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LESSONS FROM AN EMERGING ECONOMY: AN ANALYSIS OF SUNLIGHT USE IN CHILEAN PUBLIC HOUSING

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HIGHLIGHTS

- Sunlight as a tool for evaluating design quality and health in public housing.
- Using Chilean public housing growth over the last thirty years as a model for evaluating proper sunlight use and quality in public housing construction.
- A proposal for the evaluation and design guidelines in the use of sunlight in public housing projects.

ABSTRACT

Given the importance of sunlight on human health and how the built environment influences human interaction with sunlight, how can the design profession incorporate sunlight more robustly into public housing design projects? I try to answer this question by looking at the last thirty years of the Chilean public housing development. My methodological approach was divided into two parts. The first part focused in unraveling the historical precedents that led to the current public housing typology, so prevalent in Chilean public housing projects today. The second part consisted of fieldwork done along the length of the Chilean geography. Chile spans a North to South length of 4,270 km (2,653 mi) and has an average sunshine variation that more than doubles between the Northern most city of Arica compared to the Southern most city of Punta Arenas. Preliminary data from these two research approaches, reveal what steps can be taken in order to increase the relevance of sunlight in public housing design. On an urban scale, careful consideration of grid layout, location of green areas, sidewalks and transportation. On the housing scale, window location as it relates to issues of privacy, safety and accessibility, need careful consideration.

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1. ANALYSIS OF SUNLIGHT USE IN CHILEAN PUBLIC HOUSING

Currently, the worldwide trend, in certain emerging economies such as China, South Africa and Chile, is to systematize the massive production of homogenous social housing projects (OPIC, 2011; Fung, 2016; Government, 2016; Xinhua, 2016; Youqin, 2013). While this trend is successful in providing housing for a large number of people in a relatively short period of time, it usually does so at a great cost to design quality. From the design elements that are today well accepted as being needed for healthy living, such as clean air and water, sunlight in particular is systematically ignored in the public housing design process. The problem with this is, that all life forms, directly or indirectly, require sunlight to survive. In human beings, the two most common functions of sunlight are to regulate circadian rhythms (sleep: wake cycle) and produce the hormone vitamin D. While the circadian rhythm is regulated exclusively by the eye, and vitamin D through the skin absorption of sunlight or dietary supplements, both require periodic access to sunlight for adequate intake and functional regulation.

Sunlight has a complex relationship to our health and wellbeing (Holick, 2010; Ning et al., 2015). Unlike other environmental factors, such as clean air and water, which have more immediate effects on health, sunlight has a prolonged health deterioration process. This slow cumulative health decline causes sunlight to be easily ignored as a health risk factor, with grave and oftentimes-irreversible consequences. Both long-term lack of sunlight or excessive exposure to sunlight can have detrimental effects. The lack of sunlight decreases the production of vitamin D, which is vital for bone health, and connected to almost every organ in the human body (Reichrath, 2008). The lack of sunlight, and thus vitamin D, has been shown to cause rickets in children and osteoporosis in senior citizens (Bose et al., 2013; Holick, 2010; Judd, 2013). An excess of sunlight on the other hand is responsible for cancers, such as melanomas. Over the course of time an individual needs to have a balanced exposure to sunlight to minimize the effects of under or over exposure to sunlight. To the extent in which we are able to develop a balanced relationship with sunlight, the built environment plays a central role. In urban areas, which today house over 50% of the world population (WHO, 2014), the imbalance is heavily weighed towards underexposure (Klepeis, 2001; Smolensky, 2015; VELUX, 2016). This imbalance is further emphasized by people's lifestyles and behaviors.

With this in mind, I tackle the question: Given the importance of sunlight on human health and how the built environment influences human interaction with sunlight, how can the design profession incorporate sunlight more robustly into public housing design projects? I try to answer this question by looking at the last thirty years of the Chilean social housing development (MINVU, 2006). In 1990 Chile emerged from the nearly twenty year military dictatorship with a well-established neoliberal economic growth model. At this time, Chile took important steps towards increasing social spending, public services and creates a strong public housing development plan. In 1990 the estimated percentage of people living in poverty in Chile was 68%, which by 2013 it was down to 14%. Similarly, the number of indigents in 1990 was 13%, which by 2013 it was down to 2.5%. These figures reveal a tremendous and conscious effort by the Chilean government to improve the living conditions of the country's poor. These figures also indicate a staggering increase of a certain architectural typology that today dominate the Chilean landscape, a fact that can easily be perceived when driving anywhere in the country (Fig. 1). Between 1990 and 2009 Chile built 1,160,452 social houses for over 5,000,000 people, with a total population of ~18,000,000, these figures indicate that over a fourth of the country's total housing has been built in the last 30 years.

The Chilean public housing model has received considerable global recognition, and several countries in South America have begun to replicate the Chilean public housing financing model.



Figure 1: Images from public houses across Chile. At the top are the houses seen in Arica, followed by Limache, Temuco, Puerto Montt and finally Punta Arenas. *Source: Photos by Nicole Beattie-Vallespir*

Despite the governments' impressive achievements however, examples of failed, unsuccessful and subpar construction abound. From houses that were flooded in the first rain after being handed to

their new owners, to walls that “sweat” due to condensation through the use of incorrect materials within a certain climactic zone. In addition larger questions of safety, marginalization, easy access to amenities, transportation and population stigmatization also continue to emerge. Both the concerns of construction quality and the broader social problems are being actively studied. The use of sunlight however, does not materialize beyond easy to ignore government documents. It is surprising, that given the role sunlight has historically played within the fields of architecture and urban planning, along with the well known impact sunlight has on human health, that it remains nonetheless an almost non-existent consideration in the development of public housing projects in Chile today.

The relevance of sunlight, as a design element, has historically been strong (Hobday, 1999; Overy, 2007), however more recently its use to foster healthy built environments has been lacking. Sunlight today finds its protagonist role as a possible future source of sustainable energy. Sunlight as a form giver, as a source to enhance light quality, or an element that helps promote the outdoors occurs more rarely and within more exclusive design circles such as elite group of architects and designers (Kahn & Johnson, 1975; Lobell & Kahn, 2008; Plummer & Le, 2013). While sustainable energy is a fascinating and a necessary use of sunlight, it alone, certainly limits sunlight’s potential uses within the design profession. Sunlight affects each one of us individually, directly and on a daily basis. Reigniting the importance of sunlight as a health promoting design element by identifying the specific conditions that help foster healthy built environments is therefore particularly relevant today.

Some of the early conditions that help foster healthy built environments through the use of sunlight emerge not from particular design elements, but rather from the relationship between government policies, private contractors and the population directly affected by public housing projects. Understanding and separating, were possible, the role of the government, a particular culture or individual and the economic interests is recommended. The idea is a separation in terms of the decision-making process, so that conflicts of interests can be reduced. Collaboration and interconnectedness between these three players however remains key, as long as each group recognizes each other’s expertise. So, for example, participatory development in public housing has overwhelmingly proven to be more successful, resulting in safer, cleaner and with higher occupant satisfaction rates than projects developed without participants input. This reflects that the cultural identity of the participants, as “experts” in terms of their needs can contribute to a healthier and more successful development project. In this case, the cultural needs are incorporated into the design, not assumed or imposed from either the state or the economic players, but rather directly from the cultural group affected. Along these same lines, a balance in the relationship between large-scale government and individual control is encouraged.

Street grid orientation following maximum use of passive housing recommendations and local geographical conditions is highly desirable as are the location and conditions of parks and/or recreational area. Since safe access to outdoors and green areas are fundamental to accessing sunlight and its health benefits, understanding and managing the size, location and administration of common areas in public housing projects must be a priority. Today people are spending considerable more time indoors, this is particularly detrimental in the case of children.

In order to understand the “indoor” human migration that has occurred, it is important to understand the remarkable transformation to human living conditions brought on by industrialization, not only from the rapid rural to urban migration point of view, but also from the perspective of people’s lifestyles (Mumford, 1944, 1963). The pace of daily life in the city completely changed compared to that of rural life. Technology played a fundamental role in these changes, from electricity to the weaving machines, trains and alternative energy sources, which in turn had a direct effect on an individual’s daily routine (Giedion, 1948). No longer being dependent on sunlight and candles for visibility, sleeping patterns began to shift. Further, the family dynamic was greatly affected by factory work, transportation, schooling and the loss of traditional social networks. This in turn affected social

interactions at large and began to modify human behavior through the anonymity provided by urban living. All of these changes in turn, were a shock to human health, starting with the well-documented appalling living conditions of informal settlements and early tenement homes (Engels, 1926; Foucault, 1973, 1995). In addition the pollution levels not only from industrial waste, but also from human and animal refuse were staggering. So much so, that human life in the city was considerably shorter due directly to the unhealthy living conditions than its rural counterparts.



Figure 2: A view of a mega-apartment block showing one of the many ramps that make up the building complex. The idea was to create a secondary circulation system that connected all the large building blocks together. These ramps are large enough to allow for a car to drive through. Most of these ramps are closed today. *Source: Photo by Nicole Beattie-Vallespir*

From the dramatically poor living conditions found in the early industrial cities, a desperate need for solutions began to emerge. The Modernist movement, with its use of new technology and concern for human health and social reform came forward as the design professions answer (Banham, 1960) during the first half of the 20th century. Some of the characteristics found in early Modernist ideology included open spaces, removal of unnecessary ornamentation, excess use of sanitizing natural light, the use of the color white (to further highlight uncleanness), among many others (Lefaivre, Roode, Fuchs, & Amsterdam, 2002; Overy, 2007). Health concerns in particular were the birthplace of the

modernist movement, who through its design sought to rehabilitate. The sanatoriums, born from the need to “clean” human beings from the filth of the cities by giving “sun therapy” to cure “urban” ailments, such as tuberculosis, were in fact some of the earliest examples of modernist design (Paul Meurs, 2011). Some of these early modernist design principals have reemerged in light of sustainable design and solar use, such as careful consideration of indoor spatial distribution. A consideration that addresses where possible that different rooms in the house/building should be located in order to maximize access to sunlight’s potential, where all rooms can ideally get sunlight at some point during the day and in accordance to its use (Nicholas Roy, 2013). Careful consideration of number, size and location of windows in order to maximize indoor access to sunlight and connection to the outside is therefore highly encouraged in residential projects.

From the birthplace of Modernist ideals many globally influential currents emerged, of particular global appeal is the highly urban vision of CIAM (International Congress of Modern Architecture) lead by Le Corbusier and characterized by his “Plan Voisin” for Paris. High Modernism’s decidedly controlling scheme with its rational scientific backbone had an immediate global appeal (Easterly, 2006; Geertz, 1973; Hall, 1980). The most symbolic examples being Brasilia, Brazil and Chandigarh, India, the ramifications of this global appeal however, go far beyond these two famous examples (McGuirk, 2014). Worldwide, public housing projects today, owe much of their DNA to High Modernism (Lejeune & Centre international pour la ville, 2005). Public housing projects in Chile are no exception showing clear evidence of this lineage (Forray, 2011). The consequences of this lineage in turn, have proven to be problematic both ideologically and aesthetically (Hall, 1988).



Figure 3: Another exterior view of one of the mega-apartment buildings and the ramp that connects them. On the right a view of the corridor along the main floor of one of the building blocks, wide enough for cars to circulate which connects to the ramps and thus all mega-building blocks in the complex. *Source: Photos by Nicole Beattie-Vallespir*

One of the better-known examples of High-Modernism in Chile is a 1,940-home public housing development called “Villa Portales” (Fig. 2 & 3). Built between 1954-1966, this public housing project remains one of the most emblematic in the country. Many of the spatial characteristics that can be found in Chile’s current public housing projects today can already be recognized in “Villa Portales.” In addition, the social background of “Villa Portales” has had important changes over the last fifty years, social changes that have dramatically affected the way the architecture and spatial layout are used, perceived and cared for. This last point helps bring into focus a crucial aspect of social housing projects, namely its residents and their social context, which continue to be systematically neglected

during the initial public housing design process.

When built, Villa Portales represented a radical departure from the traditional city block layout (Fig. 4). In the spirit of the High Modernist movement, the 31-acre lot was conceived and built with 19 mega-block apartment buildings that provided a total of 1,638 residences as well as an extra 302 single family homes arranged in the form of townhouses. Centrally located, near the main railroad station, a subway line, a bus terminal, the Santiago library, a naval base, and a large city park, it is also not far from all the civic and political buildings. This central location and easy access to public transportation systems was one of the reasons the architects of Villa Portales were able to prioritize green public spaces in their master plan. The space was divided so that the buildings themselves only occupy 20% of the total area's footprint, thus prioritizing communal green open spaces, which account for the other 80% of the total area (a CIAM model).



Figure 4: Front view of one of the mega apartment complexes of Villa Portales. *Source: Photo by Nicole Beattie-Vallespir*

In 2006 a government initiative called “Quiero mi Barrio” (I love my neighborhood) set out to revitalize Villa Portales. A survey was conducted of its residents in order to determine priorities. At the top of the list was the recovery and fixing of Villa Portales public spaces. This reflects an important need to incorporate maintenance and upkeep into a public housing project that goes well beyond its physical completion. This refers to understanding the aging process of a project, the differences

between intended and actual use of the spaces, particular public spaces and the overall maintenance of common areas that have often become focal points for issues of safety and neglect. This maintenance can only be properly implemented through careful consideration of the cultural and geographical

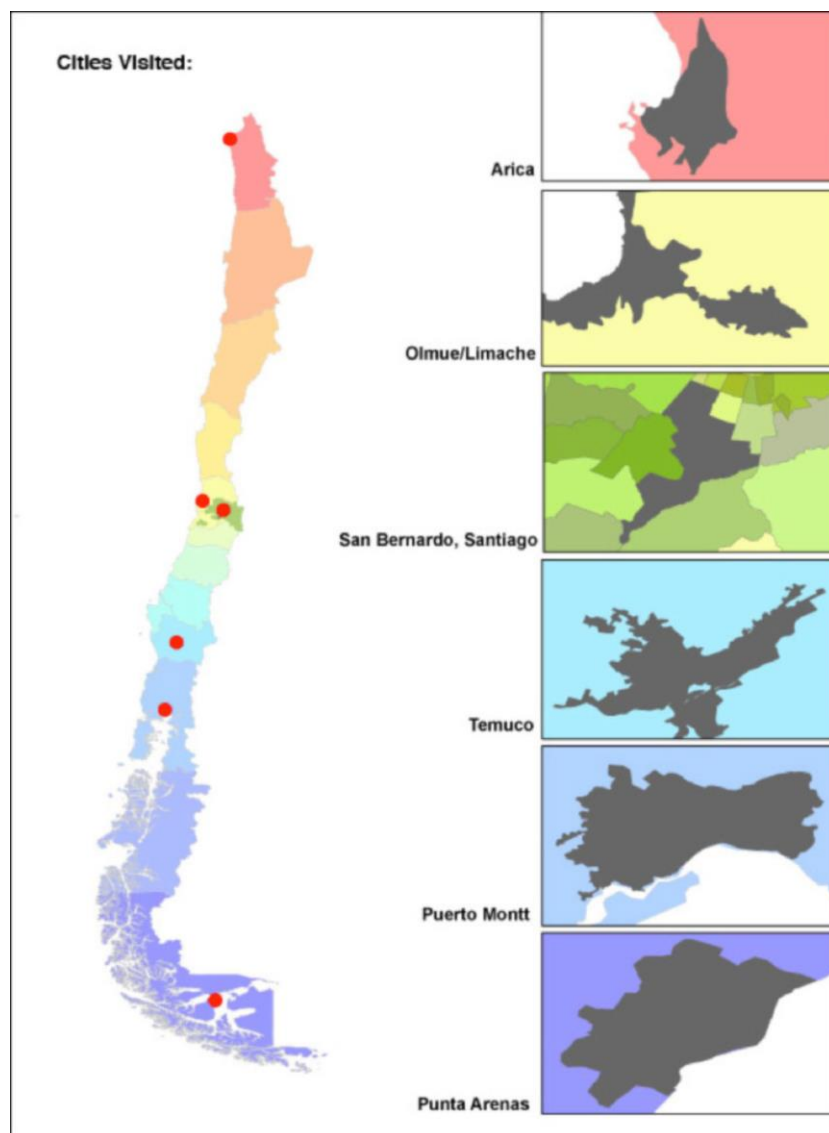


Figure 5: Red dots indicate location of cities visited across Chile.
Source: Map by Nicole Beattie-Vallespir

identity of a place. In other words, to the extent that it is possible, thought should be given to elements that differentiate, as opposed to homogenize public housing solutions. In addition, the neglect of sunlight as an aesthetic element in design is reflected in almost every aspect of the public housing projects visited for this study. This neglect has had grave consequences both to health and the development of a sustainable future. As Elizabeth Meyer writes regarding the “...the importance of aesthetics in sustainable design. So many people equate aesthetic and beauty with the frivolous. They ignore the intellectual and psychological aspects as well as ethical agency of aesthetic experience.” (Meyer, 1997). Sunlight and aesthetics are intimately linked and are two fundamental elements in the development of healthier built environments (Dissanayake, 1995; Plummer, 2009; Plummer & Le, 2013), consequently the strength of the design profession in the development process lies precisely in its ability to highlight and best bring these assets forward (Hosey, 2012; Tuomi et al., 1998). Studying sunlight use in public housing projects in Chile is relevant not only because of its vast public housing initiative over the last thirty years but also because Chile has a truly dramatic and exceptional geography that helps highlight site specific sunlight conditions. The Chilean geography spans a North to South length of 4,270 km (2,653 mi) and has an average sunshine variation that more than doubles between the Northern most city of Arica compared to the Southern most city of Punta Arenas. This is a distance comparable to going from Boston, USA, to Quito in Ecuador (passing through the Arizona deserts and Costa Rican rainforest). This geographical contrast should require highly differentiated housing types that respond to their particular geographical location, to the extent that this is so or not should help highlight the role the design profession has played in the development of these social housing projects.

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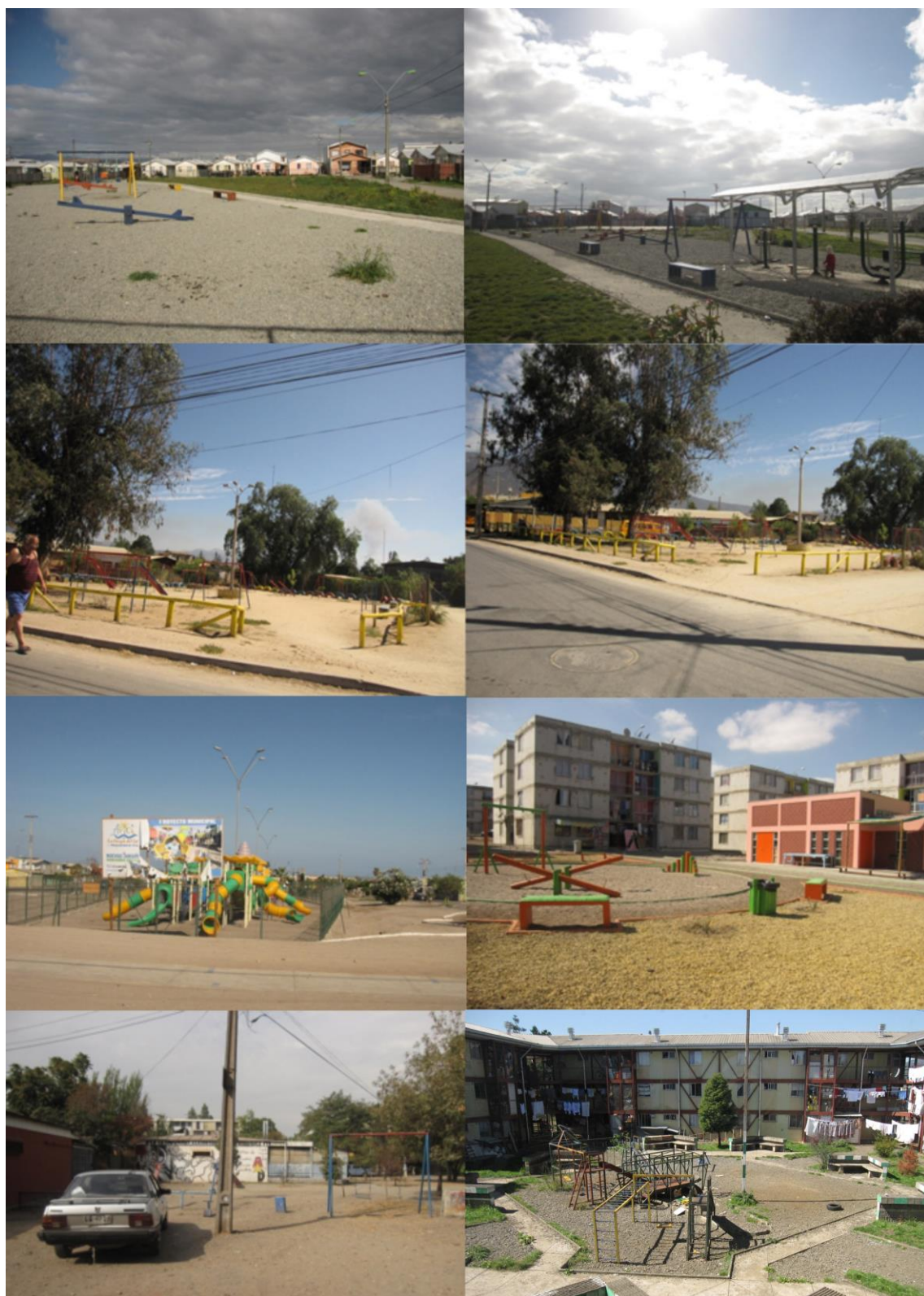


Figure 6: Composite image of playgrounds throughout Chilean public housing. *Source: Photos by Nicole Beattie-Vallespir*



Figure 7: Children playing at the periphery of the public housing complex. *Source: Photo by Nicole Beattie-Vallespir*

CONCLUSION

In conclusion, my research in Chilean public housing projects highlights key architectural and urban planning strategies that can be implemented in order to limit the detrimental health consequences that a lack/excess of sunlight incurs. On the urban scale, I found three main conditions that hindered access to sunlight: First, the street grid, repeatedly fails to consider optimal sunlight orientation usually developing on the North/South axis. In some cases the geography determines what kind of orientation the new street grid must have, but in most places, the public housing development project were located in such peripheral areas that the developers were free to lay the street grid however they wanted. Secondly, the design, location and layout of the new parks, green areas and recreational points are unsafe (cars), marginal or in some cases too close to homes so that children's play becomes a nuisance to the surrounding neighbors, as was the case in the housing project I visited in Temuco (Fig. 6 &7). In some cases the parks and playgrounds are simply located away from any amenity, so that there is no possible mixed use encouraged, thus making these recreational areas in effect isolated destinations (i.e.: children's playing only). Finally the public housing developments were usually located in the periphery, far from the city center, which carry with it the social and economic burden of difficult access to amenities, and limited public transportation that can limit and/or discourage walking. On the housing scale, the main inhibitors of proper access to sunlight were issues of privacy (curtains

drawn) safety (bars on windows, fences around the house) and lack of flexibility regarding window locations (often having only two facades to work with for window openings). These three conditions also tend to minimize views and limit the interaction between indoor and outdoor spaces.

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