve good flexibility in service systems (water, sewer, electric and telephone) through the use of relatively simple building systems, such as elevated floors and/or ceilings, these systems are not affordably available in the Brazilian building industry. Due to this, the development of building components and systems for application in Open Building projects could be an important path to be followed by Brazilian academic professors and researchers.

Concerning the occupation of steep slopes, it is known Urbel should not use the present land for housing projects because of the negative environmental impact of the required high population density. In order to mitigate the damage of the slope occupation, the linear proposal of Habraken was considered, which has proved to be relatively effective when applied on hillsides. However, the choice of a more organic occupation, specifically designed to fit on smaller portions of land, such as the third design scheme, showed to be a more efficient and environmentally friendly option to prevent slope degradation.

Here questioning Open Building comes to a point: standardization against spatial and social diversity. The principal assumption is that the application of generic and repetitive typologies (mass production) for the low-income population is undoubtedly an error. Then, collective areas (such as community spaces, public paths and ventilation/lighting channels) must be understood as support, meaning non-occupiable area and avoiding bad quality housing schemes. Finally, Brazilian architects and local housing agents should design and produce social housing according to the Open Building premises since it is extremely consistent with the systems of autoproduction practiced by dwellers at present as well a valid alternative to the generic mass produced schemes of the housing authority. However, much work must still be done with respect to the attitudes and practices of architects, local authorities, and the building industry (essentially due to Habraken’s premises). Or, in other words, which social, political and economic structure could allow support/infill approach in Brazil? Open Building still needs to be debated by the whole of participants in the design and production processes of social housing in Brazil.
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