NEW PARADIGMS FOR COMMUNITY DEVELOPMENT: AT THE INTERSECTION OF VERNACULAR ARCHITECTURE, SUSTAINABLE DESIGN, AND MULTI-UNIT HOUSING

by

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Abstract

In order to develop effective building typologies for vernacular, sustainable, multi-unit housing projects, one must first understand the implications of architectural decisions on community development, the environment, and the quality of life of the users. This study presents the stances of current experts and visionaries within the field through the scope of four primary lenses. Through the analysis of three case studies--the Collective Living project by GAD architecture, the Ruca Dwellings project by Undurraga Devés Arquitectos, and the SOS Children's Village Project by Urko Sanchez Architects--these scopes are further dissected within the methodology into ten primary characteristics. Comparison within the scope of each characteristic allows the study to determine conflicts and commonalities between how the case studies react to similar problems while facing a unique set of constraints. This provides groundwork for how the vernacular design process must be manipulated to meet the community development and sustainability goals of a project.

Contents

Introduction

This study will consider the implications of vernacular design methods on affordable residential housing communities located in China, Djibouti and Chile. Vernacular design is defined as the practice of utilizing local culture, materials and knowledge in order to achieve a sustainable typology in both design and construction. This analysis will focus on the application of this design construct through the investigation and comparison of prominent characteristics of each project. This will demonstrate how vernacular design can integrate local culture, establish the structure as an integrated part of its environment, and achieve sustainability. Above all, this study will provide an analysis of the potential benefits of vernacular design to foster community growth.

This research exploration seeks to ascertain whether the implementation of vernacular design is effective in increasing overall quality of life, sustainability, and community development within affordable low-income housing projects. Rather than experiencing any lead time for the importation of sustainable technology, the community instead builds on its traditional practices in order to develop sustainable alternatives, using methods that are already conducive to the climate and culture while promoting use of local materials, reducing transportation emissions, contributing to the local economy, and connecting residents to their culture through the continuation of traditional built space. The three case studies analyzed in this study feature projects built for relocalized peoples in one form or another. Each of the projects host a user group that has been locally displaced, but remain within the geographic realm of their ancestral culture. The use of vernacular design methods can begin to reconnect these populations to their sense of home and community by fostering connection to the natural and built environment, as well as their new community structure.

Background

By analyzing design strategies that have already been utilized in countries around the world, those of us who study vernacular and sustainable design aim to determine the most viable options for the implementation of vernacular design. Studies such as this allow us to begin to understand the threads that connect different societies through the implementation of design strategies which work to achieve a common result: increased quality of life for residents of the final project. However, it is first necessary to provide context as to why the development of the vernacular design process is imperative in the present. In this section, I will discuss this method as a reaction to global climate change, the technological and economic considerations involved, and the social push for localized design.

As climate change worsens, the most impoverished parts of the world continue to be most heavily affected. Wealthier populations not only tend to have much more stable and effective built environments; as sea levels rise and natural disasters become more common, they can avoid the worst parts of environmental degradation as they have the resources to relocate if necessary. People around most of the world are already beginning to experience the effects of global climate change, resulting from the exponential increase in fossil fuel emissions stemming from the Industrial Revolution. As these effects continue to come to fruition, implications will include mass displacement of populations due to rising sea levels, increases in severe weather patterns, and widespread food scarcity. As the built environment contributes to forty percent of these emissions worldwide, achieving sustainable design and construction practices has never been more important. The more fundamental question is whether the displacement of communities from their ancestral homes is the best-case scenario. The notion of effective sustainable solutions has become synonymous with the

implementation of sustainable technology; however, by taking a step backward and stripping down the building systems, designers may find themselves with simple designs for communities that are built on the history of local practices. These solutions not only become inherently sustainable through the removal of imported material and skill sets, but provide a connection between the community, its built environment, and natural surroundings.

This study analyzes the social characteristics of community design, which has experienced a societal shift from small-scale to large-scale social structures, creating inevitable divides between socioeconomic statuses. Wealth, in modern society, is a reflection of the disparity between prosperity and poverty. The lifestyles across the spectrum of socioeconomic status in our world today not only impact individual opportunities but can actually endanger health and well-being. As our planet continues to feel the effects of environmental damage, poverty begins to take on a whole new meaning. These communities are often the first to be affected by broad global issues as they may find themselves without the necessary resources to effectively react. In the field of design, the old adage the enemy to creativity is a blank canvas holds true, and these situations require an in-depth evaluation of cultural norms, the experiences of user groups, the contexts of construction initiatives, etc. in order to determine the ideal designed environment which will best contribute to community connection and growth.

Low-income, or affordable, housing design presents a great opportunity to explore the potential of vernacular design initiatives. Sustainable design in these regions not only prepares these areas for the impending climate crisis but provides much-needed relief to those already experiencing these effects. One of the most effective ways to achieve increases in quality of life in these communities is through connection to the natural environment.

These design initiatives can provide a reduction in cost of living as well as increased housing quality through an understanding of design and construction practices. Through the incorporation of sustainable practices, designers can create more independent living communities through the integration of on-site farming, energy efficiency, and the implementation of small-scale sustainable technology which is readily available in the area. This allows the community to become less reliant on society as a whole, shifting our definition of sustainability to one less focused on environmentalism (while continuing the integration with environmental design as a direct result) but in sustaining a community.

We, as a society, should begin to envision the way life could be with the implementation of these practices on a more romantic level. Romanticism in architecture is expressed through the imitation of classic architectural styles, but has the capacity to connect a region to its historical roots. The use of vernacular styles apply this principle in a way that is economically viable, beautiful, and sustainable, connecting the project to the culture of the region on a local level. These concepts do not just make good economic sense for the prosperity of the future, but should generally shift the cultural values of our society as a whole. Beauty is at the root of human desires. As designers discover ways to bring more beauty into the more immediate parts of the built environment, or those spaces in which an individual lives and works, those processes should be sought after and desired if nothing else than for the enhancement of the human experience. It is time to follow the example of Bhutan and put the happiness of individual people and environmental health at the forefront of our affairs (Zurick, 2006).

One often sees photos of sustainable technologies depicted in science fiction and media as utopias, featuring running waterfalls and hidden forests within and on top of

metropolitan society. This seems to be the way in which many people envision a perfect future, a future that involves a more complete union with the natural structures of Earth. The populations that live within these societies tend to be enlightened individuals who have discovered the secrets to a more prosperous life, so why, when faced with the opportunities to work toward this kind of future, does society turn away?

Justification

This study will particularly focus on the implementation of vernacular design within affordable housing complexes across three different countries and its effects on the sustainability of the community itself. Analysis and study will be focused on the improvement of quality of life and exploration of how building can be both inexpensive and environmentally sustainable by utilizing vernacular design techniques and the promotion of community life. The central argument details that there is no universal approach to global sustainability- particularly in low-income communities steeped in culture and history, but at the same time details how designers can begin to understand common threads across cultures that can be analyzed in order to reach a versatile and adaptive design method that can be incorporated as a basis for sustainable design. Community-based design creates a foundation for continual growth in the sustainability of the region while providing immediate access to increased quality of life. Sustainable design modified to meet the needs of individual regions allows for the manipulation and development of existing technology as a base within the specified region. It should be emphasized that communities around the world have completely unique environments, culture, and needs, and their sustainable solutions should be equally unique.

The case study methodology was selected as the research approach due to the argument that sustainable design should be inherently different in each scenario. Analysis of three separate case studies allows for consideration of how the same or similar needs are met in different ways by practicing a range of design methods. The three case studies selected represent entirely different regions, cultures, climates etc, but host user groups that have experienced similar scenarios as residents of displaced community living projects. These comparisons are addressed in the form of characteristic analysis of the projects. The breakdown of specifics allows the study to explore direct commonalities and contrasts. In doing so, this approach faces certain limitations including the sole inclusion of community living and low-income projects as well as the definition of these groups based on what the projects have in common, though there is of course considerable variability in other projects throughout the world.

The following sections of this thesis will adhere to four primary sections. The literature review, which is an exploration of current and former trends within the scope of this research through review of literature on the topic and its connection to this study. Following this, the methodology section will detail the three case study projects, in reference to the ten characteristics analyzed, and the findings section will contain the final discoveries from the analysis. A summary of all findings will be contained within the conclusion section.

Literature Review

The literature review will summarize stances of experts and visionaries within the field regarding four primary considerations at the intersection of vernacular architecture, multi-family housing, and sustainable building design: social, architectural, environmental, and implications on quality of life. These four lenses will be further broken down within the methodology section into ten primary characteristics that should be considered in sustainable, vernacular, and affordable multi-unit housing projects. Delving in to these attributes allows the study to strip down the concept of sustainable design into its most basic tenets, analyzing its direct effects on the environment, society, and individual quality of life in order to create effective and healthy built environments. William McDonough, renowned american architect and leader in sustainable development and design described this cohesion in *Cradle to Cradle* stating,

> We see a world of abundance, not limits. In the midst of a great deal of talk about reducing the human ecological footprint, we offer a different vision. What if humans designed products and systems that celebrate an abundance of human creativity, culture, and productivity? That are so intelligent and safe, our species leaves an ecological footprint to delight in, not lament? (McDonough & Braungart, 2002).

This emphasizes the idea that connection to culture, the human psyche, and the natural environment are integral to responsible and effective design intention.

Social Considerations

The article titled “From Affordable Eco-buildings to Sustainable Cities: Current Experiences and Future Perspectives” gives a good outline of how eco-houses have the

ability to contribute to society at large. It first defines sustainable architecture as the act of "avoiding denatured environments, creating knowledge and spreading information about nature and aesthetic reasons" (Muntean et al., 2016) or the ability to integrate design with nature by both valuing and utilizing local knowledge, landscape and resources while simultaneously making nature a visible focal point for aesthetic purposes. These buildings meet the goals of being both environmentally sustainable and highly efficient, but must still provide a comfortable living space in order to satisfy the innate human need for connectivity to both their culture and their peer environment.

Muntean, Larisa and Cioruta then use the example of common living situations in Romania to establish the contradictory approach, as these homes essentially embody the antithetical concepts that are valued in ecological housing design. Traditional houses are often expensive, small, poor quality and have a high environmental impact, with limited opportunity for expansion or changes in layout. Despite this, housing there is still immensely unaffordable with many people acquiring up to "twenty-five years of debt" (Muntean) in order to purchase a home. While it would be optimal to simply modify the existing homes to create better living situations, the construct of the homes makes it virtually impossible. However, there are ways to reduce the cost of building a new home in these areas; it simply requires the alteration of the mentality in that region of how residential construction is completed in order to create a good home for users. The most affordable eco-houses in this scenario need to be small, simple, flexible, and utilize the skillsets of the community in construction and need for shared spaces. If a community can create a simple plan that can be implemented without the use of professional assistance, it will dramatically decrease the overall cost of general home construction.

If designers are going to make any effort to implement ecological housing, it must first be determined what the world requires from it. The ultimate goal of pursuing these designs is to offer affordable, quality housing that will provide increases in overall quality of life. One aspect of this article that I found particularly helpful was the idea that these designs should be simple enough to be built by those with basic construction skills in the community. The operation of such buildings needs to be user friendly and meet the needs of the individuals in particular communities in order to serve them most effectively. Another important aspect brought up in the article was the concept of customization. If designs for sustainable housing can offer the freedom for personalization, they will inherently be more suitable for widespread use. People across various climate zones, or simply people who present differing needs from their living environment, will be able to adapt their own home in order to meet their specific needs by allowing for flexible modular design techniques that are easily manipulated without dramatic customization costs. This also offers the opportunity for growth, as a user could expand upon their construction with ease and evolve their home with their lifestyle, rather than buying a new home when the family outgrows their current residence.

The article “A Knowledge Management Framework for Sustainable Rural Development: The case of Gilgit- Baltistan, Pakistan” discusses how to bring knowledge into rural communities. The central idea is that sustainability focuses on three kinds of development (social, economic and environmental) rather than simply environmental. In order to implement sustainable practices into a rural environment, there must be a foundational knowledge of natural systems, resources and the benefits of a relationship

between social and ecological systems. The authors Ali and Avdic used the region of Gilgit-Baltistan in Pakistan as a case study. It is a typically rural area with a low population density and with many of its residents finding employment on farms. In this case, most of its knowledge comes from the local government, a single university, or donor agencies devoted to developing the region without making a profit. In this case, the authors designed a knowledge management framework in the region that should be utilized to develop the sustainability of the development process in the region.

This offers an important idea on the front of sustainable development. The technology presented to a given community must be appropriate for their current lifestyles. If one gave a rural tribe a television before they had the opportunity to establish an effective electrical network, the original use of the object has been lost and is ultimately useless in its intended purpose. This article emphasizes the importance of educating the people of rural communities how to design, use and mend these technologies as a basis for the development of their society in the future. The introduction of a knowledge base in sustainability at a preliminary level offers the community an alternate option for growth, one which bypasses the industrial revolution ideal of fossil fuels altogether, and establishes a framework to create sustainable practices on the front end. Using appropriate technology is an option which is significantly cheaper than transitioning a society that has constructed the framework for fossil fuel systems, and will reap benefits for the community through long term energy savings, increased quality of life through connectivity to nature, and the evasion of potential environmental crisis in the future.

The next article, titled “Benchmarking Green Building Attributes to Achieve Cost Effectiveness Using a Data Envelopment Analysis” delves into the importance of cost-effective sustainable design, specifically in India. Buildings are deemed the largest source for both land and air pollution. According to this source, it was anticipated that countries like India, which are rapidly industrializing, would have an even higher rate of energy usage than historically industrialized nations by the year 2020, a statistic which has proven to be true as India is now ranked at third in the world for energy per capita consumption (standing only behind China and the United States as rankings one and two respectively), showing clearly the imminent importance of the energy usage in buildings today. India currently has several tools in place for measuring the greenness of their buildings including Green Rating for Integrated Habitat Assessment (GRIHA) and the Indian Green Building Council (IGBC). According to Vyas and Jha, GRIHA is the national green building rating system and it rates buildings out of five stars on overall “greenness.” The IGBC assessment tools use a checklist format and a point system to rate a building’s performance. In order to determine the qualities of buildings that these rating systems should be focusing on, a Data Envelopment Analysis (DEA) was employed. After looking at living situations across various climatic conditions, the IGBC determined the seven most important qualities for cost-effective sustainability.

These seven qualities help to exhibit how these building practices can be standardized across an entire nation:

> (1) utilization of the Bureau of Indian Standard (BIS) recommended waste materials in the building, (2) increase in environmental awareness, (3) dedicated facilities for service staff, (4) design for universal accessibility, (5), low-impact design (6)

construction management practices and (7) use of low-volatile organic compounds (VOC) paints that contribute to more green points at a lower cost. (Vyas & Jha, 2017)

What is most important about these attributes is the ability to dissect the overall quality of a particular project in a standardized way, leading to efficiencies in both cost and time, and developing an understanding of how the project will impact its immediate and broader scope environment. One can note that when utilizing environmental technologies, the aim is often to minimize all adverse impacts that particular technology might have within its interactions in its scope. These seven factors will help to keep the main negative contributions to a minimum; however one might begin to consider whether our central aim should simply be minimizing damage rather than providing healing and improvement, a goal of the Living Building Challenge- an international sustainable building certification program.

Architectural Considerations

The book *Social Housing in the Middle East: Architecture, Urban Development, and Transnational Modernity* by Kivanç Kilinç and Mohammad Gharipour is a collection of essays which consider the effects of housing- social housing particularly- on the development of society. The authors state that "Our Central goal in Social Housing in the Middle East is then to draw an unbiased, multilayered map to explore how social housing policies and projects both relate to and diverge from western practices and, more important, to explore why such parallels and discrepancies matter in the first place" (Kilinç & Gharipour, 2019). The central component of the work is a discussion of how the built environment has a direct impact on on the social endeavours of society and in "what ways, for instance, various visions, forms, and discourses of modernity have coexisted- not always peacefully- in the architectures of social housing built in the wider Middle East." (Kilinç & Gharipour, 2019).

Composed in the form of essays, one section speaks on the idea of constructing dignity within an urban environment, focusing primarily on the disproportionately negative impacts the built environment can have to those of a lower socioeconomic status describing that “out of these economic continuities that global and local gap between rich and poor, but ultimately the fashioning of politico-economic and foreign policies that imposed dire spatial effects on Tunisian cities”(Kilinç & Gharipour, 2019).

This collection of essays emphasizes that the presence of architecture that neglects the general population can lead to social upheaval. Le Corbusier’s *Towards a New Architecture* is referenced with the phrase “for Le corbusier and his ilk, the standardization of building and methods of prefabrication was a revolution in and of itself, but he boldly forewarned of the palpable prospects of upheaval and sociopolitical revolution if architecture served only for the few and not for the many" (Kilinç & Gharipour, 2019). Therefore, this work serves as an analysis of existing practices in the Middle East and how those practices have served the people well and in what ways the people may have been neglected.

The book *Architecture For the Poor: An Experiment in Rural Egypt* by Hassan Fathy takes an in depth look at how vernacular architecture can be applied in rural regions. The author describes the existence of westernized architecture in the region,“yet in modern Egypt there is no indigenous style. The signature is missing; the houses of rich and poor alike are without character, without an Egyptian accent. The tradition is lost, and we have been cut off from our past ever since Mohammed Ali cut the throat of the last Mameluke" (Hassan, 1973). The authors discuss how the builders seem to “abandon the safe guide of tradition, and without the science and experience of an architect tries to produce “architects’ architecture.”

The result is a building with all the defects and none of the advantages of the architect's work" (Hassan, 1973). Instead, the use of vernacular architectural style hopes to "provide some solid and visible link between these two architectures in the shape of features, common to both, in which the villagers could find a familiar point of reference from which to enlarge their understanding of the new, and which the architect could use to test his own work's truth to the people and the place" (Hassan, 1973). The rest of the book details a project developed in the village of New Gourna, located in Egypt, in which native building techniques were applied and developed while working with the community.

The new informed design techniques were used in conjunction with the community, teaching them how their ancestral building practices can be adapted for the modern world. The use of these techniques can also help spread sustainable design approaches in the area, as the new practices are learned by the community and this education can be spread. This process also contributes to the economic prosperity of the region, as local craftsmen and artisans begin to build upon their knowledge base and spread these ideas, getting more people involved directly in the design and construction process rather than importing either materials or knowledge. *Architecture For the Poor* explores a case study and method into how to modernize vernacular design techniques. This practice of educating the community works to import new ideas without disintegrating the native architectural typologies present.

Refabricating Architecture: How Manufacturing Methodologies Are Poised to Transform Building Construction by Stephen Kieran and James Timberlake takes a look at how basic architectural principles can be stripped down and applied in a new way that moves us into the modern century. *Refabricating Architecture:* looks deeply at the processes and

material use of architecture and how to emphasize the principle of function over form, using only those processes and materials that contribute to the function of the project rather than aesthetic appearance.

> New processes offer elevation of the art and architecture: more control, higher quality, and improved features. To do so, we must look deeper into what lies beyond mere appearances- to see how we do things, not merely what they look like. (Kieran and Timberlake, 2004)

The conversation on material use is particularly relevant to this discussion, describing that "the use of new materials in architecture today is rarely more than a stylistic statement made in an effort to claim modernity merely through the use of an innovative product. Novelty alone, however, cannot sustain use" (Kieran and Timberlake, 2004).

Kieran and Timberlake argue that each architectural and systematic decision should be based on the realization of the optimal function of the project. When considering affordable and low-income multi-unit residential projects, function must be emphasized and all forms must coincide directly with these practices in order to achieve optimal living conditions for the user. Using the vernacular of architecture in the region can provide the necessary functionality, through the use of tried and true practices further developed to meet the needs, while still conserving the stylistic and architectural integrity of the region and culture.

In *Multi-Unit Housing in Urban Cities: From 1800 to Present Day*, Katy Chey takes a look at how and why certain housing types have been successes and failures in major cities around the world and an exploration into how the housing typologies correlate to a

contemporary context. The work is broken down by location and through time, exploring the following multi-unit housing types: Birmingham's Back-to-Backs (1800-1880); The London Tenement (1800-1880); Paris's Haussmann Apartment (1850-1870); The New York Tenement, Hong Kong's Tong Lau (1840-1960); Berlin's Perimeter Block, Linear Block and Block-Edge (1920, 1950, and 1980); Amsterdam's Solitaire and Perimeter Block (1990-2010); Beijing's Space Enclosing Structure (2000- Present); Tokyo's Kyosho Jutaku (2000-Present); and Finally Toronto's High Rise Tower (2007-Present). This work uses comparisons to case studies, emphasizing why direct analysis of existing works is especially important to understand the intricacies of an architectural and social problem. In the Internationale Bauausstellung (IBA) Housing Exhibitions, the 1984-87 works "moved away from the ideas of Interbau Berlin and instead concentrated on the needs of the existing city in a site-specific and meaningful manner. The new projects developed were developed within the old city blocks, which helped close the gaps left over from the wars and reinstate the former block identity of the early 1900s" (Chey, 2018).

Throughout this book, an in depth analysis is done into the forms of multi-unit housing within the city and how those forms correlate to the historical context present, and finally within the social context of multi-unit housing. Though this work focuses primarily on the intricacies of construction and architectural principles, it pulls in important lessons as to the impacts these practices had on the residents within each place and time. A similar form has been applied to the present study, focusing instead on three primary projects analyzed through characteristics, rather than a place and time approach which defined many more case studies, in lower detail.

Environmental Considerations

"A Simple Method for Evaluating the Sustainable Design of Energy Efficient Family Houses" by Miha Praznik, Vincenc Butala and Martina Zbasnik-Senegacnik is largely concerned with the most useful methods to design efficient family homes. The greatest amount of energy a building uses in its lifecycle is that energy which goes to both operation and maintenance. There is also the matter of the embodied energy that goes into a building, or the energies that go into obtaining raw materials and producing the materials needed in construction. There are five main indicators that need to be taken into account including "achieved energy efficiency, consumption of primary energy, CO2 emissions, associated costs, and effects on living comfort" (Praznik et al, 2014). These will identify the various effects that different forms of energy efficiency will have on the building's life. In a test performed on various forms of energy efficiency concepts in the home, the two passive homes (Variants V4 and V5) proved to be the optimal energy efficient design style in accordance with the former qualities and their characteristics are described below:

> Variant V4 is designed as a standard passive house. The heating system is integrated into the ventilation system, which lowers the investment in installations.
>
> Variant V5 is a slightly improved new building both energy-wise and environmentally, at the standard of a passive house. In order to give the building better environmental indicators, the envelope is thermally insulated using cellulose flakes in place of mineral wool. (Praznik et al, 2014)

Passive homes essentially attempt to provide heating and cooling elements with little to no inputs of energy from sources that are not onsite and rigorously optimize total energy efficiency in order to minimize their impact. Energy optimization is important when looking

at sustainable designs as this is often the largest contributor to environmental degradation and increases in maintenance and operational costs in the home. Greater energy optimization, while being slightly more expensive upfront, can therefore provide significant savings over the life cycle of the home. Another important concept looked at in this article is the idea of embodied energy which can significantly increase the total energy inputs of the home. Construction of the home will be cheaper as the materials used have a lower amount of embodied energy. This can be found through sourcing of local materials in particular.

The next article is "Nature-Based Solutions to Climate Change Mitigation and Adaptation in Urban Areas : Perspectives on Indicators, Knowledge Gaps, Barriers, and Opportunities for Action" by Nadja Kabisch, Niki Frantzeskaki, Stephan Pauleit, Sandra Naumann, McKenna Davis, Martina Artmann, Dagmar Haase, Sonja Knapp, Horst Korn, Jutta Stadler, Karin Zaunberger and Aletta Bonn. According to these authors, Europe is expected to face significant ecological changes as a result of climate change. This will result in a loss of biodiversity and threaten the functionality of all of their ecosystems. Additionally, urbanization and the spread of cities has climbed at an unforeseen rate and are increasing in density (Kabisch, 2016). This also poses a threat to the ecological state of Europe. In light of this, a workshop featuring thirty four experts from seven different countries across Europe was convened. This group discussed the benefits of pursuing nature based solutions to this problem, and any ramifications that might result from such solutions,determining that the best way to raise awareness of these issues and their potential solutions is to increase implementation of sustainable technology. The best way to identify problems with green and blue spaces is to see them in action and allow for more expert research to create

improvements. The authors also determined a need to adapt for challenges involving implementation through government. A recurring problem with using nature based solutions is the lack of budget or will from the government to prioritize sustainable issues. This will necessarily result in a cultural shift with sustainability at the center. Government involvement in the integration of green practices across society will be obligatory in order to keep the cost of living low while increasing human benefit from access to nature.

There is a socio-economic element with the practice of these solutions. As regions are beautified, the prices of homes in that area will increase. This could prevent many of the people who need such increases in quality of life from reaping the benefits of green and blue spaces. This is why government involvement in the implementation of sustainable technologies is so important. If green spaces are provided for the public, designers will side-step the inevitability of the poor being left behind in the search for an integration with nature. This article is hopeful in this regard. Experts across first world countries committed to coming together in order to discuss the viability of the future of sustainable technology and came to the conclusion that it not only is extremely possible, but should also be strived for in the development of our society.

"Rethinking the sustainability of Israel's irrigation practices in the Drylands" by Alon Tal discusses one of the world's most forthcoming issues: freshwater is becoming an increasingly valuable commodity. There is a limited amount of easily accessible freshwater and those sources seem to be drying out faster and faster. Israel, "one of the world's historically arid regions" (Tal, 2016), has spent the last sixty years trying to increase its water productivity and conserve the water present to the highest degree. The region does this primarily in two ways as discussed in the article. The first is drip irrigation, or irrigation in

which small amounts of water are consistently distributed directly to the roots of the plants. This prevents water waste, decreases the need for irrigation labor, and prevents weed growth as water is concentrated on the plant itself rather than on all of the soil. There are a number of ways that this can be customized for unique client needs, for example, underground drip irrigation can be used to avoid the aesthetic issue of pipelines running along the surface of the site. It can also be adjusted for climate-based rather than aesthetic concerns, for example, the use of sensors on individual plant specimens allows the user to track the exact water intake required in order to maintain the health of the plant with minimal resource waste. The second way that Israel saves water in its agriculture practices is through the utilization of grey water and effluent recycling. Effluent recycling is the reuse of sewage water for agriculture after it has been treated to remove particulates. This is a particularly controversial water saving technique as it carries the potential for human health problems; however, prolonged testing has shown no negative effects as a result of this technique.

Tal explores even more ways that communities can limit impact on the environment. Israel has been one of the most successful nations as far as sustainability and water conservation efforts with approximately ninety percent of its water recycled at least once. While this article focuses specifically on Israel's practices of water conservation, it can also be used as a case study in how areas suffering from climate crisis can begin to apply sustainable practices to the design of their communities. Drip irrigation in the United States has not been implemented due to its increased initial cost and the continuing availability of freshwater; however, this will not be the case forever. It does not make sense to flood our agricultural centers with freshwater that should be conserved for direct human consumption. Excessive water has also caused environmental degradation as overflow from fields finds its

way into our waterways, causing eutrophication and leading to the destruction of natural wildlife. Measures such as drip irrigation and reuse of water should be encouraged if one wants to provide for the future of our society. It is not necessary to go as far as using effluent recycling in our agriculture practices. Greywater, or water that is recycled but was never exposed to the harmful bacteria that can be found in raw meat and human waste, is also an optimal option for use in agriculture that leaves behind the fear factor of effluent recycling.

Green Roofing is not a new concept, as discussed in "Organic Greenroof Architecture: Sustainable Design for the New Millennium" by Linda S.Velazquez. It has been utilized across history in order to bring nature in as a more centralized element of human society. This article focuses on the viability of green roof usage in modern urban landscapes. This particular form of sustainable architecture can provide a multitude of services to urban centers with few negative attributes. Namely, greenroofs can provide solutions for issues with excess stormwater that overflows sewer systems and contaminates freshwater sources with heavy metals and nutrients (Velazquez, 2005). The vegetation has the ability to filter and cool this water, preventing detrimental environmental impacts that would happen otherwise. It can also extend the life of the roof as well as provide green space in historically "concrete jungles" (Velazquez, 2005). Greenroofs can also prevent urban heat islands from forming through their cooling mechanisms which can in turn help diminish ozone reduction above cities

This form of sustainable technology is one of the most exciting in the field. Green Roof technology has endless possibilities for transforming harsh, urban landscapes into areas of community and natural reclamation. Greenroofs not only have positive impacts on the environment, but also have the potential to completely transform the landscapes of urban

centers. This technology can be customized to fit the desires of any building or home owner and can range from supporting simple grass-lined roofs to large-scale gardens featuring trees and waterfalls. The green roof itself can be anywhere from only a few inches thick to up to fifteen feet deep depending on the type of foliage it is supporting. In a society which must increasingly prepare to support a large population density while preserving the ecological health of the environment and conserving water, green roofs have the potential to help this social shift by showing the beauty of a sustainable society.

Implications on Quality of Life

In the article "Maintaining Experiences of Nature as a City Grows" by Jessica R Sushinsky, Jonathan R. Rhodes, Danielle F. Shanahan, Hugh P. Possingham and Richard A. Fuller published in 2017, the authors take a closer look at the way in which cities can grow and the effect that this can have on people's access to nature. Access to public green spaces, backyards, and even diversity of bird life can have significant impacts on the quality of life of the residents. Sushinsky and the other authors used Brisbane, Australia as an example, looking at public access to these criteria. Within Brisbane, the authors also looked at sprawling versus compact growth and the connotations that can have for public access to nature. What was found, essentially, was that while the sprawling growth better retained backyards, it also lost significantly more bird species and public green spaces. In this scenario, communities of lower socioeconomic status were affected disproportionately by the disappearance of nature. Compact spread on the other hand, offered more city control of planning which could prevent the minimization of people's opportunities to experience natural environments around their homes. Brisbane, however, is a relatively low density city

in comparison to many major cities around the globe. More research must be done to determine what would work best in higher density living situations.

This article explores the idea that increased green spaces in urban areas contribute positively to the quality of life of those that live there. As cities continue to grow and spread, these green spaces and access to nature can potentially become more unevenly distributed. According to this article, compact spread seems to be the most viable option when it comes to preventing this disparity among a city's citizens. Unfortunately this still results in a loss of backyard spaces in individual homes. However, it seems that as compact spread allows more city control on where public green spaces go, it will be more equitable in the long run and ensure that most, if not all, citizens will have access to a natural environment in their area. This would be even more important when considering areas that are even higher density than Brisbane, as their spread would affect even more individuals.

Another article that discusses the importance of human wellbeing in terms of the natural environment is titled "Changes in Productivity, Psychological Wellbeing and Physical Well Being from Working in a 'Green' Building" by Andrew Thatcher and Karen Milner. The central idea of this article is to look at an abundance of statistical evidence in order to determine whether or not "green buildings" (Thatcher, 2014) create significant change in the workplace. This change can be exhibited through increased or decreased productivity, betterment of the indoor work environment, improved ventilation, increased use of natural light, etc. The authors also produced some of their own results by way of an experiment. Individuals were pulled from a financial institution with "more than 10,000 employees across the country" (Thatcher, 2014), half of which were placed in a new "green" building design and the other half stayed in their current work environments. The experiment lasted for a year

and the employees took a voluntary survey about their productivity and satisfaction with their work environment at 3 intervals throughout this timeframe. The results overall were inconclusive but suggest that there may be health and productivity benefits from working in a green building versus a conventionally styled one.

This article is particularly helpful in providing "proof" for the benefits that nature has on the self. In this particular field of study, it is difficult to come across conclusive evidence of these ideas because the research simply is not out there. In this case, a considerable amount of the available research was compiled and added upon to create a general body of knowledge. Additional investigation needs to be done in order to gain more conclusive evidence, but this is a start. Even simple concepts as small as letting in fresh air and natural light was proven to generally improve the work environment and productivity of these individuals. It is important to note that much of this research was done on a single company and experimented on in a single green building, of which countless designs that all likely have different impacts could be implemented. Even in this specific scenario, the results largely lined up with other research, showing statistically significant evidence that green buildings can have positive effects on the mental and physical wellbeing of individuals in the workplace.

"Gross National Happiness and Environmental Status in Bhutan"by David Zurick discussed the anomaly that is Bhutan. The country of Bhutan is an isolated nation with an estimated population at under a million people. It has a "uniquely biodiverse landscape of forests and tundra which are home to more than five thousand types of plants and one hundred and sixty five species of mammals and seven hundred and seventy species of birds" (Zurick, 2006). Bhutan has also created something of a large-scale human social experiment

with their governmental implementation of the policy of "Gross National Happiness" (Zurick, 2006). This partly stems from the nation's Buddhist traditions which place emphasis on spiritual fulfillment through striving for contentment, enriching cultural values, nurturing a thriving natural environment and allowing for freedom of choice. A large part of their policy of Gross National Happiness is the human union with the environment. As conservation, air and water quality, human development increases, the Gross National Happiness of Bhutan also increases.

Gross National Happiness is a fascinating concept in which the government is primarily focused on the levels of happiness of its people rather than their economic prosperity. Bhutan is an exceedingly unique nation in this way and also in the nature of their society as a whole. The situation in Bhutan represents a peculiar case study of its own accord, and yet this country is using its own uniqueness to offer a new concept of living to the rest of the world. The idea is that the rest of the world might look to them and find the desire to renew quality of life for all. While many of their beliefs follow Buddhist ideologies, the concept of returning to nature is not unique to their religion. It is a fact that proximity to nature helps to stimulate happiness and feelings of calm. It is not surprising that this small nation can boast of the happiness of their people when surrounded by one of the most ecologically diverse landscapes on the planet.

Methodology

A case study analysis has been chosen as the research methodology for this body of work. This method enables us to break down the intricacies of the projects within specific regional and cultural contexts while offering a platform to both juxtapose their characteristics and track broad connections. The case studies being investigated are Collective Living by GAD Architects, Fuyang, Hangzhou, China; Ruca Dwellings by Undurraga Devés Arquitectos, Chile; and SOS Children's Village by Urko Sanchez Architects, Djibouti, East Africa. Each of these case studies has been selected due to their work with low-income design strategies in the establishment of community living; using vernacular design methods to provide a connection between the built space, occupants, culture, and community.

1.1 Collective Living- GAD

2.1 Ruca Dwellings- Undurraga Devés Arquitectos

3.1 SOS Children's Village- Urko Sanchez Architects

These will be analyzed through the investigation of ten primary characteristics: (1) internationally based projects (in the context of the United States); (2) cultural ties within the community; (3) community development strategies utilized on the project; (4) family dynamics within the culture; regional structural and construction techniques used or adapted;

(5) public space integration (types, uses and their relationship to privatized space); (6) emphasis of design principles; response to climate concerns; (7) utilization of indigenous vegetation on site; and finally (8) steps to promote the mental and emotional health of occupants. A discussion of how each case study has applied these characteristics will occur following a description of each one in relation to the project as a whole. The analysis of case studies by way of in-depth characteristic investigation allows us to better understand the common threads in each project. In this, a base plane is established in which successes and deficiencies can be identified within the scope of the established case studies.

International Projects

The choice to use internationally based projects provides a more cumulative global perspective on how vernacular design is utilized worldwide and exemplifies how geographic location drives differing design decisions based on place and culture. Locations were chosen to better understand how similar design processes can be implemented in a variety of contexts facing varied climate specifications, cultural concerns, social issues, etc. These three projects are each unique, yet can be defined, analyzed, and studied across the same plane. One can challenge their initial reactions to successful low-income design processes by placing them in a specific and unique circumstance, understanding the effects, placing them within new sets of constraints, and determining if the same effects hold true.

Collective Living: Fuyang, Hangzhou, China

The Collective Living project by GAD architecture, also known as Dongziguan Affordable Housing for Relocalized Farmers, was built in Dongziguan Village

1.2 Exterior View

in the Fuyang Hangzhou region of China and completed construction in 2016. The rapid increase of urbanization in China has led to an equally rapid “increase in urban-rural disparity” (“Dongziguan,” 2017). As a result of this, many rural regions in China have experienced the degradation of their homes over time. This is often resolved through mass displacement into high rise infrastructure, separating communities, and degradation of local culture. This degradation of homes was the case for many local farmers residing in Dongziguan Village; however the “local Government in Fuyang District of Hangzhou decided to fund an exemplary affordable housing project in Dongziguan Village aiming at improving living conditions for relocalized farmers” (“Dongziguan,” 2017).

Ruca Dwellings: Chile

The Ruca Dwellings project by Undurraga Devés Arquitectos is located in Santiago, Chile, and finalized construction in 2011. This project was developed as a reaction to the displacement of indigenous populations from their traditional lands, in this case, “the Mapuche community in Huechuraba, on the northern outskirts of the city of Santiago" ("Ruca Dwellings", 2013). The effects of rapid urbanization have resulted in continuous relocation for these communities into “stunted locations, usually occupying lands of poor quality or poor value, with economic and health problems, and even worse, a serious cultural decline because they are imposed values and lifestyles of others, alien to their traditional systems” (“Ruca Dwellings", 2013). Like the Dongziguan Village in China, rapid

2.2 Front Facade

and mass migration into cities is prevalent in this region, but in this case, the social implications of migration have a far greater impact than the economic disparities.

> This is because the city, particularly the mega-city, in the forced transition to a globalized world, has disregarded the local cultures, and it is there where the native peoples have borne the brunt of their decline (“Ruca Dwellings", 2013).

This project aims to reconnect the Mapuche community to both their heritage and their environment by developing an affordable housing community on the outskirts of Santiago. This is intended to provide sanctuary to this group and revitalize their quality of life.

SOS Children’s Village: Djibouti, East Africa

The SOS Children’s Village Project by Urko Sanchez Architects is located in Djibouti, a small nation in the Horn of Africa, in the city of Tadjourah and was completed in 2014. This residential complex was designed as a haven for family life sheltering both from social unrest and the severe climate of this region “which suffers from persistent droughts and severe scarcities” (“SOS,” 2020). This complex was designed to shelter at-risk children and provide a safe space for their growth and development, “with no cars, where the narrow streets and squares become places to play” (“SOS,” 2020). The climate severity in this region is of particular interest as the design must provide both a nurturing and open environment for children and families while still providing much needed

3.2 Corridor View

shelter from a severely hot climate. The implementation of vegetation and shading on-site gains precedence in design strategy.

Cultural Ties

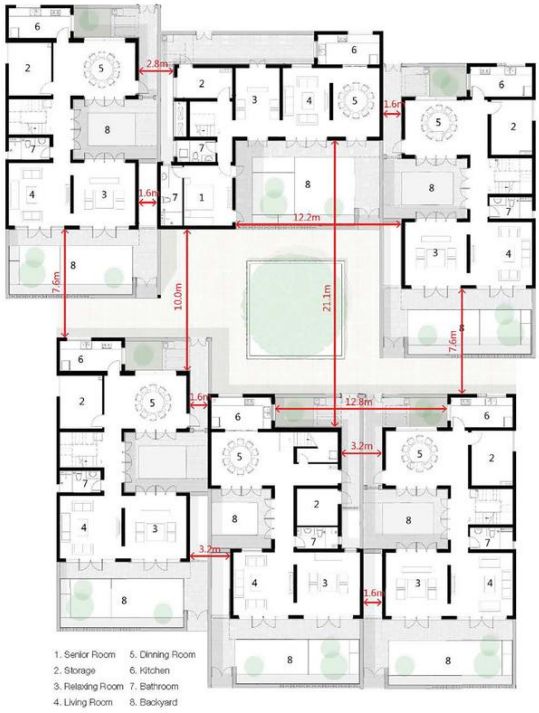
Each of these projects has been developed in reaction to the cultural needs of the specific user group; thus, designers need to fully understand the culture they are working in. The importance of this cannot be overstated; it is not only the job of the designer to develop a functional and safe space for the occupants, but in turn to create the structure for a vibrant community. This idea gains additional power when one considers the development of affordable housing communities which are not designed for the desires of the individual necessarily, but for the structure of the community as a whole. The uses that these case studies have been designed for are not only a group of individuals but a collection of displaced peoples in one form or another. This community typology amplifies the need to ground the project in a sense of culture, if the goal is not only to create a basic shelter but to provide the groundwork for a functioning home, steeped in local history and the narrative of the occupants.

Collective Living: Fuyang, Hangzhou, China

1.3 Cluster Scale Model

The original lifestyle of the occupants emphasizes the importance of living collectively within a community. Chinese culture has historically used the courtyard, or *siheyuan*, as a gathering space between different segments of a family as multiple generations historically lived together in one

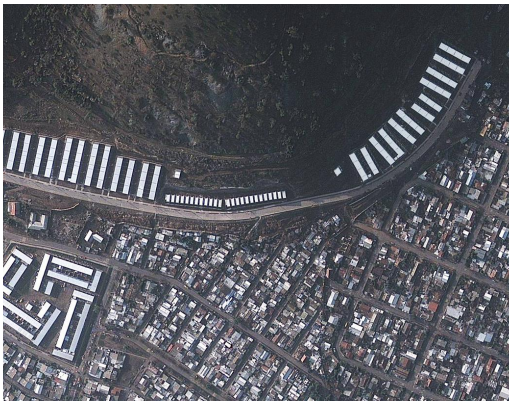
space. The typography of Chinese living styles of the past demonstrates the importance of common space to foster community. This has been modified within the Collective Living project to accommodate multiple families and foster community between them through the use of shared outdoor space. The layout of the project allows for "six different buildings in two different types of footprints (11x21 meter and 16x14 meter) belonging to six different households, surrounding a courtyard as a place for communal communication and participation. Thus, it forms a cluster and community as a prototype for collective living" ("Dongziguan," 2017). Additionally, the lines within the roof structure follow traditional Chinese stylistic choices which work to create a sense of place (home) while providing housing of increased quality built with modern design techniques.



1.4 Ground Level Floor Plan

Ruca Dwellings: Chile

The Ruca Dwellings Project is an interesting case study to understand the importance of cultural ties. The construction and design of these homes are based on the culture of the local Mapuche people rather than on the broader regional context. As an



2.3 Aerial View

indigenous population, their history differed from those descended from the Spanish Conquistadors. Mapuche traditions arise from indigenous practices.

> Their sacred spaces were not temples, but the mountains, forests, and rivers. . . . Their shelters were the rukas, and in many cases still remain transient spaces formed by light structures of branches and tree trunks. These, blended into the landscape, degrade over time to return to the land accompanying the circular nature of time. This is sufficient to understand the effort of adapting the Mapuche culture to contemporary urban reality. (“Ruca Dwellings", 2013)

Connection to the land is of the utmost importance to the Mapuche culture and the built environment this project creates for them is not reminiscent of the structures in Santiago, but instead ties the people back to their natural environment and integrates the project with nature. Consider in the aerial view above (Image 2.3) the comparison between the amount of natural landscape preserved on this site versus within the surrounding area.

SOS Children’s Village: Djibouti, East Africa

This project was created as an escape for families within the community and a safe place for children to grow up in the wake of political turmoil. The space is well protected from the elements and maximizes shading strategies by developing close housing units that provide sheltered community spaces in the gaps between homes. This project takes the form of a *medina*, or a city with many walls and maze-like streets, reminiscent of the Middle Eastern/North African influences prevalent throughout the country. This provides

3.3 Courtyard View

optimal levels of shading within the pathways and courtyards between buildings, making them habitable throughout times of severe heat. Constructing with the same Middle Eastern influences is beneficial for climate concerns as well as keeping the construction low cost by using practices that are familiar to the region. The medina offers an abundant playground for its user group, children and families, by creating interesting pathways and places of community, breaking up regularities with points of interest.

Community Development Strategies

Another important characteristic of affordable housing units is the encouragement of community engagement/development and how it is embedded into the design as a whole. Each of these projects is set up to best meet these needs within their cultural context. In order to meet these needs, the designers explored the history and traditions of the region, modifying them to meet the constraints of the site and the particular needs of the user group. This characteristic can be used to explore common threads within the layouts of the projects and understand how these design strategies show up in a variety of other cultures around the world. This allows us to explore the value of a specified usage and its possibilities within other global applications, as well as understanding its effects on the wellbeing of the community. Community development in these projects is especially important as one of the primary goals is to create a space for displaced peoples with common histories. The designer endeavors to foster connections between this group of individuals and build upon their common ground, simply through spatial layouts.

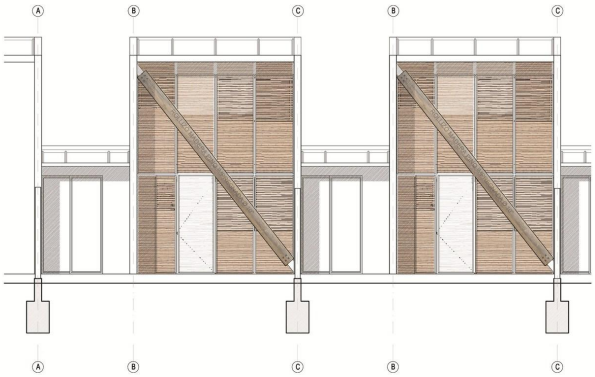
Collective Living: Fuyang, Hangzhou, China

I have already begun to touch on the cultural role of courtyard spaces; however, this practice should be additionally emphasized in their characteristic as a community development strategy. The courtyard typology draws community members into open green spaces as common areas, allowing them to form connections not only with their environment but with other residents at large. The Collective Living Project takes this typology and modifies it to fit a range of family types of different ages. The layout is informed by variances in "four prototypes that learned from the tradition and its diversity. The prototypes could be developed into clusters, which later grow into a larger rural settlement" ("Dongziguan," 2017). The relocalized farmers have lived in this way for generations and this is incorporated into the design to maintain a sense of home, location, and encourage cultural connectivity. Notice in image 1.5 the similarity that lies between the layout of the site and the surrounding area.

1.5 Site Scale Model

Ruca Dwellings: Chile

In the previous section, I discussed the need to create a sense of home and community for the Mapuche population which maintains separation from the greater region of Santiago, whose practices often clash with the values of this community. The project strives to develop



2.4 Back Elevation

a space that is private from the eyes of outsiders, allowing the people to practice their traditions in peaceful connection to their environment.

> "The houses are grouped continuously on a horizontal level, thereby allowing the length of the main facade to face east. This provision, required by the ancestral tradition of opening the front door of the house toward the rising sun, was the primary requirement from the community" ("Ruca Dwellings", 2013).

The presence of open green space on the west side of the site, or to the back of the line of dwellings, provides a shielded area for community gathering in the space between the residences and the hillside. In the back elevation shown above (Image 2.4), the spaces in between structures are closed off on the front facade, opening up to the green space on the back of the site. This continues to shield residents from onlookers, while incorporating this semi-private space into the communal area of the site.

SOS Children's Village: Djibouti, East Africa

Though the SOS Children's Village uses the form of a medina to create shadings, it also provides breaks in the winding pathways for courtyards used for vegetation, open play space, gardening, and community gathering. "In terms of distribution, all houses follow the same scheme but are arranged in different ways, placed close to each other giving shade to one another and generating alleys between them in an apparent disordered way." ("SOS," 2020). Even within the clearly defined private spaces, the walls give way for indoor-outdoor living standards, allowing occupants to feel as

3.4 Residential

though they are a part of the greater community even when in private. The medina is filled with open spaces.

Family Dynamics

Family dynamics shape the organization of each of these projects. The “users”--that is, the people who will inhabit these projects”--are consulted and the layout of the project is built around their needs. In vernacular design, the design method rooted in each of these projects, one must not only consider local culture, materials, and histories throughout the design development process. It is also necessary to consider the user group and predict the dynamic needs of each individual by way of understanding them. Family dynamics play a key role in this endeavor as the practice of family life can vary so extremely throughout the world. Despite these variances, one can begin to see the stems of commonality amongst the projects, and in doing so, develop a process of understanding which can guide the design of spaces.

Collective Living: Fuyang, Hangzhou, China

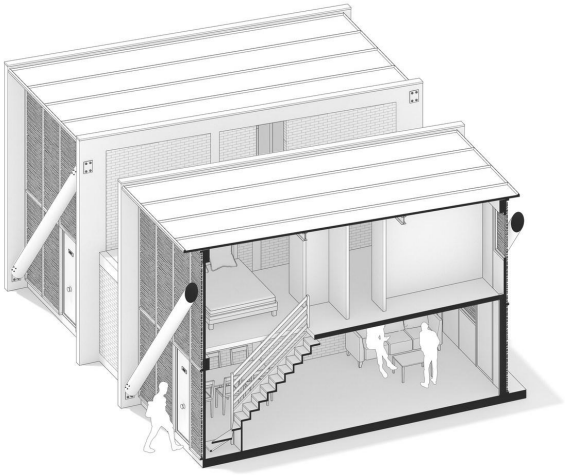
In the Collective Living project, the study has presented thus far the ways in which the courtyard typology can establish cultural ties to the community and provide an avenue for community development, but in this characteristic, I will focus on the ways that the layout of the complex can be guided by family needs. In this residential complex, different families can move into different parts of the complex based on their age and privatization needs. Age

1.6 Exterior View

range played an important role in designing the layout of the homes. “During the process of layouting the plan of buildings for each household, architects firstly conducted an investigation to communicate with different families for their living habits and the age structure, and then design the plan layout based on the common requests and information gained” (Collective, 2019). This creates a pliable structure for the complex that can be manipulated to fit the needs of the largest possible user group.

Ruca Dwellings: Chile

The Ruca Dwelling Project, on the other hand, provides a more rigid typology within the complex. Each of the homes exhibits the same external features, overall size and internal layout. The structures themselves are modular, emphasizing the natural materials utilized and referencing the environment, rather than major architectural feats. Because the user group is so specific, the needs of the project call for much less external variability than something like the Collective Living Project or the SOS Children’s Village Project. The personalization comes, instead, on the interior of the structures. “The 61 square meter home is divided into two floors. Inside, the program is simple: the living area and kitchen are on the ground floor. The latter is larger than in similar social housing, as it considers the importance of "fire" (kitchen) in Mapuche tradition. Upstairs there are two bedrooms and one bathroom. The interior was given to the residents as a bare inhabitable structure, allowing each family to build finishes according to their means and taste” (“Ruca Dwellings", 2013). The family can



2.5 Isometric Section

adapt the interior of the space; however, the sense of external community is the focal point of the project.

SOS Children's Village: Djibouti, East Africa

Family Dynamics may be most emphasized within the SOS Children's Village project, as the user group is specifically families and, above all, children. "It is a medina for children – A safe environment, with no cars, where the narrow streets and squares become places to play" ("SOS," 2020). The protection of children is high priority, with upper level spaces used to encourage play areas while still guarding children from the harsh climate. The winding streets and high walls provide safety from both the harsh sunlight and the stresses of the outside world; however this does not take away from the open capabilities of the project. The rooftops are utilized as both entry points into the structure and additional open space for the children, capitalizing on the space to build playgrounds. The children experience connectivity to all residents of the complex through the open courtyard typology and indoor-outdoor privatized space.

3.5 Interior Playground

Structural Regional Techniques Used

These projects use local building and construction practices in order to create systems that are easily managed by the community, rather than inputting/imposing foreign technology that could soon fall apart and remain in disrepair due to the lack of knowledge about the technology in the area. Use of readily available materials allows the project to contribute to

local economic development, while simultaneously educating local artisans in the practices of sustainable design. This leads to the continued development of these practices as native craftsmen take lessons from the vernacular design project and apply them to other projects in the area. Additionally, each of these case studies experience specific climatic considerations, and regional structural techniques prove useful in combating these effects by using tested methods of climate mitigation. Thermal load, shading, and ventilation are high priority in each of these projects as the regions experience hot temperatures.

Collective Living: Fuyang, Hangzhou, China

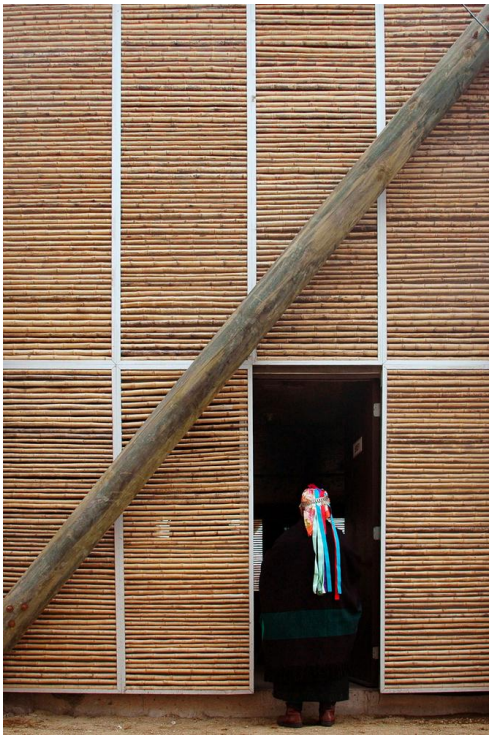
Weather patterns within the Fuyang region of China show generally mild temperatures throughout the year and a seven month long rainy season. The structural practices of this project aim to create comfortable year round temperatures through the use of variety in material choice. “The design for construction drawings explores the best usage of the brick, steel and glass to ensure the best thermal and ventilation performance. The 24mm brick wall is equipped with waterproof coating and hollow glass and the solid wall varies at the place of stairs with staggered pattern” (Collective, 2019). Image 1.7 displays the detail in which the brick layout is used as a passive ventilation strategy. This technique retains privacy within the space, continuing the sleek facade while providing airflow through the structure. Additionally, this technique allows for the continuation of airflow in the rainy season. While the windows remain closed, the 24mm openings provide ventilation without introducing water to the interior space. The project pulls in traditional roofline typologies, reminiscent of

1.7 Facade View

the curvilinear forms of the human body, giving the residential complex a sense of place and connecting it to local traditions.

Ruca Dwellings: Chile

The Ruca Dwellings continue the trend of using vernacular design methods by integrating construction techniques and materials specific to the Mapuche people. The diagonal structural framing member was used in response to the earthquakes that frequent the region, providing additional support while showing off the impregnated pine wood that characterizes the structure. “As a construction technique, the artisanal tradition of brick and reinforced concrete frame was used, expressing the correspondence between appearance and structural nature of the project” (“Ruca Dwellings", 2013). Integration with nature is at the heart of the project, placing emphasis on natural light and airflow. “A double skin of "cañada de coligüe" covers the wall and windows of these facades. The minimum distance between the rods allows the passage of light filtered inside, while at the same time displaying the tradition that inspired the project” (“Ruca Dwellings", 2013). “The interior spaces are defined by simple forms reminiscent of traditional rukas of the Machupe



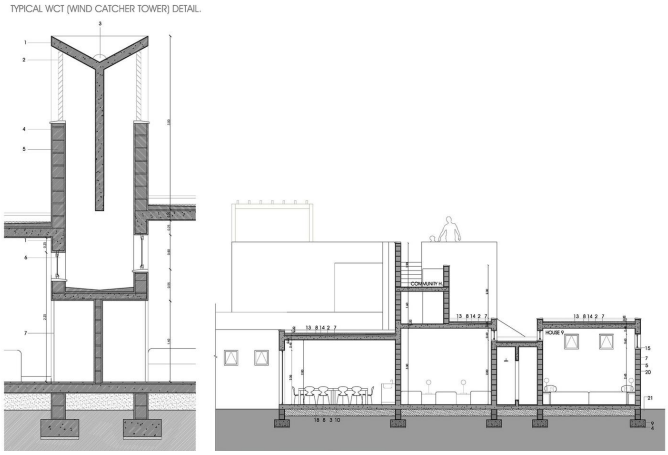
2.6 Facade Material View

2.7 Unfinished Interior

people; “the dim and fragmented light inside evokes an atmosphere that reminds us of the darkness of the rukas, separating them from what happens outside in the city. This strategy also defined crisply the interior and exterior, opposed worlds in the Mapuche tradition, different from the modern tradition where interior and landscape are continuously integrated” (“Ruca Dwellings", 2013).

SOS Children’s Village: Djibouti, East Africa

The SOS Children’s Village takes a simple approach to the design of structure, characterizing the project primarily through breaks in the architecture, creating playful pathways and courtyards. “The materials were very simple: cement blocks, RC structure and Cemcrete finish from a South African company” (“SOS,” 2020). Flat roof systems are used to add to the footprint of a small plot of land, continuing to provide shade through variances in wall heights but allowing for upper level pathways and open play areas. Shading and aeration of the structure is of the utmost importance in this project as the region faces severe temperatures, with Djibouti classified as the country with the hottest temperatures on earth. The design strategy is modular; however, the dynamic variations between modular structures create both shade and passive cooling across the entirety of the property. The section view above (Image 3.6) details the stackable element of the modular components along with the inclusion of wind towers across the site.



3.6 Section View

Public Space-Types, Uses and Relationship to Private Space

As these projects handle multi-unit housing projects identified as residential complexes, the distinction between public and private space is a careful balance between community communication and familial privacy. Public space in these instances is utilized to build connections between community members and to the environment they live in. Private spaces are used to separate individuals and create quiet and comfortable spaces catering to individuals rather than the group as a whole. Each encourages socialization and community in order to build a better quality of life for all. These projects handle this challenge within their specific context and help to define the advantages of taking an individualistic approach to the project rather than using a blanket system for these similar, yet inherently different, projects. I will be dissecting the types of public spaces within the scope of each project as well as their uses and relationship to the private spaces on site.

Collective Living: Fuyang, Hangzhou, China

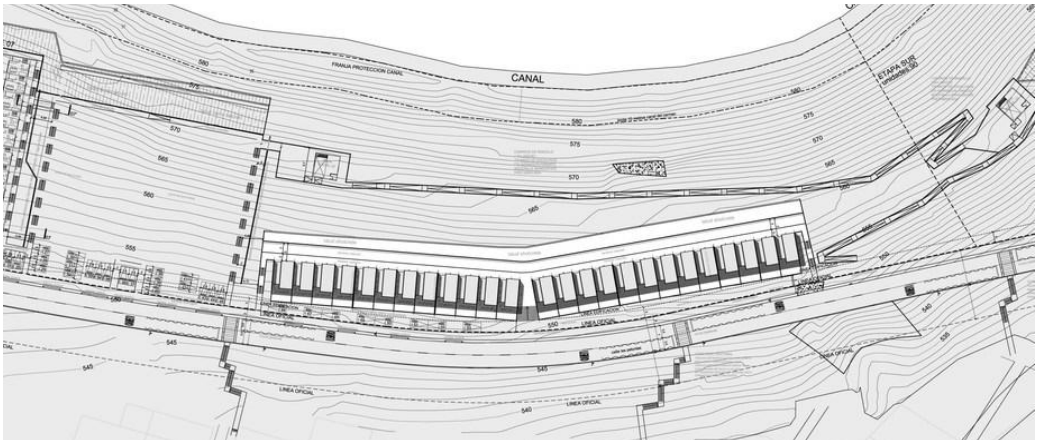
The public space in the Collective Living project is an exemplar of the courtyard typology, is defined by six buildings surrounding the communal courtyard, creates an open plan, and encourages connectivity between these occupants. The "architects firstly conducted an investigation to communicate with different families for their living habits and the age structure, and then design the plan layout based on the common requests and information gained" in order to determine the best layout for the project based on user needs (Collective, 2019). Chinese

1.8 Interior Perspective

culture places an emphasis on familial community as well as connections with neighbors, and the floor plan of the project reflects these values. The privatized units have enough variability to fit the needs of specific family units, which may be characterized by numeric size as well as age range. The relationship of this private space to public space is defined by "the final layout besides meets the functional requirement, but also indicates a particular spatial order, from public to private toward north" (Collective, 2019). Image 1.8 is an example of one of the more public housing units, emphasizing connectivity between neighbors while maintaining private elements.

Ruca Dwellings: Chile

Public space in the Ruca Dwellings project is defined by the relationship of enclosed space to the back of the dwellings and the hillside, allowing for the public collection of the group while remaining shielded from outside spectators. Additionally, the gaps between structures provide semi-private spaces that can provide connectivity between both the enclosed, privatized space and the public space. "Between the houses and the hill we designed a common space, similar to traditional urban space. From there is the access to the housing. The continuous construction of the project did not exclude the individual expression of each house, echoing the rukas isolated in the landscape" ("Ruca Dwellings", 2013). This space is used as a gathering space for community members as well as an open location to appreciate the cultural significance of the hillside to the Mapuche people. The relationship from this open, common space to the private enclosed structures of the home is characterized by direct access from private dwellings to the public space as it extends the length of the row of rukas and continues between them. The changes in topography reinforce distinctions between public and private zones, making this particularly successful.



2.8 Site Plan

SOS Children's Village: Djibouti, East Africa

3.7 Courtyard View

Open space within the SOS Children's Village Project is primarily provided in the gaps between structures and by sporadic openings into courtyard typologies. The complex is composed primarily of concrete material. The public spaces allow for some connection with nature, connectivity to those around them, a safe space to play, and allows for indoor-outdoor living in an immensely harsh and sweltering climate. Farming practices are also utilized within the community spaces by way of integration of vegetation within the small footprint of the site: this allows the residents to connect with nature while reaping the benefits of on site farming. The relationship of these maze-like public spaces to their privatized counterparts are defined as " a medina with plenty of open spaces – Public and private spaces are clearly defined. And in the private, the inside and outside areas melt, allowing residents to maintain certain outdoors living" ("SOS," 2020). The familial element in this project is reminiscent of the

considerations taken in the Collective Living project, identifying key needs of different families and catering to them within the private spaces of the project.

Design Principles Emphasized

This characteristic allows us to take a look at the aesthetic and architectural principles emphasized within the scope of each project and how they have been applied to the individual geographical contexts. I discussed how this has been done structurally in a previous section, but this characteristic allows us to take a more conceptual look at the design approach that appears in the context of each project. This will develop an understanding of how the processes overlap and juxtapose each other by looking at simple architectural principles and design aesthetics. One can begin to understand how details in both sections and plans establish boundaries and transitions between the spatial usages discussed formerly.

Collective Living: Fuyang, Hangzhou, China

Within the scope of the Collective Living project, there are three major design principles that are applied throughout the space: rhythm, unity, and variety. Rhythm as a design principle emphasizes movement and action. This is applied throughout the project in both plan and elevation. In plan, the corridors and connections between courtyards suggest movement, while in elevation, the simple facade is broken with the curvilinear movement of the rooflines.

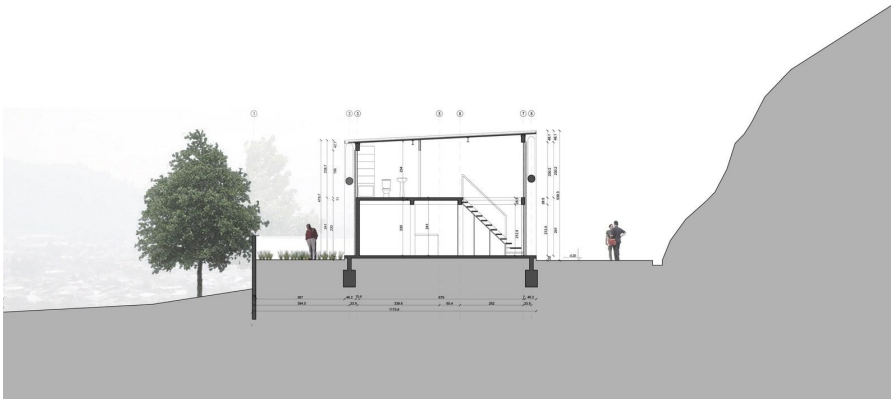
1.9 Corridor View

The same principles in the roofline create a sense of unity across the whole of the project,

additionally emphasized through continuity in color scheme, style, and finish materials. Breaks are shown in this through moments of variety which take place with the manipulation of the plan to meet the varying privatization needs of different users, allowing for modifications in special layout to accommodate these needs.

Ruca Dwellings: Chile

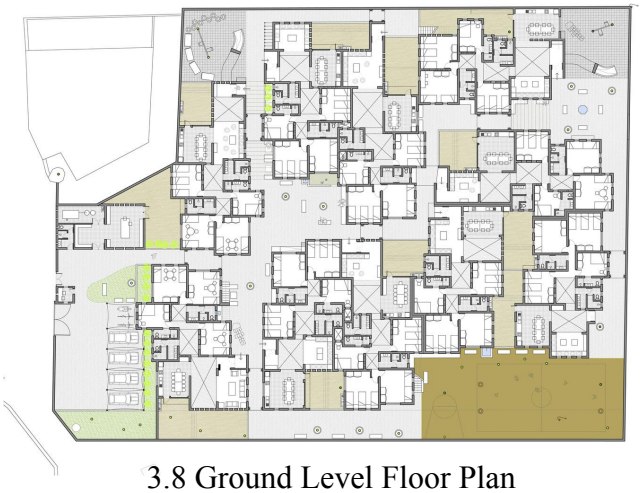
Within the Ruca Dwellings project, the three major design principles identified are balance, proportion and unity. Balance is defined as the distribution of visual weight within the project, and is applied in this project through balance within the structures themselves. The entry facade features a diagonal member which emphasizes the strong rectilinear form of the individual building. The buildings are distributed in a single file line and the shape of the entry facade is mirrored on the east and west elevations, widening but retaining the ceiling height. As far as proportion, the rectilinear, modular forms of structure stand at two stories tall, proportional to the height of the hillside rather than overtaking it, as shown in Image 2.9. Finally, unity within the structures is a major component of the conceptual design. The buildings are individualized to the user group it has been designed for, yet each component building repeats creating strong visual unity through the repetition of form and material.



2.9 Section 3 In Context

SOS Children's Village: Djibouti, East Africa

In the scope of the SOS Children's Village project, proportion, hierarchy, and unity take precedence as the three key design principles. Proportion is emphasized in this project as well, but takes a much more dynamic approach that the Ruca Dwellings project. This project uses proportion as a means to create avenues and shading throughout the entirety of the site. Wall heights and towers included are intended for a specific purpose, yet retain and emphasize the medina layout that this project design was based upon. Hierarchy within the village is additionally used as a means to create this dynamic community, by placing priority on community areas over privatized spaces. In image 3.8, one can see that the public spaces are carefully placed throughout the site and emphasize avenues of central importance. Finally, material choice, color, and even variability all contribute to the general unity of the project as a whole.



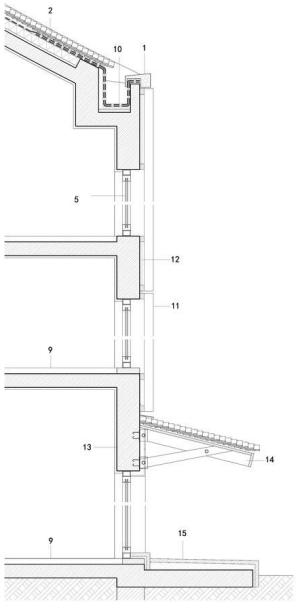
3.8 Ground Level Floor Plan

Response to Climate

Each of these projects addresses specific climatic conditions typical for their particular regions of the world. The systems integrated into each of these projects are adapted from traditional construction methods and design strategies that have historically proved effective for that region. Adapting systems from traditional methods builds on the groundwork formed in that region and can better prepare the area for more severe climate crises in the future. Climate change will generally affect regions through more severe climate

emergencies rather than general global warming. As these regions have already experienced changing climatic conditions to some scale, they are better prepared to handle more severe versions of climate change through adaptations of their traditional practices. I will be identifying the natural factors each project is responding to and how the project works with or against its environment while adapting to its environmental conditions. I will discuss why these questions are important in the greater conversation on sustainable design techniques in the findings section.

Collective Living: Fuyang, Hangzhou, China

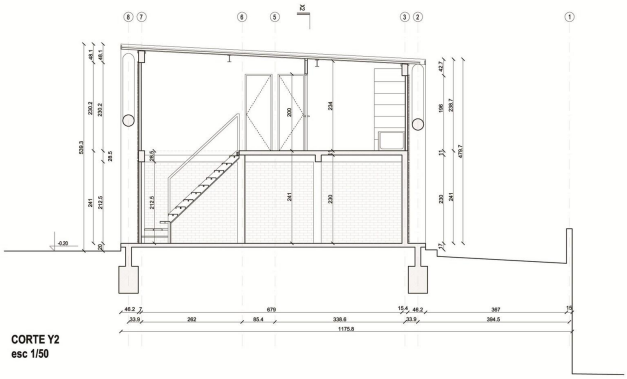


1.10 Section View

The Fuyang region of China possesses a relatively moderate climate with temperatures rarely reaching extremes of hot or cold. The rainy season lasts seven months in this area, making this region ideal for the farming community this project is housing. Stylistically, the architecture not only works to adhere to the language of built space in the region, but also to capitalize on the systematic advantages within the structure. "The roof cantilever out aesthetically reminds the vernacular architectural style in Hangzhou, functionally as part of the shelter considering Hangzhou has a raining season."(Collective, 2019). The shape of the roof works to direct water off of the structure and the ventilation system discussed previously works to maintain the simple facade of the structure while providing ventilation without introducing additional water into the structure through open windows.

Ruca Dwellings: Chile

Chile works within the constraints of a hot climate which is also threatened by frequent earthquakes. The Santiago region is classified as a mediterranean type climate, featuring a long dry season and short, rainy winter. The Ruca Dwellings use passive cooling strategies through gaps in the material on the front and rear facades, held together through "the diagonal made of impregnated pine wood that characterizes the main and rear facades is a structural element that braces the side walls in case of an earthquake" ("Ruca Dwellings", 2013). The section drawing above (Image 2.10) displays how the use of porous materials on the front and rear of the structure allows air to pass through the modular structure.

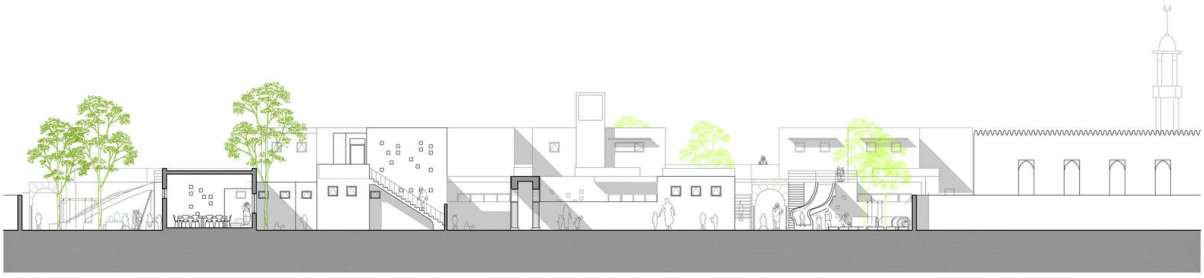


2.10 Section 2

SOS Children's Village: Djibouti, East Africa

"Djibouti is located in the Horn of Africa, which suffers from persistent droughts and severe scarcities" ("SOS," 2020). Known for the hottest climate on earth, Djibouti's architecture emphasizes the importance of passive cooling strategies in the form of shading and ventilation. The SOS Children's Village project takes the arabic influence within Djibouti architecture and strips it down to its essentials, using simple structural systems while retaining the systematic benefits of this style. The site conditions were heavily considered and "natural ventilation and sun shading was intensely studied, introducing natural ventilation towers where needed" ("SOS," 2020). The enclosed spaces are built close

together, forming shaded pathways and courtyards between dwellings and providing breaks in the structure for windflow and ventilation. The elevation view below (Image 3.9) displays the shading effect caused by sectional changes in height as well as the location of the wind towers at the center of the site.



3.9 Elevation

Vegetation

An additional response to the climatic conditions discussed in the previous section within the projects falls within the scope of on-site vegetation. Local plant life is introduced into the built environment of each structure, primarily in the areas of community gathering. Many of the projects utilize an element of community farming within these spaces as well. The use of such vegetation adds to the project in a number of ways. First, the introduction of on-site farming allows the projects to become more independent of the societies they are located in, providing a measure of self-reliance. Second, the use of local vegetation, not necessarily in a farming capacity, works to integrate the built systems with their natural environment, providing additional cooling, insulation and water management on site through the use of natural systems. This promotes the biodiversity of the area and helps to strengthen the ecosystems the projects exist within. Finally, access to and the presence of local flora provides benefits to occupants as far as mental health and connection to the environment.

Collective Living: Fuyang, Hangzhou, China

1.11 Courtyard View

Within the Collective Living project, one can see that local trees and plant life are integrated into the public space of the project (ie. the courtyards). These spaces have also been designed to act as meditative environments in accordance with Chinese culture, incorporating trees, bushes, and seating areas within the courtyard. The buildings themselves are slightly separated with a cluster of buildings sharing a courtyard space. This allows these public areas of community to act as a backyard, establishing direct access to the natural world just outside their doorsteps.

1.12 Exterior View from On-Site Garden

Ruca Dwellings: Chile

The indigenous people of the Mapuche community carry with them the need for access to nature as a part of their cultural ideals. The Ruca Dwellings work to integrate these ideas into all aspects of the design and give the community members as much access to those

areas of the site as possible. It can be argued that, in this project, the architecture is less important than the environment it was built within. As such, the layout of the complex emphasizes the natural environment as much as possible while keeping the design of the built space simple, clean, and organic within the context. “But even in the variegated fabric of houses, the geography of hills so characteristic of Santiago, is imposed on the tapestry of tin roofs that do not exceed two stories high. There, at the foot of these hills, we locate these 25 homes so that they could be as close as possible to nature” (“Ruca Dwellings", 2013).

2.11 Rendered Perspective

SOS Children’s Village: Djibouti, East Africa

The SOS Children’s Village uses the integration of vegetation as a strategy for both mental health and inclusion of biodiversity, “it is a medina with lots of vegetation – Where the inhabitants are encouraged to take care of their plants and benefit from the result” (“SOS,” 2020). This project works to essentially help

3.10 Preserved Tree

raise these children and aid their families. Working with nature begins to root these people in the safety of the community. The residents take pride in their work, establishing separation from society and providing a sense of control. Children learn responsibility as well as important skills in discovering how to grow their own produce and work within their region's conditions. "Vegetation is also an important part of the design: the only existing tree on the site has been preserved and the inhabitants are encouraged to garden" ("SOS," 2020). The use of local plant life is especially important in this case as they will grow well within the severe climatic conditions of the region.

Mental and Emotional Health

A major concern within each of these three case studies is the accommodation of displaced peoples. Each of the user groups features a community that is faced with a social issue resulting in the need for an affordable housing community. Such displacement may have negative effects on the mental health of the occupants, and in this section I will be exploring how each one of these projects has approached this concern. One of the key issues here is how each of the projects creates community development opportunities and connects the residents to both a sense of place and sense of culture. The inclusion of vegetation can also have an effect in this realm as previously discussed; however, this section will focus specifically on community development and the construction of a safe space as a key role in the design process.

Collective Living: Fuyang, Hangzhou, China

In the Collective Living project, the residents are facing relocation from their ancestral housing due to deteriorating conditions and are being moved into this complex to

rectify this issue and create a safe, beautiful space for the community of farmers. In this instance, the community itself has not been broken up, but instead modified to fit the new residential situation. The goal of the project is to provide good quality, affordable housing to this community, while still making it feel like home within the Chinese countryside. "Since moving in, the new residents have reported a high quality of life due to the new housing. The project brings an opportunity to regenerate the countryside besides providing quality affordable housing" (Collective, 2019). The inclusion of updated, yet traditional, structures continues to connect the residence to a sense of place while providing beautiful living conditions and rejuvenating the area at large.

1.13 Courtyard Perspective

Ruca Dwellings: Chile

The Mapuche community needed this project to be approached and designed in a personalized way. This is a people who wish to exist separately from the culture of Santiago, rooted in their own indegenous traditions. The people themselves have faced and overcome adversities as a people who do not relate or thrive within the fast paced culture of the cities that they have been pushed into. The location of the project is on the outskirts of the city, allowing them to have access to the opportunities within that

2.12 Front Entry

environment, yet escape to a home rooted in their own culture. “This initiative arose from a small Mapuche community who were willing to participate in modern society, but didn't want this to lead to an impairment of their ancestral traditions and beliefs" ("Ruca Dwellings", 2013). This project advocates for healing by providing reconnection to their ancestral culture within each detail of the design. Community life within their group is encouraged, yet the space has been privatized from the public eye. The structures are cohesive from the eyes of an onlooker, but the inner familial spaces can be individualized and expanded upon to meet the needs of the individuals residing there.

SOS Children’s Village: Djibouti, East Africa

The SOS Children’s Village project adapts to the needs of its residents in a way that is still different from our previous two examples. Safety is the priority in this project, creating a haven for families experiencing distress and providing a safe space to raise their children. The project emphasizes freedom and safety from the harsh climate and political turmoil of the region through a private and safe facility pushing for family unity- relating to the freedom through privatization emphasized in the Ruca Dwellings project. The complex is shielded from outside viewers, allowing children to run free within the safety net of the complex. The interiors shield the residence from the harsh climatic conditions and provide a diverse range of private and public space. This project is unique from the previous examples as it becomes a haven for a diverse group of people in need rather than a specific community. Uniting the user group becomes a way to develop this community and

3.11 Exterior View

provide an opportunity for connections between people of varying experiences. The sporadic public spaces create a place for friends and children to meet and connect. The private spaces are not closed off, but establish an indoor to outdoor experience continuing the connection between the residents and the broader residential complex while maintaining familial privacy.

Closing Remarks

In this section, I have explored the details of our three case studies through the lens of characteristic components. This study has endeavoured to reveal the following items in regards to the importance of said characteristics. International projects were chosen to gain an understanding of how regional variability can influence a project and an analysis of the cultural ties of the community must be completed in order to fully meet the needs of the user group. Only after this is understood can the project endeavour to meet community development goals and contribute to the quality of life of the society. In this, family dynamics within the culture contribute strongly to the needs of the groups and can define accommodations that must be made within the scope of community projects such as these.

I then discussed the utilization of regional structural techniques and how vernacular design methods were used in the realm of each project including distinctions and connections between public and private spaces, how these are used, and their connection to the culture/user group. This was followed by a discussion of conceptual design within these projects and which design principles have taken precedence. This section also discussed the climatic conditions each project faces, how regional structural techniques can be built upon to best suit the needs of the region, and the uses and applications of vegetation on site. Finally, I looked to the user groups to understand how their circumstances, culture, and histories may contain implications for the design direction.

Findings

In this section, I will analyze each of the aforementioned characteristics through the comparison and juxtaposition of their application within the three case studies. This comparison will provide a lens through which to view the priorities of design in future, similar projects, and analyze the effects of each characteristic on the overall success of each project, including economic viability, structure, and, most importantly, effects on and consideration of the occupants.

International Projects

The three case studies: Collective Living by GAD Architecture located in Dongziguan Village in the Fuyang Hangzhou region of China; Ruca Dwellings by Undurraga Devés Arquitectos on the outskirts of Santiago, Chile; and SOS Children's Village by Urko Sanchez Architects in Tadjourah, Djibouti, each represent affordable multi-unit housing projects in different cultural contexts. The Collective Living project houses displaced farmers in the community who have experienced low housing quality, the Ruca Dwellings create a home for the culture of the Mapuche community, outsiders within the broader Santiago social construct, and the SOS Children's village was built as a safe space for children and families to grow together within the safety of its walls. The case studies show three vastly different cultures, Chinese farmers, an indigenous population in South America, and an East African community feeling the effects of their severe climate and social vulnerability. Using these three international projects allows us to create a structure within this study similar to that of *Multi-Unit Housing in Urban Cities: From 1800 to Present Day* by Katy Chey, which used

time and place to characterize its case studies, whereas I am using socially important characteristics to describe the case studies within their implications for vernacular design.

One can identify how characteristics of a project may be prioritized in accordance with the situational needs of the community, working to highlight the commonalities and differences in order to build a precedent for how to approach similar housing projects using vernacular design techniques in the future. By looking at international projects, one can see that while the structure of each project is similar, the cultural needs are extremely different. Within the Collective Living project, values of familial hierarchy and age in Chinese culture create a design reaction within the spatial layout of the project. Ruca Dwellings, on the other hand, recognizes the individuality of its community members, but emphasizes the connection between its people through the priority of natural common space defined by simple, culturally significant dwellings. Finally, the SOS Children's Village must create connections that may not already exist within this new community, finding common ground between its members through integration of public space melding into its privatized spaces.

Cultural Ties

The integration of local cultures begins to formulate a regionally specific design language that contributes to the sense of place and time within the projects. In the Collective Living project, this is done through the use of *siheyuans*, or traditional Chinese courtyard typologies, positioned between clusters of structure with aesthetics specific to the region. This emphasizes movement between the integrated pathways and establishes places of connection for people to gather. In the Ruca Dwellings, emphasis is placed not on the internal pathways between the structures, but on the common, natural space created between the straight line of Rucas and the adjacent hillside, blending the structure back into its landscape.

This adheres to the principles of the Mapuche people and the importance of connection with nature in their culture. The design of the SOS Children's Village holds strong Middle Eastern influences and establishes the style of the medina, a maze-like organization broken with points of gathering space, blending contrasting spaces to create shading.

There is a common thread experienced through these projects, establishing the importance of connection between people, their community, and their environment. However, this characteristic must be applied to each case study in a different way, one which coexists within the cultural context presented. The maze-like streets rising from concrete structure works well in the context of Djibouti, but the same structure would work against the ideals of a community like the Mapuche people residing in the Ruca Dwellings, as nature has not been established as the foremost priority, but instead shade and movement take precedence.

Community Development Strategies

Community Development strategies are implemented as a direct effect of the cultural identity established in the previous section. The types of connectivity necessary to meet the cultural needs of the community has been revealed, and the establishment of this comes to life within the built structure and layout of the project. The importance of family dynamics in the Chinese culture leads to the layout of fluid structural clusters that can be manipulated based on the privatization needs and connection to other community members. This is established through the courtyard typology. The same privatization needs are considered in the Ruca Dwellings project, but lead to a new design typology when placed in the context of the Mapuche people. The Ruca Dwellings essentially require three different privatization strategies: one which privatizes the community from the eyes of outsiders, creating a safe

space for gathering and expression; another which develops an open and public space for community members to create connections, and finally one that provides a sense of familial privatization which can be found within the dwellings themselves. This layered approach is also present in the SOS Children's Village, one which again protects community members from outsiders, provides space for gathering and connection within the winding pathways and courtyards, and familial privatization within the homes that blends indoor and outdoor space.

The commonality here can be found in the overall inclusion and emphasis of open green, gathering space for the residents to form connections and enjoy the outdoors. The levels of privatization versus public gathering space is dependent on the culture in which it is built; however, the general layered approach present to some degree in all three case studies proves the most viable method of encouraging community development. These spaces can be used for activity rather than just connection, including growth of vegetation and play space for example, which begins to create a defined culture within the community itself.

Family Dynamics

The family dynamics defined by the user group in each project delineate the quality of privatized space, those reserved for the familial unit rather than the community at large. Variability plays a key role in each of the projects; however the level at which it occurs is dependent on the context. In the Collective Living project, for example, the hierarchy determined by age demands an increased quantity of private space for the elderly, and more public, communal space for younger community members. The function of these spaces then defines the floorplan of the site, creating variabilities that allow residents to occupy the space which best fits their needs. In the Ruca Dwellings project, age is less of a concern than the

family unit itself. In this project, private space is derived within the confines of the repeated rectilinear structures, which have the same exterior facade, but can be manipulated internally based on the abilities of the resident. In the SOS Children's Village, the family unit is also emphasized, but children begin to take precedent. The goal in this project is to foster the development of its community's children, the public spaces present become play spaces and the private spaces blend the interior with the exterior world, creating open space wherever possible.

This characteristic emphasizes the importance of local context within multi-use housing projects, as hierarchy of space is directly determined by the needs of the community members. When the goal is to promote the quality of life of the occupants, the designer must first understand the intricacies of the context before beginning to create built space that is intended to meet the goals of the residents, engage them with their environment, and design a space that is a direct reaction to the complexities of the project's conditions.

Structural Regional Techniques Used

Regional structural techniques used can also be defined as the use of vernacular design practices within the scope of each project. This component is central to this research analysis as it provides an in-depth consideration as to the utilization of vernacular architecture. There are three central threads that can be followed within each of the projects as related to this characteristic: the inclusion of design that stylistically adheres to regional context, local material usage, and integration of commonly used systems. The roofline typologies of the Collective Living project work as a water management strategy, and the 24 mm (a little less than an inch) permeable masonry facade sections create clean openings which allow for year round ventilation. Brick, steel, and glass are readily available within the

region and are used to ensure optimal thermal and ventilation performance. The double layers of horizontal rods fastened by a diagonal structural beam in the Ruca Dwellings provides light filtration, air ventilation and reinforcement from earthquakes while using artisanal concrete framing and masonry as a base. The dynamic modularity present in the SOS Children's Village creates breakages in structural mass that allow for airflow and shading throughout the entirety of the site by using only cement blocks, reinforced concrete structure and cemcrete finish.

Each structural system has the ability to solve the site specific concerns of the project because of the utilization of methods that are familiar and proven within the region and use materials that are locally available and understood. This can contribute to the reduction in overall cost of the project, as the technology does not rely on the importation of knowledge, labor, or material. The systems provided with the use of these vernacular construction practices provide the best quality functionality of the space while retaining the historical design language of the region. These systems have been developed in each project from their traditional practice to gain the best quality solution to the presented problem, a practice which can then be developed within other regional projects, spreading the knowledge and skill sets developed within the community.

Public Space-Types, Uses and Relationship to Private Space

The organization of private and public space varies across the three projects, but the general concept is consistent. In the Collective Living project, the south end of the project contains the majority of public space and more privatized space is located at the north end, creating a range of public and private space that can be occupied based on the needs of the user. Within the Ruca Dwellings, privatized space creates a wall between the public and the

community, characterized by the straight row of Ruca Dwellings at the front of the property. Each Ruca has direct access to the public green space at the back of the site and adjacent to the hillside that is important to the Mapuche culture. Private spaces are clearly defined in the SOS Children's Village as well, but are located in a more sporadic form throughout the property, defining the avenues and pathways between the public courtyards.

In each of the three projects, the presence of private space defines public space and vice versa. These spaces are planned in an intricate pattern consistent with the needs and intentions of the communities residing within their walls. The public spaces within each community are open to the residents, but shielded from outside spectators, creating a sense of inclusivity and privacy. Private spaces can be adapted to meet the individual needs of dwellers, but have the capacity to open up into the public spaces, creating central community hubs just outside of each doorstep. These usages also contain commonalities, defined by places of connection used for gathering, play and access to the natural environment, important to each context in its own way.

Design Principles Emphasized

The three primary design principles within each project share the principle of unity. This is expected within the scope of these projects as each intends to create a cohesive living environment for the multi-unit project and unify the residents at large. It is also interesting to note how principles identified in one project can be implemented in the others, further defining the hierarchy created by the user needs of each project. Rhythm and variety are identified in the Collective Living project, emphasizing the movement and flow from public space to private throughout the project. Continuity is found through color scheme, but variances are created in the cluster system that allow for manipulations based on familial

need. Balance is identified within the Ruca Dwellings as defined by the regular symmetries throughout the layout of the site. While the Collective Living project and SOS Children's Village certainly contain more variances, there is an overall sense of balance achieved across the floor plan as a whole. The SOS Children's village further defines this variability through the form of sectional changes in roof height, making a hierarchy of space both in plan and section of particular interest. Ruca Dwellings and SOS Children's village both make use of proportion. SOS Children's village achieves this through the formerly mentioned sectional changes, which result in the existence of shading and layered pathways. Ruca Dwellings operates on a uniform two-story elevation, directly proportional to the adjacent hillside. The analysis of these design decisions helps us to understand how the variances in a project program can help us to manipulate and define the boundaries within the design of a project to best suit the need.

Response to Climate

Climatic conditions work to further define how the integration of local technologies can be an effective and affordable approach to design within each region. This highlights the differences within the scope and program of each project. The SOS Children's Village exists in the hottest climate in the world, and is challenged by arid conditions and severe resource scarcity, while the Ruca dwellings in Chile experience less extreme hot temperatures with the added consideration of earthquakes in the area. Collective Living in the Fuyang region of China, on the other hand, operates within a relatively moderate climate, but endures a seven month long rainy season. It is safe to say that the integration of similar systems within these three projects is not an intuitive move within the design, and each case study must instead find localized solutions to these problems. By using technological systems that are

commonplace in the region, any issues that arise can be addressed without external knowledge and can be corrected efficiently within the local context.

Cooling, shading and ventilation are all introduced on site through passive design strategies, but are manipulated within the context to best suit the vernacular design. With ventilation for example, the Collective living project uses openings in a waterproof brick wall layer to prevent the introduction of water internally while providing ventilation in the rainy season, whereas the Ruca Dwellings use gaps in the wooden rod facade, as rainwater is less of a concern. The SOS Children's village deals with on-site ventilation through the introduction of wind towers, which direct air through the avenues and pathways present between the privatized structure. Each adapts to its need effectively, but must be understood within a different context.

Vegetation

As mentioned previously, on-site vegetation can establish a number of benefits for community members. These include the introduction of on-site farming, use of local vegetation to promote biodiversity, integration of built systems with their natural environment-providing natural cooling, insulation and water management, and mental health benefits to occupants. Each of the projects integrates local flora into the public spaces of the project with variances. Collective Living has built plant life into its public spaces by adding landscaped trees and bushes around the seating areas and SOS Children's Village was built around the only existing tree on site with space for community gardening integrated into the floorplan. Ruca Dwellings, on the other hand, was built with the preservation of nature in mind, with the footprint of each structure taking up minimal amounts of space and conserving the majority of the property for the preservation of the hillside. The use of local

plant life in these instances is especially important in order to promote the biodiversity of the area, and use vegetation that has the best chance of survival with minimal care.

Mental and Emotional Health

The mental and emotional health of their occupants is considered in each of these projects. It becomes apparent that each case study took great care in the accommodation and analysis of the experiences of their respective user groups. Above all, this characteristic analyzes the improvement of the quality of life of residents and the capacity of the project to create a haven for displaced individuals. While each case study approaches this challenge in a different way, the use of vernacular methods have been applied specifically to meet local needs and adapt the project to accommodate the social needs of the user group. This characteristic needs to be approached from an individualistic standpoint; however, there are some general aspects of their considerations that overlap and allow for further broad discussion.

First of all, the cultural practices and traditions of the community must be adhered to and present themselves at root in the design vernacular in order to establish a sense of home. Secondly, integration of nature and vegetation within the project can contribute to connection with the new environment and foster community engagement. Finally, connections between community members must be encouraged through the avid implementation of community space and social opportunity. The integration of these three practices help to establish the community within the built space.

Conclusion

The insight of experts in the field, detailed in the literature review, provide perspectives into four important considerations in the application of vernacular, sustainable architectural practices: social, architectural, environmental, and implications on quality of life. The methodology section further breaks down the aforementioned considerations into ten specific characteristics: social considerations into international projects, cultural ties, community development strategies and family dynamics; architectural considerations into structural regional techniques used and public space usage; environmental considerations into response to climate and vegetation; and finally implications on quality of life through mental and emotional health. The overarching considerations enveloping these characteristics inherently create overlap within the analysis, as they are reacting to and blending with one another and the environmental constraints they exist within. The categories concerned with social dynamics and quality of life also overlap heavily, as the social endeavors of the community create a direct impact on quality of life and determine whether or not the strategies produced within the projects are successful.

I found, through this analysis, that these ten characteristics are the most heavily developed within each of the projects, emphasizing that, while the use of vernacular methods is prevalent, architectural form is not the main priority within the designs. Vernacular design is particularly successful at integrating the built environment with local culture and the natural surroundings. In each of the case studies, it was shown repeatedly that the design strategy in place served a specified purpose, catering above all to the needs of the user group. This method achieves this primarily through the use of local structural practices, which have

the ability to define the space within the culture and create a built framework for the emphasis of community development goals.

Vernacular design strategies place equal emphasis on structural durability and environmental sustainability, but higher priority on community development and quality of life. The architectural and environmental considerations presented work to promote the central idea that community form drives the design. We can see this numerically through the number of characteristics that fall within each consideration, with social and quality of life representing five of the ten characteristics, architectural presenting three, and environmental presenting two. So why is this important? The emphasis on development of social structure is directly in line with the design adage of form following function. Vernacular architecture lends itself particularly well to this ideology, as the needs of the users directly determine the form of the project. Native building practices are utilized, but are also developed and manipulated to best suit the needs of the user group. Finally, the use of vernacular design techniques allows the projects to handle regional environmental concerns in the most effective way while continuing to use this constraint as a way to promote quality of life.

This study acknowledges that the chosen projects are particularly successful at meeting the characteristic requirements under consideration. Given more time, it would be beneficial to analyze studies attempting to achieve community development strategies focused on sustainability, but utilizing techniques in addition to vernacular design methods and concepts. This method would allow for a more in depth comparison as to the strengths and weaknesses within each design method as compared to one another. However; each of the chosen case studies provides a unique perspective into the merits of vernacular methods, which is the focus of this study. Analysis of varied scenarios allows us to place the

characteristic priorities of vernacular architecture into a variety of scopes, determining their viability within a global context. In future affordable, multi-unit housing projects, I would recommend using the characteristics laid out in this study as a basis in forming a project centered around community development. This gives a very successful framework for research during the initial design process, remaining conscious of the users and how the project can best aid in the development of a strong community, and is adaptable enough to be applied to a broad range of regional and cultural considerations.

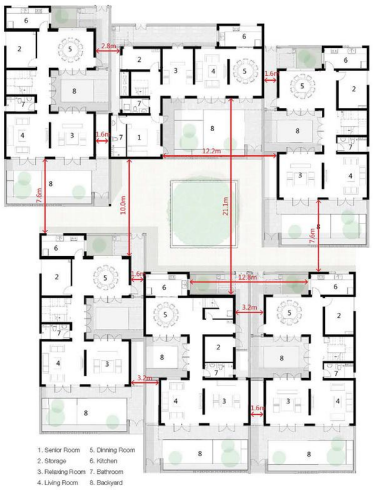
List of Images

Yao, Li et al. (2016) *Dongziguan Affordable Housing For Relocalized Farmers* [Images]. Retrieved from https://www.archdaily.com/802369/contemporary-rural-cluster-dongziguan-affordable-housing-for-relocalized-farmers-in-fuyang-hangzhou-gad

1.1 Exterior View

1.2 Exterior View

1.3 Cluster Scale Model



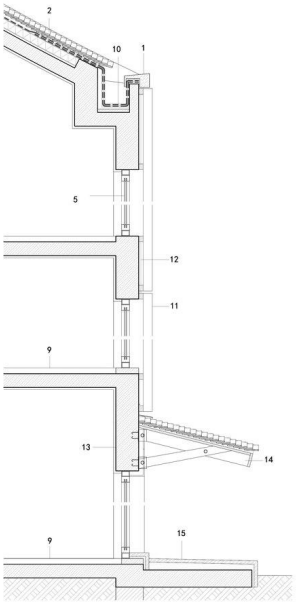
1.4 Ground Level Floor Plan

1.5 Site Scale Model

1.6 Exterior View

1.9 Corridor View

1.7 Facade View



1.10 Section View

1.8 Interior Perspective

1.11 Courtyard View

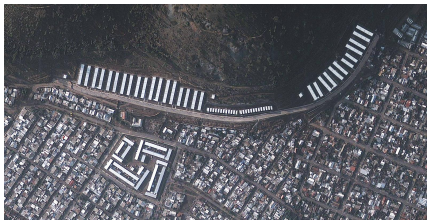
1.13 Courtyard Perspective

1.12 Exterior View from On-Site Garden

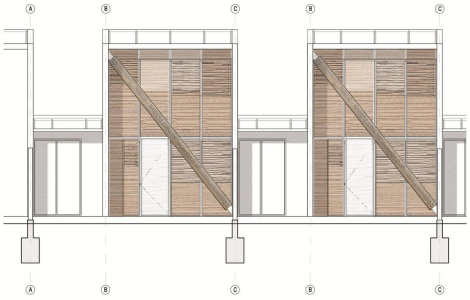
Undurraga Devés Arquitectos et al. (2011) *Ruca Dwellings* [Images]. Retrieved from https://www.archdaily.com/456299/ruca-dwellings-undurraga-deves-arquitectos?ad_source=search&ad_medium=search_result_projects

2.1 Construction Image

2.2 Front Facade



2.3 Aerial View



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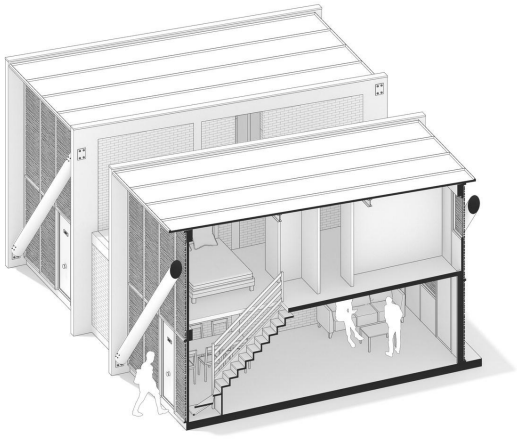
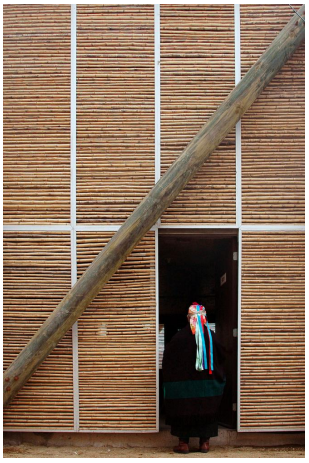
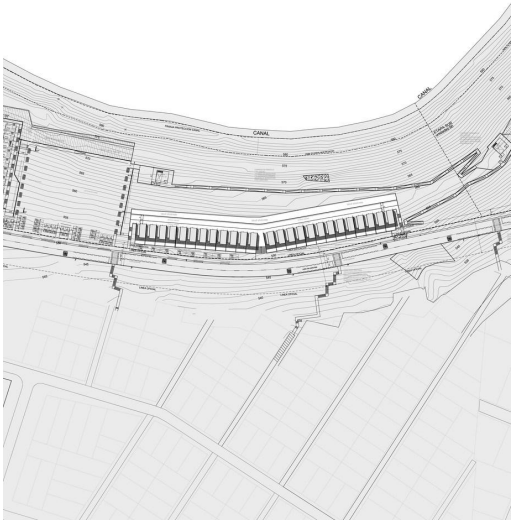


2.5 Isometric Section

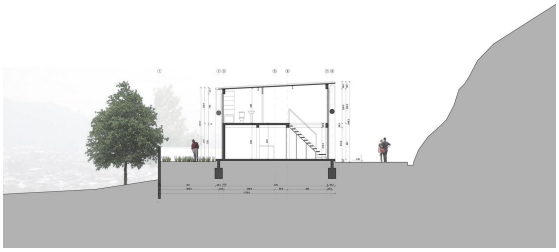


2.6 Facade Material View

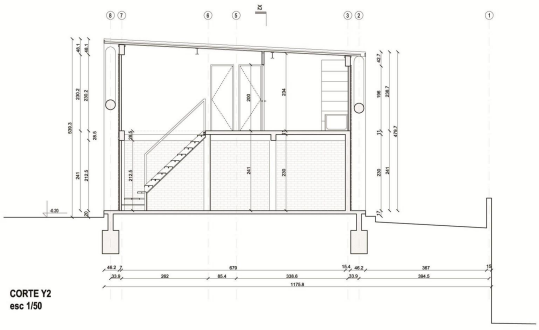
2.7 Unfinished Interior



2.8 Site Plan

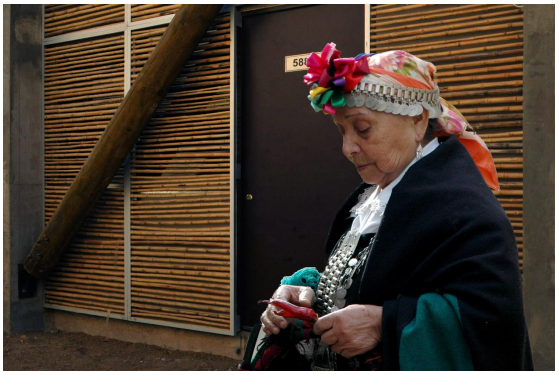


2.9 Section 3 in Context



2.10 Section 2

2.11 Rendered Perspective



2.12 Front Entry

SOS Children's Village: Djibouti, East Africa

Callejas, Javier et al. (2014) SOS Children's Village in Djibouti [Images]. Retrieved from https://www.archdaily.com/773319/sos-childrens-village-in-djibouti-urko-sanchez-architects?ad_source=myarchdaily&ad_medium=bookmark-show&ad_content=current-user

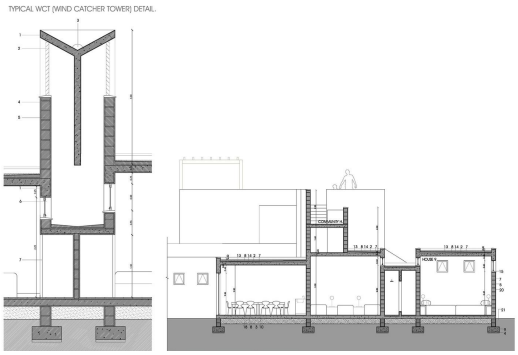
3.1 Rooftop Perspective

3.2 Corridor View

3.4 Residential

3.3 Courtyard View

3.5 Interior Playground



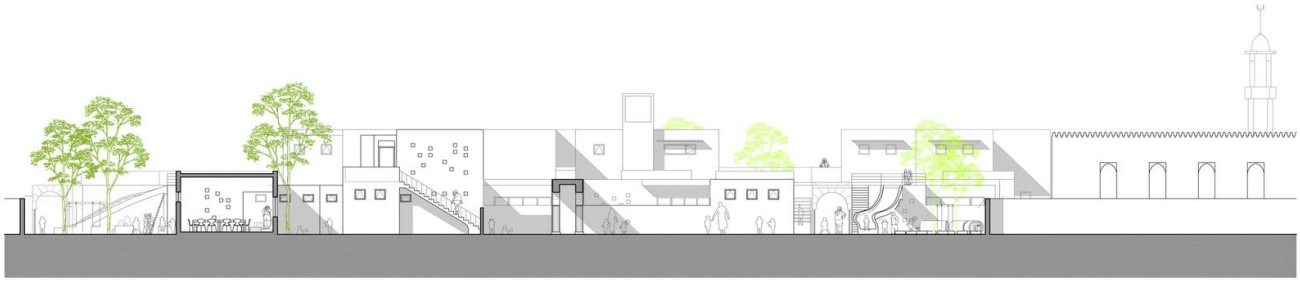
3.6 Section View

3.7 Courtyard View

3.8 Ground Level Floor Plan

3.10 Preserved Tree

3.11 Exterior View



3.9 Elevation

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