

HER OWN HOME

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ABSTRACT

This research paper explores the tool of parametric design to address more inclusive, sustainable, and adaptive housing in the vulnerable context of the informal settlement of Los Arenales, in Antofagasta, Chile. Recognizing residents' rights and self-built methods, the research focuses on the inhabitants needs, cultural background and preferences, especially of women (soft parameters), and evaluates location, environment, materials, and craftsmanship (hard parameters). The goal is to propose housing solutions that combine both soft and hard parameters, enabling diverse typologies catering to end-users with a focus on inclusivity, sustainability, and adaptability in the challenging context of informal settlements.

KEYWORDS: *parametric, informal, self-built, women, inclusive, sustainable, adaptative, Los Arenales*

I. INTRODUCTION

In the exploration of social housing, the focal point revolves around social and environmental sustainability. To do so, the settlement of Los Arenales stands out, due to the indispensable role women play for the community, taking on leadership responsibilities. A pivotal shift is proposed for the design, aiming to develop a new perspective into housing typologies in a manner that not only accommodates but also celebrates the unique contributions of these women. The concept of incorporating women's needs into the design process represents a significant departure from the conventional, archaic approach to housing design that has persisted until the present day, neglecting the unique requirements of its (female) occupants. The 'cookie-cutter' or 'copy-paste' approach into social housing design, where one typology serves everyone forces people to adapt to the architecture and not the other way around (Kershner, 2012). I personally stand against this way of designing social housing. Consequently, the essence of this research is to empower the inhabitants to articulate their specific needs. Furthermore, this research extends beyond merely examining the needs of women, the inhabitants, and their communal aspects, which can be categorized as 'soft parameters or 'software'. It is key to understand the culture and social context of Los Arenales to be able to translate it into parameters. Furthermore, it encompasses a comprehensive evaluation of the location, the surrounding environment, the available construction materials, and the knowledge of the craftsmanship, that can be classified as 'hard parameters or 'hardware'. In broad terms, the design aims to propose a housing solution that incorporates a blend of soft and hard parameters, allowing for the implementation of diverse typologies tailored to the end-user. The objective is to move away from the conventional approach of imposing a uniform design typology in social housing, emphasizing the importance of creating spaces where diverse families and individuals can thrive (Currie & Sorensen, 2019). All of this is undertaken while acknowledging the validity of self-built construction methods and the residents' rights to remain and settle where their current houses and community are.

To translate all this contextual research into a design process, my thematic research focuses on the documentation and organization of vast amount of information related to the soft and hard parameters. The intricate web of data is central to the research and by using rules or guidelines, the apparent chaos of information is controlled (Viamonte Fernández & Peinado Checa, 2014). These do not have to be definitive, parametric means flexibility and adaptability, they can vary through the design process. Furthermore, it is particularly interesting to employ this rather innovative technology in such a resource-constrained and vulnerable environment. As a result, this research aims to investigate the use of parametrization and digitization as a tool in a data driven design in the context of the informal settlement of Los Arenales. For this, organizing the data into soft and hard parameters is a crucial point to understand the complexity of the

inhabitants, especially the women and the given context. Therefore, the main problem case of this research is how can data utilization in design contribute to the development of social and environmentally sustainable housing models based on the specific needs of the inhabitants of the women led, self-built settlement of Los Arenales in Antofagasta?

To sum up, the expected result of this thematic research, and its subsequent integration into design, is the development of an alternative methodology for social housing. By effectively harnessing data-driven design principles, parametricism, and a deep commitment to the women living there, the research endeavors to produce housing typologies that are inclusive, meaning socially sustainable, and environmentally sustainable for the community Los Arenales. Through this process, the inhabitants' needs and requirements will stay at the forefront (Figure 1).

II. METHODOLOGY

The new methodology is rooted in the application of data collection techniques that distinctly prioritize a social and feminist perspective to than be applied into the quantitative aspects of an architectural design (Figure 2). The research focuses on meeting, listening and learning from the women of the settlement, and all inhabitants in general. It is key to understand the culture and social context of Los Arenales to be able to translate and seamlessly blend the qualitative into quantitative parameters. The essence of my research is exploratory and experimental in nature, with a focus on pioneering a novel approach to social housing design, rather than providing a final, rigid blueprint. This emphasis on the social dimension introduces fluctuant parameters, as the needs and priorities of the inhabitants may vary not only between different families but also over distinct periods of time. It is crucial to recognize that this approach provides a snapshot, not an absolute truth, of the settlement's dynamics. Furthermore, my methodology is centred on the concept of planning with informality, which "requires somewhat different knowledge, skills, and methodology, as well as presents different moral dilemmas than planning in other contexts" (Papke, 2020, p. 2).

The research employs a multifaceted approach to gain comprehensive insights into the contextual landscape of Chile and Antofagasta. Recognizing the inherent complexities within the socio-political context as an outsider is crucial; thus, engaging in a thorough literature review becomes a means to foster broad knowledge. Integral to this methodology is the collection of contacts on site, many of which are authors of the analysed literature (Figure 3). These connections serve as pivotal conduits, enabling the collection of firsthand perspective (primary data) and enriching the study with valuable insights. The interviews follow a semi-structured format, encouraging open dialogue with non-leading questions (Figure 4).

During the research trip, the focus centres on understanding the community, particularly the management and organizational strategies of female leaders within a settlement. The research aims to gather information ranging from personal anecdotes to legal insights, treating these leaders as experts. Interviews also involve inviting participants to sketch and express their needs through drawings, serving as conversation starters and aids in mutual understanding (Figure 5). One of the main goals amidst these interviews is to bridge geographical and cultural gap, immersing in the community's daily lives and building trusting relationships, to produce knowledge through respectful interactions (Quirós, 2014, p. 63).

After the site visit, the wealth of data collected from Los Arenales becomes the cornerstone of the research journey. To navigate this trove of information effectively, I adopt a multifaceted approach that combines both qualitative and quantitative analysis. This dual approach ensures a holistic comprehension of the community's dynamics, encompassing its needs (software) as well as its architecture (hardware). Creating diverse datasets, a comprehensive overview of individual families, their unique circumstances, and the nuanced narratives shared during interviews is enabled. The goal is to find out correlation between qualitative insights and quantitative parameters, facilitating a more nuanced understanding of how individual experiences align with tangible architectural considerations.

Reflecting on the participatory nature of this research journey underscores the potential impacts, both positive and negative, on the Los Arenales community. Engaging with locals and entities offers a platform for mutual exchange, yet fieldwork prompts contemplation about potential one-sided benefits. Addressing concerns about equitable exchange becomes pivotal, emphasizing the reciprocal contribution to the community during and after the research phase.

III. RESEARCH

3.1. SOFTWARE OF LOS ARENALES – INTANGIBLE CONCEPTS ABOUT LOS ARENALES

3.1.1. GENERAL: BROAD CONTEXT UNDER RESEARCH

In a nation with a population of only 19 million, over 71.961 households reside in informal settlements, a number that continues to grow (Ministerio de Vivienda y Urbanismo, 2022). Between 2021 and 2023 alone, approximately 75,72% more families relocated to a *campamento* [Chilean term for informal settlement]. As stipulated by the Ministry of Housing and Urban Development in 2017, that a *campamento* is, a group of families living in poverty and social vulnerability, who informally occupy land as a result of an individual or collective strategy to satisfy the need to live, preferably in urban sectors, with 8 households or more, in concentrated or contiguous precarious housing and lacking at least one of the three basic services corresponding to electricity, water and gas (Ministerio de Vivienda y Urbanismo, 2022). However, it is estimated that the housing crisis impacts over 600.000 families, significantly outnumbering those residing in the *campamentos* (“El Chile de Las Tomas y La Crisis Habitacional Que Dejó La Pandemia,” 2022). On average, people in Chile reside in *campamentos* for about eight years, where they often ended up driven solely by immediate needs, and pressing urgencies (Vergara-Perucich, 2020, p. 18). With one of Latin America’s most privatized economies, citizens fight to “access to social rights in a struggle in a neoliberal society where nobody grants you anything” (Martin, 2019, p. 68). Thus, in Chile, *campamentos* directly stem from the government’s subsidiary role (Farha, 2018). On current times, the Government of Gabriel Boric, elected in 2022, proposed an extremely ambitious *Plan de Emergencia Habitacional*, [Emergency Housing Plan] under which only in the Region of Antofagasta 17.000 houses should be built by 2025. Almost two years after the plan was implemented, only 922, have been constructed (“Plan Emergencia Habitacional - Informe 2023,” 2023). Nevertheless, this proposal addresses the urgent housing shortage rather than the underlying structural issues, which is primarily attributed to the lack of available land, to which this plan does not provide a comprehensive solution to this core problem (de la Fuente, 2023). However, noteworthy aspects include the potential for positive outcomes, such as directing investments towards enhancing services in existing *campamentos* instead of displacing communities. This strategy is embodied within the PEH in the initiative *Plan Construyendo Barrios* (Ministerio de Vivienda y Urbanismo, 2022, p. 55).

The housing problematic extends to disproportionately impact migrants, primarily from Bolivia, Peru, and Colombia, arriving via the northern regions such as Antofagasta (Tapia Gómez, 2020, p. 17). They make up to 34,7% of the households in the *campamentos* (Gómez, 2023). Immigrants and Chileans were initially renters in urban areas, financially stable and part of the formal economy (Cifuentes, 2023). However, several factors, including racism, led to their inability to sustain rent payments, forcing their relocation to *campamentos*. In the northern regions, especially in Antofagasta, inequalities are incremented by the market of the miner. This sector has a direct link to the poverty of the region, or better said, disparities (Ferrer, 2018). Antofagasta “has the largest copper and lithium deposits in the worlds and is the largest producer of both minerals” (Arias-Loyola & Vergara Perucich, 2020, p. 283). The consequences of the extraction include contamination, destruction of the ecosystem, unemployment, precarious living standards as well as a disproportionate increase in the housing and renting prices due to the exorbitant salaries of the people working in this sector.

3.1.2. SPECIFIC: SELF-BUILT AND SELF-MANAGED CAMPAMENTO

Los Arenales specifically aligns with Lefebvre's notions, advocating for “grassroot organizations to form a political agenda for social transformation through utopian thinking” (Vergara-Perucich, 2020, p. 3). This implies that, currently, a sense of belonging to the city is absent, yet there exists “the possibility of creating a different city, thanks to the radical participation in all public domains” (Lefebvre, 1968). Thus, the informal settlement of Los Arenales, the residents, and the neighbourhood transcend mere physical spaces. Under the cooperative of Rompiendo Barreras they encompass social dimensions, daily life, collective histories, and intangible elements that coalesce to form a cohesive whole (Costes, 2010). Being led mostly by women and united in 16 housing Comitees, they have advocated for change and “developed a master plan by applying transductive reasoning to advance their political agenda” (Vergara-Perucich, 2020, p. 7). Collaboratively, for example, they have implemented safety measures to mitigate risks, establishing Emergency Brigades after campamento fires to avert potential disasters. Remarkably, 90% of those who joined were women (“Habitantes de Campamentos de Antofagasta Se Capacitan En Emergencias,” 2020). Together, they unite in advocacy for their people. This proactive involvement stems from their direct engagement in traditionally understood as feminine duties, encompassing the upkeep and tidying of communal spaces, managing food and its preparation, and engaging in public social exchanges. These responsibilities are influenced by archaic societal, of unwritten norms. Where “men often justify themselves by saying that they don't have enough time” (Gómez León & Merino Leyton, 2022, p. 25). While it is taken for granted that women do have time after cleaning, cooking, working, and taking care of the children and elderly. Collectively, these women support each other, not only enhancing their personal living standards but also uplifting their families and the broader community.

3.2. HARDWARE OF LOS ARENALES – TANGIBLE DEVELOPMENT

3.2.1. GENERAL: BUILDING SELF-BUILT CAMPAMENTOS

Antofagasta, observed from above, echoes the elongated and slender shape of Chile itself, tucked between natural confines, the Pacific Ocean on the western side and the Andes on the eastern boundary. Situated in the northern reaches of the country, the city finds itself bounded in by the world's most arid desert, the Atacama Desert. Consequently, its parched and lifeless terrain contrasts with the vibrant hues of the surrounding waters. Gifted with a perpetually open sky, scarce rainfall, and minimal cloud cover, Antofagasta benefits from the ceaseless ocean breeze, affording its inhabitants an eternal, temperate climate, neither excessively cold nor oppressively hot. Despite this idyllic setting, the city, spanning forty-five kilometres in length and a mere 2,5 kilometres in width, grapples with topographical challenges that hinder the construction of itself. The scarcity of flat land is conspicuous, as the Cordillera de la Costa [name of the mountainrange] rises rapidly. Along the coastline, modern and covered in mirroring glass skyscrapers and a pedestrian-friendly waterfront contrast with the eighty-nine campamentos climbing up the mountainside, attempting to establish homes on uncharted terrain for over 7.298 families (Roldán, 2022). This juxtaposition encapsulates the pattern where the higher the elevation, the scarcer the resources and lower the financial means available to its residents. Although the city is known as “The northern pearl” and on the news its *campamentos* are ironically entitles as “The Chilean Dream,” they could be better described as ghettos of exploitation (Martin, 2019, p. 6). From any vantage point within the city, this paradoxical landscape is visible, a perpetual duality, offering a continuous two-sided view (Figure 6).

3.2.2. SPECIFIC: BUILDING THE CITY OF LOS ARENALES

Los Arenales translates to English as “The Sandbanks”, capturing the essence of its geographical location. This campamento resides upon a striking site marked by a thick layer of sand overlaying exposed rock, occupying a rugged and uneven site and sprawling 11,4 hectares of public land (Arias Loyola et al., 2023, p. 12). The construction of Los Arenales began during nighttime to mitigate the risk of potential eviction by the law enforcement. The process involved a systematic division of the area, establishing well defined street layouts. In a swift and intense effort, within

just a couple of nights, more than 20 houses can emerge, creating the new campamento. At this initial stage, any available material, be it cardboard, tents, or wooden planks, is utilized within budget constraints. Over time, through collective labour, more durable materials gradually replace the light ones, such as concrete or welded metal structures. The duration of this progression varies, spanning from days to weeks or even months, contingent upon the families' resource availability. With time, a connection to the water lines, the sewages and power is ensured, all of this is done by them or by someone they hired. From the city's side it is a clear message, if one lives in a self-built settlement, it does not belong to the city. This is visible just by walking around the campamento, where one side of the street is paved, and the half next to the settlement, is not (Figure 7). Currently Los Arenales, as an exception to the other campamentos are on the path of changing this while engaging in open conversations with the leaders about the process of settling and making of a neighbourhood.

Despite many of the men working either in construction or in a job related to craftsmanship, many of the houses are in critical state. From a personal analysis on site and their own statistics, it could be stated that around 70% of the houses are precarious and in relatively poor condition, impacting the lives of their inhabitants (Rompiendo Barreras, 2023, p. 2). From enduring cold due to holes in walls and roofs, to dealing with leaks or the lack of light and ventilation from the absence of windows, various factors demonstrate the substandard state of many homes. It is noteworthy that there are also very good houses with multiple rooms, polished floors, and even balconies or terraces, all depending on the family and what they have been willing and been able to invest in the construction.

3.3. TRANSLATION INTO DESIGN

3.3.1. ADAPTABILITY - DATA IN ARCHITECTURE

Looking back into the technical aspect of this research paper, parameters and information, when organized and governed by rules, coalesce into a system, creating a network of possibilities. Although the word rules might sound stiff and set, the whole idea of the system is that they can vary, therefore, be able to adapt, change and explore further solutions. As a result, "parametrization is a mechanism that allows the application of the same algorithm to different types", enabling the selection of the most effective solution from numerous proposals to address the problem (Viamonte Fernández & Peinado Checa, 2014, p. 115). The created network of proposals is not solely a tool for information filtration; it also serves as a foundation for an architectural design. Thus, this technology empowers architects to comprehend, organize and filter copious information, facilitating the design for more fitting end products. This evokes a fundamental question: At the end, who shapes the design? Is it the computer, filtering data and making decisions, or the architect, interpreting the information and crafting the final product?

The duality between Communicative Reality (the architect) and Instrumental Reality (the computer) not only concerns the data itself, but also its collection methods. For instance, traditionally census, often overlook spatial dimensions within settlements, focusing solely on inhabitant counts (DESA, 2019). Nonetheless, much more information is needed, that only the inhabitants can provide, such as their financial possibilities, their needs, their dreams and their requirements. It is incumbent upon the architect to navigate biases, transcending mere numerical data (the computer) and viewing technology as an enabling tool rather than an absolute truth, therefore creating an empathetic truth (the architect). However, I advocate that the architect's interaction with the computer can be of great advantage a symbiotic relationship, as a tool.

As important as it is to understand who is responsible for the use of data, it is to consider, what information is worth being stored. Patriarchal societal norms make invisible the lack of data that regarding women, which affect their lives daily. It could be as insignificantly small burden as not reaching the top shelf because it was set based on the male average height (Travis, 1993). The male reality in sizes and lifestyle, between other aspects, has been used as the generic norm. This discriminatory standard is even visible in many language constructs. As Criado Perez exemplifies, there could be a room with hundred female teachers, in Spanish *profesoras* and the moment one male teacher would walk in, they would all become *profesores*, the generic masculine (Criado

Perez, 2019, p. 6). Regarding language, it is important to point out, that the women leading the settlements in Antofagasta, are not just leaders *dirigentes*, but they are *dirigentas*. The feminine word is used in this case as the default one, as they are the solely ones managing the settlements (Figure 8).

Through this research and the subsequent design, the aim is to investigate the impact of architectural decisions on the sexual division of labour, exposing its negative influences on women's lives. For instance, a considerable number of women residing in informal settlements subsist on a day-to-day basis. Consequently, an unexpected event, such as inclement weather that prevents them from work, may leave them without food for the day (Marín, 2023). These women engage in various forms of employment, often conducted from their residences, such as selling drinks, preparing meals, or cutting people's hair (Figure Zoning Uses Map Los Arenales). In informal settlements lacking regulatory zones, these domestic spaces, seamlessly transform into commercial establishments. Nonetheless, currently within government-developed public housing projects, the designated use is merely for residential purpose. This stringent policy dictates that "running a business from your home is strictly forbidden" (Criado Perez, 2019, p. 44). As a result, these entrepreneurial women face the risk of homelessness or unemployment, as their means of livelihood remain invisible due to insufficient research and understanding. Meaning, the solely act of working to survive could end up with them being evicted as the planning of the zone was not done with them in mind.

Out of the conversations with many women, needs and dreams were written down. A compilation of their parameters, including the number of inhabitants their cultural background, their pride in self-building, the needed rooms and functions as well as their dreams and hopes for a better home were considered (Figure 9). These conversations nourished the datasets out of which the quantitative parameters can become a housing typology. The imperative within this context is to preserve and uphold the uniqueness of each resident's dwelling. Ultimately, it is everyone by themselves, who, through conversation and visuals, shape and designs Her own Home.

3.4. SCALES OF INTERVENTION

The development of the different variable typologies as outcome of this research is not merely based on their anecdotes and their stories. To be able to design a house, it is not only necessary to consider the number of rooms or the construction material; one must propose possibilities for how to distribute and connect these rooms and these materials. Therefore, as an architect, I suggest a couple of rules or standards from what I learned on site and my expertise as an architect, organized at different scales, ensuring a final design that is inclusive and socially sustainable (software). In the more constructive section, a more collaborative approach is taken, considering their construction knowledge and their intention to self-build to achieve homes based on materiality and environmentally sustainable principles (hardware).

3.4.1. INCLUSIVITY AND SOCIAL SUSTAINABILITY - SOFTWARE

I. THE BODY SCALE

Starting from the smallest scale, the physiology of the end-user, specially the women, will be considered to tailor the housing design. Depending on the ethnical background body sizes change. As mentioned, over 80% of Los Arenales population is migrant, coming mostly from other nearby Latin American countries. To develop the new body scale, average female heights from Peru (154cm), Colombia (157cm), Bolivia (155cm) and Chile (159cm) have been considered (World Population Review, 2024). While still being different, they are averagely smaller than for example the Netherlands (170cm) or even Spain, my home country (162cm). By considering this, *La Formula* is made from the different measurements from these local women ensures that the future typologies are created for these women specifically. The name *Formula* (a feminine word in Spanish) refers ironically to Le Corbusier's Modulor, while providing a new perspective. By looking at it from the opposite gender and making it more flexible with different body types, *La Formula* becomes a diverse and inclusive parameter. Out of *La Formula* in The Body Scale elements and spaces will be specifically adapted to these women. This could influence them

feeling more comfortable and at home as the counter depth is adapted to their reach, the shelf to their height, and the corridor to their width and movements.

II. THE INTERIOR SCALE

Only 30% of households correspond to the traditional family model, typically consisting of couples (male + female) with two children, for which houses tend to be designed (Collectiu Punt 6, 2019). Regardless of family size and its members, it is essential to eliminate any hierarchy among individuals in a living space based on factors such as gender, age, or other conditions. Spatial configurations often lack flexibility, with rigidly defined uses in physical forms. This inflexibility becomes apparent when considering hidden household rooms like the laundry or kitchen, which could be more centrally located to advocate for more visibility in the burden of the domestic labour. By incorporating large, flexible openings between rooms, spaces could be opened during household chores. This avoids women being secluded in the background of the domestic sphere, ensuring their presence is not hidden. Additionally, this more inclusive design through The Interior Scale could encourage others to participate, as they witness the responsibilities and efforts involved in managing a household. Moreover, beyond domestic functions, considerations should extend to integrating spaces for businesses, workshops, or shops if needed within households.

Along the same lines, these broad connections could enhance ventilation and natural light within the house. Currently, a significant issue in Los Arenales is the lack of windows and openings, resulting in inadequate fresh air and direct sunlight. Mimicking the existing large openings in the house could facilitate proper air circulation between the limited available openings.

3.4.2. MATERIALITY AND ENVIRONMENTAL SUSTAINABILITY – HARDWARE

III. THE BUILDING SCALE

In Los Arenales, houses are predominantly constructed using scraps. Over time, these structures undergo improvements, with surfaces being refined, roofs sealed, and walls painted. However, starting a project with such limited resources often results in a shortage of appropriately utilized materials and precise finishes. Conversations with the women revealed the common desire to complete their houses without necessarily needing larger or brighter rooms; the primary focus is on achieving a proper finished look and quality. In general, the inhabitants have the knowledge, skills, and craftsmanship required for construction. Occasionally, they hire each other workers for specific tasks, such as welding a large metal structure for a multi-story building or installing sewage systems for hygiene standards. With proper planning and organization, the skills and materials available on-site could be more efficiently utilized. The Building Scale introduces a material library and a cooperative-like flow of elements and craftsmanship. A close collaboration with the residents could ensure that government subsidies, if accepted, are directly invested in the settlement itself rather than hiring an external construction company. Moreover, the Building Scale guarantees the option, if desired, to continue the processes of self-building and self-management.

IV. THE CITY SCALE

Through a thorough analysis of the current urban landscape in Los Arenales and extensive discussions with community leaders, the plot size for The City Scale has been formulated. While currently a fixed dimension, the use of a parametric model allows for potential adjustments to this plot size in the future. Within each 5,5m x 8m plot, is a home, and when arranged side by side, they collectively form a city. The research has consistently advocated for an alternative approach to social housing, challenging the monotony of current copy-paste developments that result in boring and non-human neighbourhoods. Despite maintaining a uniform plot size, these flexible and adaptable typologies differ in height, facade, and, most importantly, how they integrate into the urban landscape. The multiple designs alter the private-public transition, introducing possibilities such as a business at the front, a small garden, a more urban facade, or urban furniture like a bench. These diverse implementations and variations, when viewed from a pedestrian perspective, ensure a dynamic street that can be actively appropriated by the community.

3.5. TESTING THE MODEL

As the initial step in incorporating data into a design program the parameters of B.I.A serve as a case study, emphasizing her requirements for two small bedrooms and a compact living-kitchen area. Special attention has been given to creating an outdoor space for her 7 dogs (Figure PDF-parameters, Figure Floor plans typologies, Figure Screenshot Grasshopper). The parametric model generates multiple floor plans with various features, providing the architect the flexibility to choose and modify options easily, while allowing B.I.A as a final user to select their preferred layout. The Body Scale, considering that B.I.A is Colombian, stands at around 155cm, and currently resides on a second story with a relatively high first floor, it is essential to tailor the staircase to *La Formula* instead of using a generic staircase dimensioning. The new design spaces the steps appropriately and adjusts the height of the railing to her. Currently, in her house, arches decorate the connection between rooms. This prompts a parameter consideration for The Interior Scale, suggesting the incorporation of arched connections in future designs. On The Building Scale, B.I.A expresses a desire for her house to be constructed from timber or brick, with an emphasis on a clean, bright, white finishing coat for the interior. Although neither she nor her husband work in construction, her sister's husband does. Through cooperative efforts, materials could be sourced, and her brother-in-law could be hired to contribute to the construction process.

IV. CONCLUSION

In conclusion, this exploration of how to design social housing in the context of Los Arenales emphasizes a paradigm shift towards social and environmental sustainability, with a particular focus on the indispensable role women play within the community. Departing from conventional housing design practices, this research advocates for an empowering approach that not only acknowledges but celebrates the unique needs of female occupants. It challenges the historical neglect of such needs and aims to create a housing solution that blends soft parameters (relating to the inhabitants and their community) with hard parameters (related to the location, environment, materials, and craftsmanship). The research underscores the importance of diversity in housing typologies, moving away from uniform designs. By employing parametric design principles, the study seeks to create flexible and adaptable solutions tailored to the specific context of Los Arenales. The thematic research focuses on organizing vast amounts of data, utilizing rules and guidelines to control the complexity of information.

Ultimately, the expected outcome is an alternative methodology for social housing that is socially and environmentally sustainable. By leveraging data-driven design principles and prioritizing the unique needs of the women-led community in Los Arenales, the research aims to contribute to inclusive and sustainable housing typologies. The inhabitants' requirements remain central to this alternative approach, ensuring that the resulting designs meet the specific needs of the community.

REFERENCES

1. Arias Loyola, M., Vergara-Perucich, J. F., & Vega-Rojas, N. (2023). Pedagogía crítica y aprendizaje-servicio en la universidad neoliberal: coproduciendo un espacio público en el macrocampamento Los Arenales, Chile. *Scripta Nova*, 27(3), 1–29.
2. Arias-Loyola, M., & Vergara Perucich, F. (2020). *Comunidad, academia y el desafío de la primera panadería cooperativa en un Chile sin derecho a la ciudad*. 273–302.
3. Cifuentes, J. (2023). *Interview by the author*.
4. Col·lectiu Punt 6. (2019). *Urbanismo feminista : por una transformación radical de los espacios de vida* (Virus Editorial).
5. Costes, L. (2010). Le Droit à la ville de Henri Lefebvre : quel héritage politique et scientifique ? *Espaces et Sociétés*, n° 140-141(1), 177–191. <https://doi.org/10.3917/esp.140.0177>
6. Criado Perez, C. (2019). *Invisible Women. Exposing Data bias in a world designed for men*. Penguin Random House UK.
7. Currie, M. A., & Sorensen, J. (2019). Repackaged “urban renewal”: Issues of spatial equity and environmental justice in new construction, suburban neighborhoods, and urban islands of infill. *Journal of Urban Affairs*, 41(4), 464–485. <https://doi.org/10.1080/07352166.2018.1474081>
8. de la Fuente, A. (2023). Marcial Echenique, urbanista: “Creo que el Gobierno de Boric no va a ser capaz de construir 260.000 viviendas.” *El País*.
9. DESA, U. N. (2019). *Guidelines on the use of electronic data collection technologies in population and housing censuses*.
10. El Chile de las tomas y la crisis habitacional que dejó la pandemia. (2022). *CPI*. <https://www.infraestructurapublica.cl/el-chile-de-las-tomas-y-la-crisis-habitacional-que-dejo-la-pandemia/>
11. Farha, L. (2018). *Report of the Special Rapporteur on adequate housing as a component of the right to an adequate standard of living, and on the right to non-discrimination in this context, on her mission to Chile*. <https://data.oecd.org/chile.htm>.
12. Ferrer, C. (2018, September 12). Región de Antofagasta y campamentos: Familias en tomas aumentaron en más de un 500% en los últimos 8 años. *Emol.Nacional*.
13. Gómez León, J., & Merino Leyton, M. (2022, December). Entrevista Elizabeth Andrade. *Revista REDES*, 24–27.
14. Gómez, P. (2023). Casi 6 mil familias llegaron a vivir a campamentos de la región de Antofagasta en 2022. *Timeline*. <https://www.timeline.cl/casi-6-mil-familias-llegaron-a-vivir-a-campamentos-de-la-region-de-antofagasta-en-2022/>
15. Habitantes de Campamentos de Antofagasta se capacitan en Emergencias. (2020). *Region2.Cl*. www.region2.cl/habitantes-de-campamentos-de-antofagasta-se-capacitan-en-emergencias/
16. Lefebvre, H. (1968). *Le droit à la ville*. Edition Anthropos.
17. Marín, J. (2023). *Interview by the author*.
18. Martín, M. (2019). *Lutte pour le droit à la ville et au logement digne des habitants des quartiers informels - Le cas de la ville d'Antofagasta au Chili*. Institut d'études Politiques .
19. Ministerio de Vivienda y Urbanismo. (2022). *Plan de Emergencia Habitacional 2022-2025*. <https://www.minvu.gob.cl/wp-content/uploads/2022/07/Plan%20de%20Emergencia%20Habitacional.pdf>
20. Papke, M. (2020). *Planning with informal settlement communities: Exploring the working relationships between NGO planners and informal settlement communities. Case study of two communities of Chitwan district in Nepal*. Norwegian University of Science and Technology.
21. Plan Emergencia Habitacional - Informe 2023. (2023). *Ministerio de Vivienda y Urbanismo*.
22. Quirós, J. (2014). Etnografiar mundo vívidos. Desafíos de trabajo de campo, escritura y enseñanza en antropología. *Publicar*, XVII, 47–66.

23. Roldán, F. (2022). Descontrol de asentamientos informales aumenta el riesgo de desastre por aluviones en Antofagasta. *El Mostrador*.
<https://www.elmostrador.cl/destacado/2022/06/23/descontrol-de-asentamientos-informales-aumenta-el-riesgo-de-desastre-por-aluviones-en-antofagasta/>
24. Rompiendo Barreras. (2023). *Nuestra Hoja de Ruta y el Plan Maestro de Los Arenales*.
25. Tapia Gómez, M. (2020). *Ciudades Posibles. Apuntes para el debate sobre la nueva constitución de Chile* (1st ed.). Crítica urbana.
26. Travis, C. (1993). *The Mismeasure of Women. Why Women are not the better sex, the inferior sex or the opposite sex*. Touchstone.
27. Vergara-Perucich, F. (2020). Participatory action planning as transductive reasoning: Towards the right to the city in Los Arenales, Antofagasta, Chile. *Oxford University Press and Community Development Journal*, 00(3), 1–21. <https://doi.org/10.1093/cdj/bsaa002>
28. Viamonte Fernández, P., & Peinado Checa, Z. J. (2014). Arquitecturas efímeras con herramientas paramétricas. *Expresión Gráfica Arquitectónica*, 114–125. <https://doi.org/10.495/ega.2014.1746>
29. World Population Review. (2024). *Average Height by country*.
<https://worldpopulationreview.com/country-rankings/average-height-by-country>

APPENDIX A - VISUALS

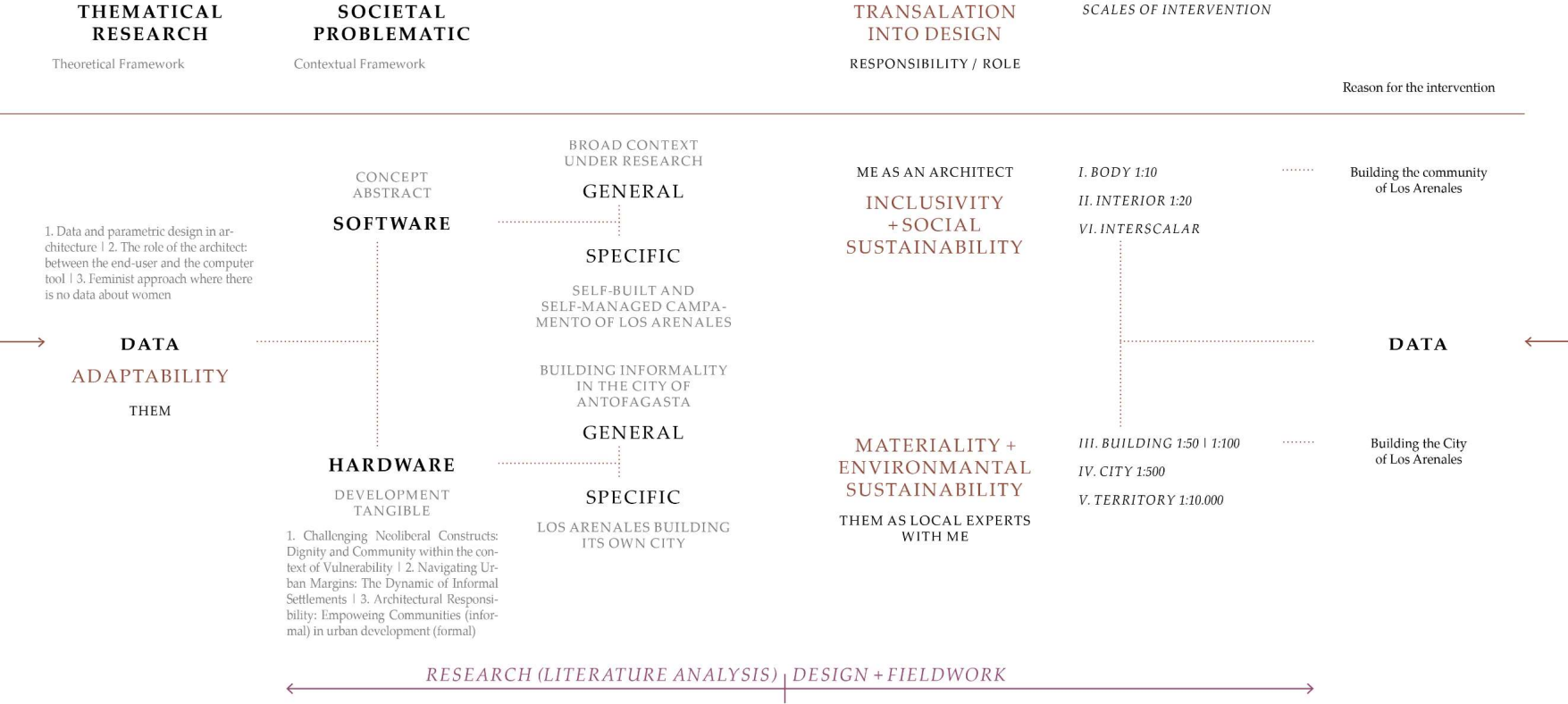


FIGURE 1. Visual Representation of the Research Outline.

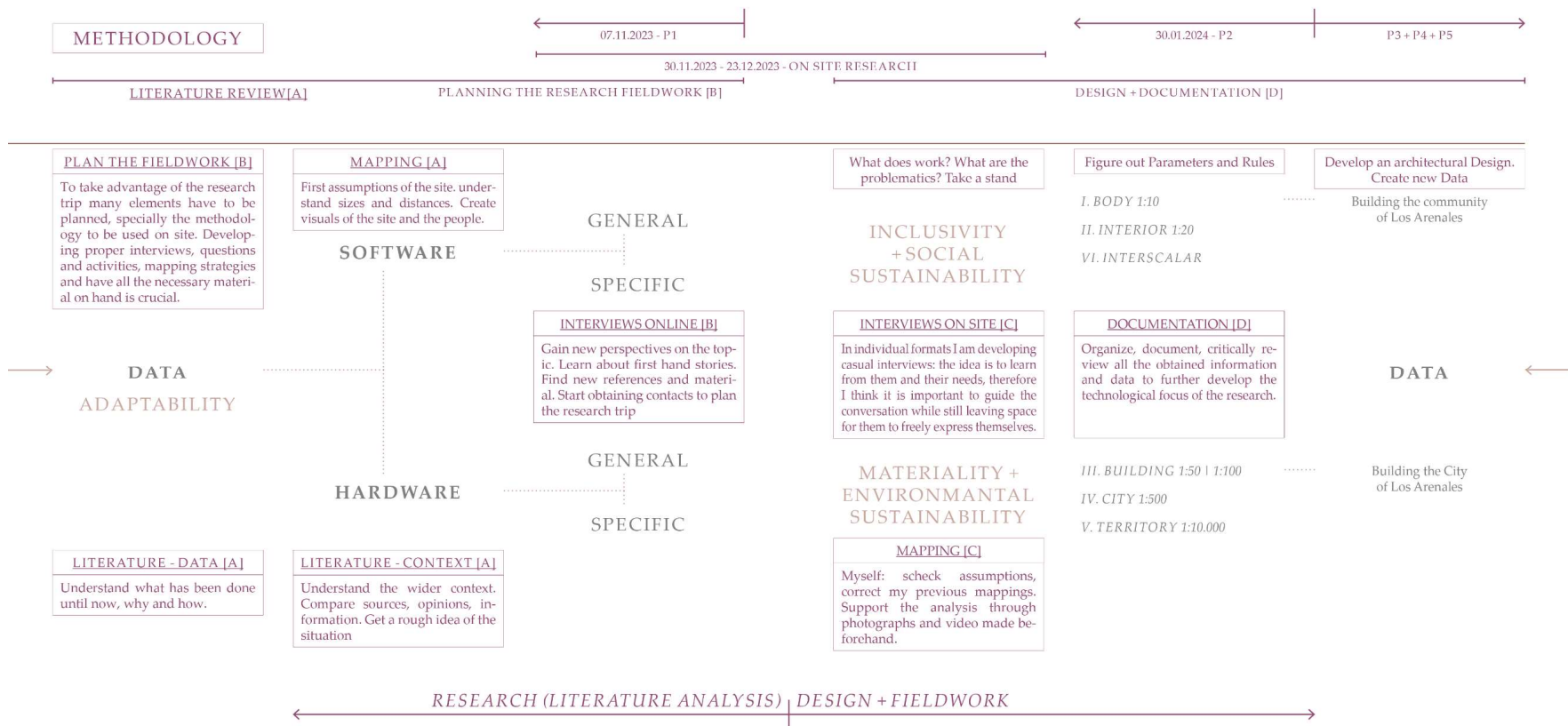
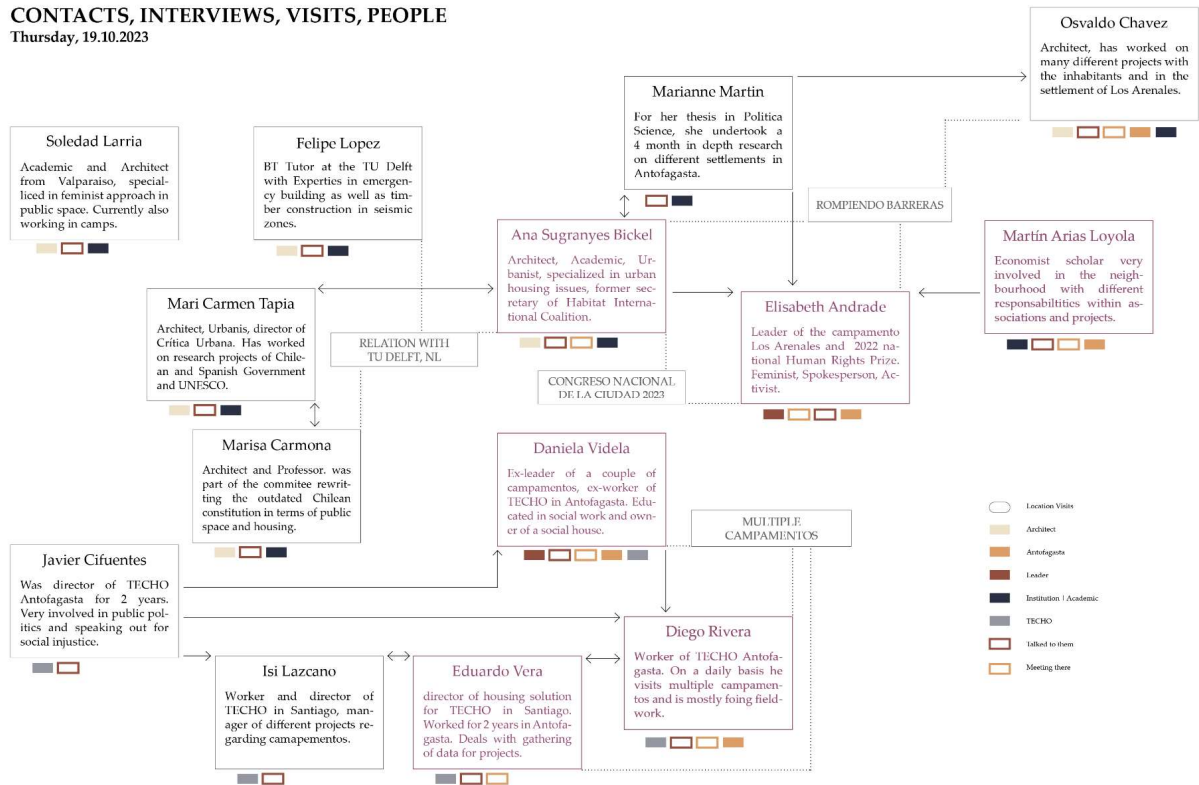


FIGURE 2. Visual Representation of the Research Methodology

CONTACTS, INTERVIEWS, VISITS, PEOPLE

Thursday, 19.10.2023



ON SITE VISITED PEOPLE

Wednesday, 20.12.2023

- LOS ARENALES - ON SITE**
- Jessica Marín, dirigente, Los Arenales
 - Marta Cortés, dirigente, Los Arenales
 - Blanca Idalia Arcos, dirigente, Los Arenales
 - Jimena Arcos + Marido e hija, Los Arenales
 - Ximena + Marido, Los Arenales
 - Carme y Salomé Arcos, Los Arenales
 - Blanca Arcos, Los Arenales
 - Carlos, Los Arenales
 - Jeannette Arcos, Los Arenales
 - Daniela Arcos, Los Arenales
 - Valeria Castro, Campamento Villa Constancia
 - Dayolin Choque, Campamento Mirador La Portada
 - Victoria, Campamento Mirador La Portada
 - Jeannette Muñoz, Campamento Familias Unidas
 - Charlotte Cerda, Campamento Familias Unidas
 - Humberto Moncada, Campamento Familias Unidas
 - Eduardo Astudillo, Campamento Caleta Coloso
 - Valeria Castro, Campamento Villa Constancia
 - Hernán, SEREMI de Vivienda
 - Ricardo, SERVIU
 - Ricardo, Gobernador
 - Francisco, Movimiento Pobladorxs Vivienda Digna
 - Millaray, Movimiento Pobladorxs Vivienda Digna

FIGURE 3. Visual Representation of the gathered contacts, interviewed people, locals, inhabitants and women



FIGURE 4. 08.12.2023. On site visit to different campamentos guided by Daniela Videla (left in black) and Diego Rivera (background with sunglasses). Here in Campamento Mirador La Portada with its leader Dayolin Choque (light blue).

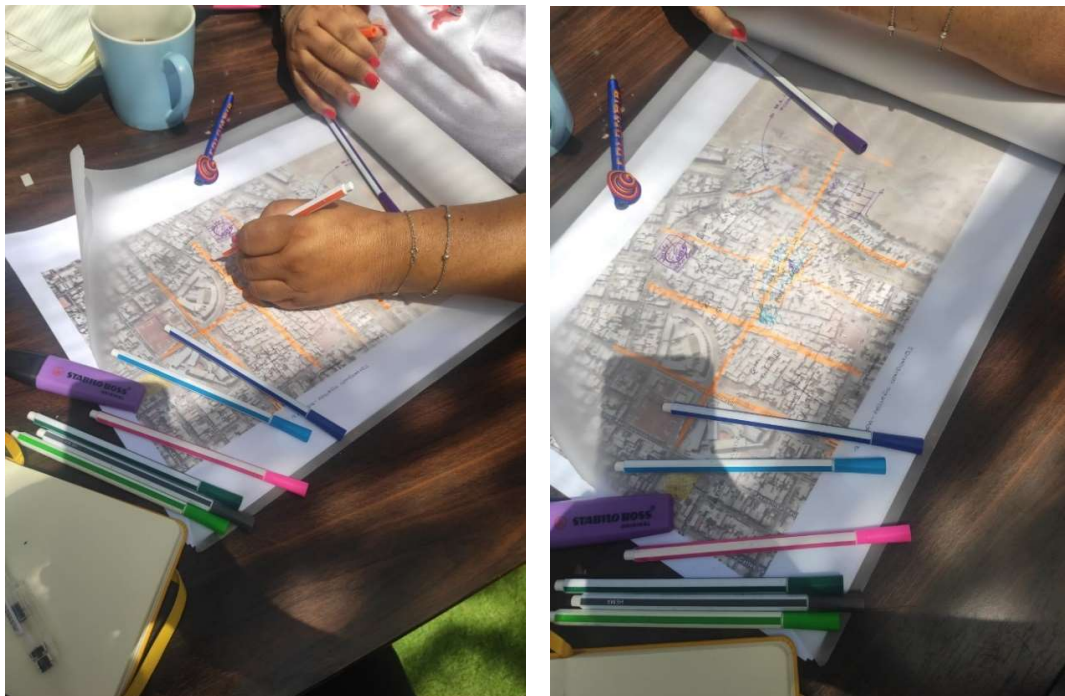


FIGURE 5. 12.12.2023. Elizabeth Andrade sketches over Los Arenales while explaining me their dream master plan for the future development of the settlement in a neighbourhood.



FIGURE 6.1.



FIGURE 6.2. The two-sided view. In one picture the skyscrapers are in the foreground. A symbol for wealth and development. In the second picture, the elf-built houses are in the foreground, representing a large portion of the city's population. Nature is always in the back, either the blue infinite ocean or the arid and rough deserts mountains.



FIGURE 7. On the left, Los Arenales. On the right side, a school. In the middle, the invisible and at the same time, visible border of how the municipality declares what belongs to the city and what does not. The straight line of pavement includes some people and leaves others behind.



FIGURE 8. 09.12.2023. Women leaders united share, collaborate and strengthen each other. Here the leaders from Tocopilla, a different city in the Region of Antofagasta, that attended the first Regional Congregation of leaders of the whole II. Region of Antofagasta.

CURRENT SITUATION

FUTURE POSSIBILITIES

	B.I.A.	J.A.	E.A.	M.C.	J.A. + D.A.	B.A.	C.+S.	X.	
TYPOLOGY	H H	H H	H H	H H	A A	A A	A A	H H	TYPOLOGY
STORIES	1 1	2 2	1 2	2 2	1 1	1 1	1 1	1 2	STORIES
PEOPLE IN THE HOUSE	3 3	4 4	2 2	4 4	3 3	1 1	3 3	4 4	PEOPLE IN THE HOUSE
NATIONALITY	CO	CO	PE	CO	CO	CO	CO	CL	
N. ANIMALS	7	1	2	2	1	2	7	2	
N. BEDROOMS (WITHOUT WINDOWS)	2 x S (1) 2 x S	2 x S (1) 3 x S	2 x S (1) 2 x S	5 x S (4) 4 x S	2 x S (2) 2 x S	5 x S (4) 4 x S	2 x S (1) 2 x S	3 x S (3) 3 x S	BEDROOMS
N. BATHROOMS (WITHOUT WINDOWS)	1 x S (2) 1 x S	1 x S (1) 1 x S	1 x S (1) 1 x S	2 x S (2) 2 x S	2 x S (1) 2 x S	2 x S (2) 2 x S	2 x S (2) 2 x S	1 x S (1) 1 x S	BATHROOM
LIVING + KITCHEN (N. WINDOWS - NO DOORS)	M M	S M	M S	S S	S S	S S	M M	S S	LAUNDRY LIVING + KITCHEN
STATE OF HOUSE LEVEL OF FINISHES	70% S	50% S	80% S	50% S	50% S	80% S	80% S	20% M	STORAGE
CLUTTERED	20% YES	70%	50%	50%	40% YES	20% YES	20%	100%	GARAGE
FRONT PATIO COURTYARD BALCONY	B. CY.	B.	F.P. B.	F.P. F.P.	F.P. F.P.	B. CY.	B. CY.	B.	EXTRA USE (BUSINESS)
GREEN	S M	S.	S S	S M	M	M	M	S	FRONT PATIO COURTYARD BALCONY
TOPOGRAPHY	//	//	--	--	--	--	--	--	GREEN
SELF-BUILT	YES YES	YES YES	YES YES	YES YES	YES YES	YES YES	YES YES	YES YES	TOPOGRAPHY
									SELF-BUILT

FIGURE 9. This almost unreadable list of parameters represents the complexity of the settlement. It is impossible to reduce a census to just gender and age and portray the reality of Los Arenales and any other self-built neighbourhood. In red, what they told me and what I saw about their current housing and familiar situation. In black, what they wish for, what they need and what they can do.

APPENDIX B – GRANTS

My sincerest thanks to the various grants that have supported my project through funding the research trip to Chile. These scholarships have not only provided the financial means to undertake this crucial exploration but have also served as catalysts for personal and academic growth. The invaluable support from these grants has enabled me to delve into hands-on research, meet the community under research and experience first-hand the context.



VAN EESTEREN-FLUCK & VAN LOUIZEN STICHTING



IR. HENK WESTRA FONDS VOOR VOLKSHUISVESTING – FAST GRANT TU DELFT



TU DELFT GLOBAL INITIATIVE



PHILIP SPANGENBERG FUND – URBAN DESIGN