Quality of life and sustainability issues as seen by the population of low-income housing in the region of Campinas, Brazil

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Abstract

This paper presents a study on quality of life and sustainability indicators relating to site-planning parameters for low-income public housing projects in the region of Campinas, Brazil. The study is based on a post-occupancy-evaluation (POE), conducted in five housing developments. Most of these housing projects are based on a repetitive model and are devoid of urban infrastructure. Users act on their own in providing for some elements considered necessary to create an identity and community spirit. Results show that the population relates quality of life to economic factors and sustainability is associated to reduce utility bills. Houses are preferred to apartments and satisfaction with the present housing conditions is high, despite low feelings of security in the neighbourhood. This work is part of a broader study, which aims to develop design evaluation tools. Most sensitive quality of life and sustainability indicators related to site-planning should permeate these tools and establish design guidelines. The inclusion of a large number of qualitative design issues into the decision-making process and the questioning of existing standardized solutions are seen as essential means to increase local housing quality.

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Keywords: Quality of life; Housing; Low income; Sustainability; Site-planning

Introduction

A study on quality of life indicators and site-planning parameters related to the issues of sustainability of housing projects was conducted in five low-income developments in the region of Campinas, in the State of São Paulo, Brazil. The study used post-occupancy-evaluation (POE) methods. The main purpose of the study was to test the population’s views on quality of life and sustainability issues. The potential for design parameters that incorporate up-to-date guidelines was also assessed in relation to future public housing developments in the Campinas region. The literature of the past 50 years on housing design tendencies and lists of quality of life and sustainability indicators directed the content of questionnaires and observation sheets.

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Local housing developments, especially those built for low-income level families, are slow in adopting recommended practices and perpetuate a standard design model often not adapted to specific geographic and social situations. Such observations guided this investigation, with the prospect that the study results may uncover simple ways of improving these practices, without incurring major changes in policies or costs of such residential projects.

Quality of life and sustainability indicators

Quality of life issues were investigated through a literature search prior to the POE study described here. Indexes to measure living conditions have been discussed for some time and most indicators are associated to a wide field of issues, such as health and economic conditions of a population (Drewnowski & Scott, 1966). In Brazil, the human development index (HDI) is used to measure life expectancy, education and income levels in municipalities (PNUD, 1998). Housing conditions are part of most general quality of life indicators and of what is often referred to as healthy cities, especially in Latin America (Martínez, 2003; MejorHab, 2001). Lawrence (2002) identifies eight essential housing quality components: (1) site characteristics, (2) residential buildings as a shelter, (3) safe supply of water, sewage and solid waste disposal, (4) neighbourhood ambient atmospheric conditions and indoor air quality, (5) household occupancy conditions which avoid transmission of infections and the occurrences of injuries (6) access to community facilities and services, (7) food safety and finally (8) control of vectors of disease that can propagate in the building structure.

Site-planning guidelines, which incorporate quality of life indicators, can be found in the housing literature. Lynch (1960), Alexander, Ishikawa, and Silverstein (1977) and Kowaltowski (1989) criticized the modern movement in architecture which, although emphasizing the idea of bringing Good Life to all people, failed in many cases, as attested by the Pruitt Igoe public housing development in Saint Louis. Recommendations for the humanization of the built environment are brought forward. Many towns have established their own recommendations and converted guidelines into bylaws, which often combine quality of life and sustainability indicators. Guidelines give special attention to: a community spirit and feelings of security, street and parking systems, site-planning arrangements, landscaping, public and private open spaces and finally the architectural quality of buildings (LGC (Local Government Commission), 2003). Good Design is advocated, which includes meeting the user’s needs, understanding and responding to the context, enhancing the neighbourhood, and building to last (HUD, 2005).

Most quality of life indicators include basic needs and desires of people and thus general housing design guidelines should be applicable across cultural boundaries. For specific situations, however, climate, culture and available resources should be incorporated into local recommendations.

Satisfaction rates are often part of indicators, but must be used with reserve in low-income family housing questions (Hayes, 1995; Kowaltowski & Pina, 1995; Reis & Lay, 1995). Families who lived in risk areas, paid high rents for poor quality housing, were crammed into borrowed spaces and have finally reached legal home ownership will rate any degree of housing improvement highly. Thus, in these situations user attitudes depend on the psychological well-being, feelings of security and safety and the perception of space as territory. A sense of crowding is considered negative but feelings of belonging and privacy are important (Gifford, 1997; Newman, 1972; Reis & Lay, 1996).

With regard to sustainability indicators the Brundtland Commission’s declaration of 1987 has been a guiding force for architecture and urban design, especially through the implementation of Sustainability Indicator Sets (Astleithner, Hamedinger, Holman, & Rydin, 2004). Studies on sustainability investigate the complex interactions between society and nature and the connection between the symbolic and material dimensions of social practices. They have been shown to depend on local cultures and the general levels of education of the population to enforce them (de Schiller, da Silva, Goijberg, & Treviño, 2003; da Silva, 2003).

For housing, sustainability is related to, among other factors, water and energy consumption, gas emissions related to the production of construction materials and furnishing, housing areas (floor space), and households’ share of methane emissions from waste deposits. Development footprints, construction density, impermeability rates, materials and soil conservation are typical indicators found in the official lists used by governments. Also, urban form, microclimate and traffic systems affect energy efficiency, pollution levels and infrastructure systems (Thomas, 2003).
Although addressing a wide range of topics, most sustainability indicators are less subjective than the quality of life issues presented above and have quantitative measures, which permit testing (Diener & Suh, 1997). They include the topics of: environmental quality; energy consumption; soil; building materials; water; environmental load; health; equity/justice; quality of open areas; services; visual impacts; interior space and air quality; interior space health conditions; quality of individual residential units; urban infrastructure; transportation systems; investments and costs; benefits and business opportunities.

Field study of local public housing developments

In Brazil many residential projects have been evaluated (Abiko & Ornstein, 2002; Medvedovski, 1996; Motta & Del Carlo, 1975; Reis, 1995; Szücz & Razera, 2000). Such evaluations have primarily been based on POE studies, with emphasis on technical construction factors and user-satisfaction rates.

The POE study described here was conducted in projects developed and built by the São Paulo State housing authority CDHU (Companhia de Desenvolvimento Habitacional e Urbano do Estado de São Paulo). This company has been the largest producer of public housing in the State since 1986, when Brazil stopped its national housing program. CDHU has greatly contributed in reducing the housing deficit of the State of São Paulo, through its many programs (CDHU, 2005). Priorities and policies of the company are to attend the housing needs of low-income level families, through subsidies and state funding.

The company’s projects are based on similar design principles for similar population strata. Many projects are located in smaller cities and thus not especially affected by large urban conglomerations problems as found in the city of São Paulo. Forty projects have been completed in the last 10 years in the region of Campinas. A total of 8292 residential units of different typologies (single-family houses on individual lots and apartments in walk-up blocks) were constructed around the city of Campinas, according to the official CDHU documentation available.

Campinas is a city of around one million inhabitants, about 100 km from São Paulo, the largest city in Brazil. The city’s population has doubled in size from 1985 to 1995. The region is comprised of several smaller towns with a total population of approximately three million inhabitants.

To test the population’s views on quality of life and sustainability issues and observe the present design model in detail were the main concerns in this study. The two subjects have mostly been treated separately, but are brought together here to assess the potential for change in design parameters for future public housing developments in the Campinas region.

The 40 CDHU housing projects of the Campinas region are divided into 5 programmes. One housing development was randomly selected from each program and 5% of the residential units in each project. A site plan example is shown in Fig. 1 of a project with both apartment blocks and semi-detached single-family houses. Sample selection was based on a uniform distribution over each site. Single-family residences and apartments were included. Various floor levels were represented in the selection of apartments.

A total of 105 questionnaires were applied. Twenty-seven families were questioned in the city of Campinas and the rest in nearby towns as follows: 7 in Atibaia; 14 in Valinhos; 9 in Itatiba and 48 in Santa Barbara. The Campinas project dates from 2003 and the other 4 areas were occupied in 1996. Two projects (Campinas and Itatiba) are based on 4- to 5-storey apartment buildings and 2 projects (Valinhos and Santa Barbara) are divided into 2 distinct typologies of 4-storey apartment buildings and an area occupied by single-family units on individual lots. Atibaia is a small project with single-family dwellings on individual lots only. All projects are located on the outskirts of their respective towns.

The field study instruments were based on questionnaires, observations and design analysis. The research team, using interview techniques, applied questionnaires personally and conducted observations on site. The study was conducted in summer, between November and December of 2003, a period characterized by hot and humid days and nights.1

The aspects observed and analysed on site and through drawings included: building density, percentages and distribution of different use areas, as well as circles of influence of institutions and services. The interior of

1Winter days, in the local climate, have high solar radiation and can reach high daytime temperatures. The clear skies influence directly the drop in nighttime temperature. Winds are predominantly southeasterly and strongest in the months of September to October.
residential units was not evaluated in detail, since neighbourhood and site-planning issues were the major focus of the investigation.

Users were identified through age, profession, place of birth and schooling. The monthly income of the family was asked and costs relating to housing were described in the interviews. The questionnaire further asked users to identify urban area references. Satisfaction was rated in relation to the residential area and the larger neighbourhood, its parks and local institutions (schools, transport systems, police station, hospitals or clinics and the housing administration).

Families living in apartments were asked to identify problems with common areas (parking, entrances, walkways, staircases, garbage disposal, gas cylinders, green areas and fences). All families were asked to identify positive and negative points regarding common areas, services and urban equipment. Missing items in public areas were listed. People were asked if a community spirit existed, what kinds of activities were organized in the neighbourhood community centre and their participation in these activities. All families described their former home, its residential and neighbourhood qualities. Families indicated the period of time they have lived in the present home and described the changes they introduced. The ‘dream’ house was described in relation to type, size, place and special details. Habits were described in relation to common domestic activities and their place of occurrence.
The applied questionnaire related the concept of sustainability to habits of energy efficiency, water conservation, solid waste recycling and the use of the family car. Users also evaluated the need for vegetation and its conservation. These issues were selected after a preliminary inquiry with the sample population showed that the concept of sustainability is not well understood regarding wider aspects of conservation, pollution and other related issues.

Quality of life was related to feelings of security, physical safety, protection from the elements (wind, rain, lightening) and environmental comfort (thermal, acoustic, visual, and functional space). Further problems with smells and smoke were included, as were vermin and insect infestations. Security and safety feelings were related not only to crime rates and the quality of policing, but also to street lighting and visibility of movements in public areas. People were asked to rate aesthetic values of their home and neighbourhood and to describe details that contribute to urban beautification. In relation to the housing authority, users were asked to identify problems with the local administration, by-laws and regulations. Finally, site-planning questions were made in relation to housing density, distances between buildings, street layout and topography adjustments.

Field observations and questionnaire results

The design criteria, which prevail in the company’s model (CDHU), are based on repetition of basic design models with few design adaptations for specific geographic and social situations. Observations of the housing projects are best exemplified by the site plan presented in Fig. 1 and views that illustrate projects with single-family houses on individual lots (Fig. 2) and housing estates with apartment buildings (Fig. 3).
The design concept of the CDHU projects has changed little in the last 10 years. The only improvement that can be observed is that the latest project in Campinas has a higher degree of urban infrastructure. The ownership condition of single-family dwellings induces a process of rapid transformation of the residential unit. Functional area is increased, garages are built and lots are walled, so that the resultant constructions have little resemblance to the original CDHU houses. Although such modifications break the typical monotonous repetition of standard units, they may be considered a waste of public investment. The transformation of houses in public projects has been extensively studied and in most cases the causes are related to insufficient functional space and designs based on flawed architectural programs (Kowaltowski & Pina, 1995; Reis, 1995; Tipple, 2000).

Usually, housing developments in the interior of the State of São Paulo have a fairly low density. Considering that the size of families is predominantly composed of 3–4 members, the densities of each housing area was calculated in this study on the basis of 4 persons per residential unit. Thus, densities of the 5 developments range from 100 persons per hectare (p/ha) in Atibaia to 468 p/ha in the Campinas project, with 5-storey walk-up H-shaped blocks.

Except for the latest projects, no landscaping is included in the site plan and no play areas are provided. Urban trees, when present, are located in the centre of minimal sidewalks, thus hampering pedestrian circulation. Residents quickly introduce fences around houses and buildings but avoid other improvements, especially on public land, which may be classified as leftover areas, or no-man’s land. Maintenance of common areas is not adequately supported through design. For instance, garden taps are lacking and residents must
attach hoses to their kitchen taps, sometimes from upper floors, to wash around buildings, clean stairways and water gardens.

Site-planning problems are related to street layouts, which are arbitrary and not related to sun orientation and predominant wind directions. On steep sites buildings lack integration. The horizontal plateaus are minimally dimensioned for the footprint of each building, without an adequate reservation of an apron of open space. This siting condition causes steep, dangerous slopes between constructions and users introduce fences for their protection, resulting in inaccessible, isolated land strips and architectural barriers. The CDHU policy to overcome accessibility problems is to allocate ground level apartments to people with disabilities and the elderly.

Fencing, car parking and garbage disposal areas have only recently been included into the site-planning concepts of the projects. In some cases the site plan included enlarged paved areas of streets for car parking. For security reasons the population prefers to fence open space around buildings, creating parking lots where play areas and community facilities were intended by design. In the Campinas project, car and pedestrian accesses are not separated and no communication exists between individual residential units and gates at street level. This situation implies that access by visitors to homes depends on the chance opening of locked entrances by residents.

Although the projects reserve some areas for institutional and commercial uses, priority is given to the distribution of residential building blocks. Non-residential areas are small and fragmented. Shops, workplaces, schools, parks and civic facilities are therefore not within easy walking distance of one another, as recommended by guidelines. A centre focus of civic and cultural uses is also absent from site plans. Commercial activities, some as clandestine establishments, quickly sprout on the fringes of the projects, but not on designated land. This is due, in part, to legal problems and costs of approved constructions.

Children living in apartment blocks quickly learn to improvise where play areas are absent. They use unprotected drains and gas cylinder deposits for their play activities and avoid the large un-shaded open spaces between building blocks.

Privacy is seen as another problem. Apartments on the ground floor are exposed to movement around the buildings, children playing, vandalism and theft through open windows. A level change between access and private areas could avoid this situation. Living room windows of all apartments face each other at a 6–8 m distance and common stairways open directly from entrance doors in H-shaped blocks. The shape of buildings and the distance between windows create acoustic problems. For privacy most users do not open living-room windows, relying on the kitchen and bedrooms for ventilation. Apartments are not provided with terraces and open public stairs are in some cases used as porches.

The populations’ views were analysed and global questionnaire results are presented in Kowaltowski et al. (2005). Tables 1 and 2 present some stratified results. The characteristics of the population show that the people interviewed are represented mainly by young to middle aged women. The monthly family income, as estimated by the population, ranged from SUS 83.00 (1 minimum salary—SM, at the time) to US$340.00 (4 SM). According to Brusky & Fortuna (2002) families earning up to two SM must be considered very low income and those earning between 3 and 4 SM fall into a medium low-income range. In our study, 43% of families fall into the first category and 40% into the second. Although the income levels are low, for eligibility the population of public housing developments needs to demonstrate a stable employment at the time of registration at CDHU, which, however, does not guaranty job security over a long period. Our study identified a significant number of unemployed residents in all projects analysed.

In relation to education, 60% of respondents have full primary education and one-third completed high school. Most people came from the region of the present home and previously lived in single-family, 1-storey houses. The previous home was generally well evaluated but not owned by the family.

The data further shows that most people recognise their community through landmarks in the neighbourhood (item 1 of Table 1) and are satisfied with their housing conditions (item 2 and 8 of Table 1, as well as item 3 of Table 2). Perceived beauty of the community and common areas are rated positive (item 3 and 5 of Table 1). These ratings may be due to the fact that families no longer pay rent and are on the way to achieving home ownership. Some differences exist between areas. Itatiba is the only housing area where a negative evaluation was expressed (item 3 of Table 2). This development is located at the rural edge of a small town. No community amenities were included in the project, only a school exists close to the buildings. The
steep slope separates the buildings. Communication among residents and play by children in open areas is difficult under such conditions. The fences introduced by owners further fragment the residential area. These separations exist even in the middle of building blocks, marking and isolating territories according to access stairs. The reasons for such territorial behaviour are related to maintenance responsibilities and utility bills, which are divided amongst groups of apartment owners.

Results demonstrate that the population has little or no experience with participatory decision-making. The existence of a community spirit was affirmed by only half of the population (item 4 of Table 1 and item 2 of Table 2). Housing administration rules are ignored by almost 50% of the people questioned. The participation in community activities is low as shown in item 6 of Table 1. This situation is reflected through observations as well. The population, in terms of needed services and infrastructure, seldom improves public areas.

Looking at some of the stratified results, no marked differences can be seen in relation to the community spirit between house and apartment owners, but single-family house owners have a marked negative opinion regarding common green areas (item 7 of Table 1). Observations showed that, at least close to apartment

<table>
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<tr>
<th>No.</th>
<th>Aspect</th>
<th>Type of housing</th>
<th>Type of response</th>
<th>Positive opinion (%)</th>
<th>Negative opinion (%)</th>
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<td>House</td>
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<td>3</td>
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<td>Itatiba: apartment buildings on steep slope (%)</td>
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<td>Atibaia: small area with single-family houses at town edge (%)</td>
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<td>Campinas: 5 story apartment buildings with recent occupation (%)</td>
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<td>St. Barbara: flat area with single-family houses (%)</td>
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<td>St. Barbara: 4 story apartment buildings on flat area (%)</td>
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<td>Valinhos: area with single family house (%)</td>
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<td>Valinhos: small area of 4 story apartment buildings on steep slope (%)</td>
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<td>Existence of community spirit</td>
<td>Pos. 44 Neg. 56 Pos. 17 Neg. 83 Pos. 59 Neg. 41 Pos. 30 Neg. 70 Pos. 48 Neg. 52 Pos. 70 Neg. 30</td>
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<td>Quality of life</td>
<td>Pos. 44 Neg. 56 Pos. 83 Neg. 17 Pos. 92 Neg. 8 Pos. 70 Neg. 30 Pos. 85 Neg. 15 Pos. 100 Neg. 0</td>
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<td>Feelings of security and safety in the neighbourhood</td>
<td>Pos. 22 Neg. 78 Pos. 50 Neg. 50 Pos. 17 Neg. 83 Pos. 60 Neg. 40 Pos. 27 Neg. 73 Pos. 20 Neg. 80</td>
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buildings, in the older developments some landscaping has occurred. This has not happened on common areas between single-family houses. The “feeling of belonging” can be considered weaker among house owners, who value their own lot or territory.

The questionnaire included an item about the “dream” or desired home (item 24 of Table 1). Most people, independent of whether they live in a house or apartment, described this as a single-family home on an individual lot, in the city of their present residence. Apartments are rarely desired as a residential option, although the experience of apartment living does slightly increase the acceptance or desire of living in multi-family developments.

People related quality of life to monthly earnings and the job market in the region and, in some cases, factors like good health, family and God were also mentioned. Physical elements of the home, such as size of rooms or thermal comfort were not especially noted. Only one respondent mentioned comfort as a quality of life element. All residential units have good cross ventilation conditions. However, the population does not identify this condition as an important thermal comfort element. The results are equally divided between bad and good thermal comfort ratings.

The declared quality of life is slightly higher among single-family house owners (item 19 of Table 1). In relation to area differences, the Itatiba development was the only project where the quality of life was considered negative (item 4 of Table 2). The population there complained of a lack of job opportunities in the region, drug use amongst the young and general violence problems.

Security and safety are issues strongly related to quality of life indicators in a society with high crime rates. These feelings, in general, are positive in relation to the home, but negative regarding the neighbourhood (items 15 and 16 of Table 1, and item 5 of Table 2). On the whole, the single-family residential areas are considered safer.

Water and electricity bills are related to sustainability issues (items 9–14 of Table 1). A global concern for the environment is weak and economic issues are prevalent. Many families, especially those living in houses, convert recyclable solid waste into extra income. Limiting hot baths reduces utility bills, since electric showers are used in all residential units and these are not energy efficient. Residents also accumulate laundry to wash only once a week, saving on water. Pollution is not considered a problem and most people in the sample are not car owners. Car ownership is however, a strong desire.

The population does complain about unpleasant odours from nearby factories, or agricultural practices and dust in the air. Insects and other vermin are mentioned as a general problem in the areas.

The population perceives few site-planning problems, but stress the importance of marking territories through fences and locked gates. Better schools and health services are considered essential. Vegetation is seen as a positive item, but few people plant trees in front of their houses or on public land. Spontaneous intervention on public land is extremely rare. Thus, no paved sidewalks or landscaped parks exist in most neighbourhoods. On the other hand, most people think that the home or building where they live should have some aesthetic value and the neighbourhood should be beautiful (items 17 and 18 of Table 1).

When asked to comment on street layout and construction densities, many people believe that a larger number of homes could have been planned for, so that more families could benefit from government housing projects. This attitude contrasts to the general lack of a community spirit observed in our POE study. Most people, independent of the type of housing they presently own, considered general densities adequate (item 21 of Table 1). Site-planning evaluation is high (item 20 of Table 1; item 1 of Table 2). However, the relation between green and built-up areas is considered poor (item 23 of Table 1). Distances between buildings (item 22 of Table 1) are not seen as a particular problem, even though windows between apartments face each other at a distance that affects privacy. The evaluation of distances between houses is lower than between apartments. This may be due to the fact that privacy expectancies among people living in apartments are lower.

Discussion and recommendations

The results of the survey presented here show that the studied housing developments lack many of the recommended design elements for quality and sustainable communities. Satisfaction rates in general terms are high but are not directly related to physical elements of the home and its neighbourhood. They are very much dependent on the home ownership condition. As well, the population is not aware of specific sustainability
### Table 3
Site-planning and housing design guidelines and recommendations for local conditions

<table>
<thead>
<tr>
<th>Topic</th>
<th>Guidelines and recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrated community and security</td>
<td>Include housing, shops, workplaces, schools, parks and civic facilities within easy walking distance of one another in the project</td>
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<tr>
<td></td>
<td>Provide diversity of housing</td>
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<td></td>
<td>Build a community centre for the whole development to optimise resources</td>
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<td></td>
<td>Provide small open recreational structures for outdoor activities (barbecues, family parties) between buildings attached to shaded green areas with picnic tables</td>
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<td>Include the construction of shops into the project to avoid clandestine buildings on the fringes of projects</td>
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<td></td>
<td>Conserve resources and minimize waste. Provide for the efficient use of water through natural drainage, drought tolerant landscaping and recycling. Street orientation, placement of buildings and the use of shading should contribute to energy efficiency</td>
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<td></td>
<td>Develop a local character and community identity through the use of specific regional materials and methods of construction</td>
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<td>Consider people’s feelings of insecurity, providing for territorial markings through adequately designed fencing and access control through gates</td>
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<td></td>
<td>Detailing of territorial limits should avoid negative images of confinement, isolation from city life and facilitate access of visitors</td>
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<tr>
<td>Site-planning:</td>
<td>Ensure distances between buildings to ensure natural ventilation and privacy of individual residential units</td>
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<td></td>
<td>Ensure that building entries are prominent and visible</td>
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<td></td>
<td>Provide pedestrian accessibility with special gates and pedestrian walkways. Introduce communication systems between gates and residential units</td>
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<td></td>
<td>Locate common facilities centrally and link them to common outdoor space. Common facilities must be defined with the population. Include common space for families to organize a barbecue or typical local festivities (reserve areas with a large, flat, open space and simple kitchen and bathroom facilities for support)</td>
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<td></td>
<td>Locate buildings and landscaping to control sun exposure during hot season. Maximize natural ventilation</td>
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<td></td>
<td>Provide views for each unit when ever possible</td>
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<td></td>
<td>Provide for clotheslines in the sun, away from pedestrian movement or children playing and allow for supervision from individual residential units</td>
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<tr>
<td>Street and path system and parking</td>
<td>Reduce paved areas through a rational street and parking lot system</td>
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<td></td>
<td>Anticipate the changing mobility of the population at their older years with appropriate design of sidewalks</td>
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<td></td>
<td>Special attention must be given to sun/wind orientation of streets and sidewalks</td>
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<td></td>
<td>Place good shade trees along walkways without inhibiting circulation of pedestrians, wheelchairs, baby carriages, etc.</td>
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<td></td>
<td>Walkways must be paved (finished) at the construction stage</td>
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<td></td>
<td>Pedestrian path systems must be integrated with controlled entrances and communication with units made possible from gates</td>
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<td>Place parking lots at rear or side of the site to allow a majority of dwelling units to front on the street</td>
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<td></td>
<td>Build multiple small parking lots in lieu of one large lot. Plant trees and shrubs to soften the overall impact of parking areas and to provide shade and noise reduction</td>
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<td></td>
<td>Place parking lot in proximity to dwelling units to allow for casual surveillance. The provision for a parking spot (as a desired item) should be made for every residential unit</td>
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<td></td>
<td>Separate bicycle and pedestrian paths from vehicular traffic</td>
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<td></td>
<td>Provide paved areas for bicycle riding and skate boarding away from play areas of smaller children</td>
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<tr>
<td>Public and Private Open Space</td>
<td>Provide public open space, which can be used for play, recreation, social or cultural activities</td>
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<td></td>
<td>Locate public open spaces so that they can be viewed from individual units, preferably from the kitchen, living room or dining room</td>
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<td>Locate play area(s) centrally and to allow for adult supervision from dwelling units and/or from a central facility.</td>
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<td></td>
<td>Avoid leftover spaces that are too small to accommodate a flat football field or play yard with simple equipment (slides, swings, etc.). Introduce equipment and landscaping in the design of the project. Shade is of extreme importance in hot climates</td>
</tr>
</tbody>
</table>
issues, but some habits can be harnessed to make local communities more sustainable. Thus, income generation with recycling habits and energy and water saving attitudes to reduce utility bills are positive. The lack of a community spirit and the actual user interventions, such as the proliferation of fences, are seen as problems to be overcome by specific post-occupancy programs, which companies like CDHU should test.

Also, opinions and observations point towards fairly simple changes that could be introduced into the design models of low-income housing projects in the region. Table 3 presents some recommendations for local applications that should be added to general housing quality guidelines found in the literature. Fig. 4 presents an application of some of these recommendations. The Campinas project is shown in Fig. 4a as built. In Fig. 4b, simple changes were introduced. H-shaped apartment blocks are oriented to reduce east and west façades. Paved areas are reduced and streets no longer fragment the open areas between buildings. Institutions are concentrated in the centre of the projects and commercial areas are introduced on the edges. Finally, a community centre area is reserved to replace the small and inadequate recreational structures shown in Fig. 3. Not all recommendations of Table 3 have been applied to this example, thus housing typologies have not been varied and possible landscaping is not shown. The modified site plan can, however, exemplify that the improvement of housing developments quality do not necessarily incur in extra costs.

Brazil has developed many innovative processes of improving people’s living conditions, including infrastructure interventions in favelas, the squatter settlements of large urban areas. Some experiments have been made in housing design through a process of participative construction and the adoption of new design typologies. Such examples are few in relation to the large housing deficit of the country and the duration of such programs is usually restricted to a specific administrative mandate. The majority of the building stock, in social housing, is still based on the models discussed in this research. The site-planning details recommended

<table>
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<tr>
<td>Make maintenance easy</td>
<td>Introduce (garden) taps distributed around common areas, with water consumption monitoring devices</td>
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<td></td>
<td>Provide each household with some form of easily accessible, useful private open space, such as a patio, porch, deck, balcony, yard. Discourage incorporation of these open areas into indoor space through design or location. Screen balconies for privacy and define boundaries, but avoid solid walls that prevent small children from looking out and are safety risks</td>
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<tr>
<td>Landscaping</td>
<td>Use hardy, native plant species easy to maintain. Chose adequate vegetation for shade and avoid root damage to constructions through sufficient planting area reservation. Provide good ground cover to avoid erosion and mud problems. Foresee plant growth and adult tree dimensions in original planting scheme. Provide nature strips in street layout</td>
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<td></td>
<td>Provide good shading in public open space for play and recreation</td>
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<td>Shade paved areas (paths, parking lots)</td>
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<td>Provide a variety of seating in landscaped areas</td>
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<td></td>
<td>Provide appropriate lighting in open areas</td>
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<td></td>
<td>Provide gentle grading of open areas</td>
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<td></td>
<td>Provide good visibility in open areas and around buildings for security</td>
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<tr>
<td>Architecture</td>
<td>Avoid stock plans. When necessary, use stock plans intelligently through sensitive design and enhancement through siting, landscaping and use of colour</td>
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<td>Relate first floor to the street, but raise level slightly to provide privacy</td>
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<td>Provide access for disabled people through the provision of elevators, ramps with proper inclinations, adequate width of sidewalks and paving without obstructions</td>
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<td>Optimise building orientation to reduce solar radiation gains on east and west façades. Allow for cross ventilation in all residential units. Extend floor slabs or eaves on north façades to shade openings</td>
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<td>Garbage disposal and the proper incentive to recycling must be part of design criteria</td>
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<td></td>
<td>Introduce user participation in the design process to reduce transformations. Space requirements must be in accordance with local domestic activities</td>
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</table>
Fig. 4. Campinas housing project as built and showing possible site-planning modification to improve quality. (a) Site plan of the Campinas project as built. (b) Site plan of the Campinas project modified according to recommendations of Table 3.
for local housing developments, as shown in Table 3, do not affect costs per residential unit, but allow for the introduction of small and incremental improvements.

The systematic introduction of the diverse and complex design factors, to create better quality and sustainable communities, is not a simple matter. Inertia must be overcome. POE studies should provide feedback for new designs and avoid repetition of errors. Some signs of such changes are apparent in the latest CDHU projects, where urban infrastructure is being revised. A large housing company has an important role as a potential instigator of change in local regulations. Such codes often limit innovation in design and are restrictive. Although created to ensure minimum standards, such bylaws are mostly predictive of monotonous urban models. The width of roads and dimensions of city blocks are prescribed and green and institutional land is reserved as percentages. Qualitative values are not specifically indicated and thus mostly absent in local residential subdivisions.

Most cost–benefit studies of housing programs do not include social and indirect costs of construction transformations and thus old and less than recommended models are perpetuated. A structured and transparent decision-making process is needed in local social housing programs to provide a link between design criteria and user desires.

Conclusions

Further studies on quality of life and sustainability issues are necessary. Questions should be asked. Why are private housing developments mainly in the form of high-rise apartment buildings in a society where the majority of people prefer single-family houses? Does the population accept less than desired living conditions, due to security fears? Regarding sustainability, a study on the impact of vegetation in open public and private space in residential districts should be conducted stimulated by the population’s affirmation on the positive impact of vegetation on the environment. The results presented here should also contribute to the discussion of the issues of quality of life and sustainability on a national level.2

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2Existing programs like HABITARE of FINEP (Financiadora de Estudos e Projetos), the national agency for support of scientific and technological research already provide a framework for such debates.


