Sustainable Concepts Reflected in Mapuche Constructions

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Abstract. The Mapuche people make up an important part of the native population of present-day Chile. Over the course of its history, the culture has produced small-scale architectural manifestations and features on the landscape, some of which survive to this day. This article addresses the similarities between aspects of these constructions and modern concepts of sustainable building. The main research question asked is: what can Mapuche culture teach us about building in a sustainable manner? We propose that, alongside disciplinary advances regarding what constitutes sustainable architecture, a return to a simpler perspective informed by vernacular wisdom may constitute a valuable contribution to the discussion. In order to answer this question, we will first identify the key Mapuche constructions present in the landscape. We will then explore the way in which this ethnic group views and understands its physical space, before proposing and analysing principles of sustainability offered by Mapuche architectural practices.

1. Introduction
The present work focuses on two main subjects which we propose are more closely linked than is commonly believed: Mapuche constructions and a number of principles of sustainable building. We offer an overview of the two subjects and address a number of territorial aspects that we consider relevant.

This is not the first time that the Mapuche mode of living has been studied in terms of its sustainability. There are three existing works which have addressed the issue. Two of them focus on Mapuche buildings, particularly the ruka (traditional house) [1] [2], while the third looks at certain spaces within the Mapuche territory [3]. Our work adopts a general approach and, unlike those mentioned above, seeks to offer insights into Mapuche constructions, primarily the ruka, in terms of modes of inhabiting and construction. As such, we will highlight certain elemental architectural aspects, including the shape of the building and the surroundings in which it is erected. The study focuses not on quantitative measurements but on general spatial qualities that provide us with an overall idea of the Mapuche outlook which, we believe, coincides with certain principles of sustainability promoted today in construction strategies.

2. Mapuche buildings
The history of the Mapuche—the largest indigenous group in Southern Chile—may be broken up into a number of different chapters, but certain types of vernacular building have endured to this day, including the nguillatuhue (a ceremonial place), the kuel (tumulus or burial mound) and the ruka itself. The nature
of these constructions has been covered in a doctoral thesis [4], and we will reference a number of ideas addressed by the author regarding the Mapuche mode of living and spatial understanding of reality.

The nguillatuhue is a temporary construction that is the focus of periodic community rituals, and it is erected on a large piece of flat land reserved exclusively for this purpose. Its structure is simple, consisting of a number of interwoven branches [4]. The floor plan is a C shape open to the East, in the centre of which is positioned a carved wooden figure known as the rehue, before whom a variety of ceremonies are conducted. In some communities, following a few days of use, these interwoven branches are taken down, but the rehue is left in place.

Very little was known about kuel until recently, when research by Dillehay [5] revealed a little of their nature. In simple, material terms, the author identified them as artificial mounds.

The ruka is the traditional house and the main architectural expression of the Mapuche culture. There are a number of interesting studies on the subject of these constructions. Claude [6] provides a description of the rukas found in Mapuche communities during the first half of the 20th century. The author describes them as “simple homes”, generally with a rectangular base, although more primitive examples had a circular base and conical shape. Their vertical outer walls reach a height of between one and two metres and are topped by sloping roofs. One nineteenth-century commentator even described the ruka as superior to the homes in which some sectors of the Chilean population lived [7]. Work by Coña [8] recounted how the construction of a ruka was a community event. The process is known as the rukán, and according to Coña [8], it took place in two phases: the construction of the load-bearing framework, and the subsequent thatching of this structure.

By comparison to the far grander scale of other pre-Columbian monuments found across the continent, Mapuche constructions are small and subtle. Reference to these constructions as such by no means diminishes their significance; indeed, the scale of such interventions may be taken as a sign of the Mapuche people’s austerity and consideration for their surroundings.

3. Mapuche habitat and worldview
Araucanía and other regions of southern Chile have been home to the Mapuche people for centuries, and their presence has had an impact on the landscape. Mariño, a Spanish chronicler [9], refers in particular to places known as aliben, which were spaces used for social gatherings. However, during the 19th century, forms of inhabiting and constructing the Mapuche territory suffered a radical transformation. As the Chilean State began to make advances into the Mapuche domain [10], indigenous
families were forced into far smaller tracts of land which later became known as ‘reductions’ or ‘Mapuche communities’, and their assimilation into the Chilean nation was unavoidable.

Following this turning point in Mapuche history, a number of detailed observations were made concerning their built environment. Claude [6] recounts the way in which the Mapuche became dispersed across the territory, remaining “in close proximity to each other” but never coming together to form a town or even a village. The author notes that their distribution across the landscape was influenced by the location of hills, and settlements tended to be close to water courses while maintaining a moderate distance from trails. In addition, choice of sites reflected the need for monitoring of crops, livestock and potential visitors, and facilitated mutual help and support.

Mapuche construction techniques are more sophisticated than may be immediately apparent. They also stem from a mode of inhabiting that is shaped by their view and interpretation of reality. Ancestral knowledge concerning a wide variety of territorial issues is handed down through the generations. An account by Coña [8] tells of how, in the past, the Mapuche gave names to diverse elements of their surroundings, a fact which leads us to speculate that this knowledge helped them both to inhabit and to construct.

A number of studies into the Mapuche world view offer insights into their spatial conception of reality [11] [12], a construct incorporating not only the visual, physical and material, but also the immaterial and spiritual. These studies point to the traditional Mapuche view of a world comprised of elements imbued with strong mythical significance. One key characteristic of their culture is respect for the various “places of cultural significance”, identified by a number of studies [3] [11] [13]. Although the Mapuche would settle and take control of certain lands, many of these locations were considered to have another spiritual ‘owner’, known in Mapudungun—the Mapuche language—by the name ngen.

Today, the Mapuche way of life remains inextricably linked to the rural world, and traditional constructions are still found dotted around the landscape. However, ancestral beliefs and traditions no longer prevail in all communities.

4. The vernacular and the sustainable
A number of works have addressed the links between vernacular architecture and sustainability. May [14], citing Paul Oliver, offers the following observations: vernacular architecture adheres to its surroundings or environment, construction is restricted to the resources available within these surroundings, and the process takes place by means of self-building or through the combined efforts of the community. Heywood [15] identifies four features of vernacular buildings which he claims are also “characteristics of sustainable development”: limited use of resources, low energy consumption, adaptation to the climate, and cultural significance.

May [14] claims that insufficient attention is paid to vernacular constructions and, in light of this, the present work proposes the need for renewed assessment of certain sustainable aspects of vernacular buildings. This call is echoed by both May [14] and Heywood [15].

According to May [14], vernacular architectures are well suited to the purposes for which they are built, not only in terms of their environment, but with regard to the diverse purposes to which they are put over the course of their useful life. May also highlights the ingenuity of the solutions and strategies inherent to vernacular buildings, such as regulation of air temperature in the Iranian desert [14], techniques from which we could benefit today. It is clear that adaptation and common sense are key concepts of vernacular architecture.

5. Sustainable concepts applied in Mapuche constructions
In light of the diversity of literature concerning Mapuche culture and sustainability in architecture, the present work seeks to lay the foundations for a discussion of Mapuche constructions and their connections with their surroundings, focusing on ideas derived from the ruka.

As a solution to the problem of habitability, a number of sustainable principles propose the use of natural means of environmental control within a space, and require planning, design and construction that is tailored to the climatic context. Some relevant concepts [16] found in Mapuche architecture
include the site surroundings, the shape of the building, and the nature of the building envelope. Each of these variables may be used to a greater or lesser degree to affect the heating or cooling of the interior space according to thermal comfort and air quality requirements [16].

Mapuche architecture involves the articulation of a variety of natural means of controlling the environment within a space, and these strategies are applied either directly or indirectly to improve the liveability of the building and the relationship with the environment. The Mapuche have achieved this thanks to their adaptability to the region’s climate, which is predominantly cold and wet, and generates a considerable need for heating [17]. The space within the ruka offers comfort in terms of acoustics, visuals, air quality and temperature [18], but it is the latter two which are in clearest evidence.

Some of the sustainable principles of the ruka concern optimising thermal performance and air quality in order to achieve comfortable living conditions, along with energy efficiency in terms of preserving the heat generated by the central fire pit. A number of concepts contribute to this, the first being the compact form of the ruka. Minimisation of the surface area of the building envelope that is in contact with the outside contributes to good thermal behaviour by mitigating energy loss through heat dissipation. The second concept concerns the minimal permeability of the ruka’s building envelope, a feature which contributes to improved thermal behaviour: fewer gaps mean less energy loss. Rukas are built in cold environments, and the Mapuche have found that a closed skin material that offers good protection is preferable to one which improves the capture of sunlight by means of more openings; in other words, protection from the elements is more important than maximisation of sun capture. The third concept is thermal resistance. The dense, wooden walls that form the lower section of the ruka provide effective resistance to the transfer of energy in the form of heat through the building envelope. This helps to maintain optimal thermal comfort and reduce the amount of heat generation required. The fourth concept is heating. The above strategies, which are all aimed at avoiding heat loss and maximising heat gain within the interior of the structure, function in combination with the ruka’s central fire pit. This is the main source of the building’s warmth, producing comfortable temperatures and contributing to the energy efficiency of the home. The fifth concept is ventilation. Alongside the need to heat the building is the requirement to maintain a good level of air quality inside, allowing fumes to escape and fresh air to enter. This is achieved by means of adjustable openings below the apex of the roof which allow the passage of a cross draught. This removes the convected fumes from the building, allowing fresh air to replace them and maintaining acceptable levels of particulate matter. Although this does lead to some heat loss, the liveability of the building depends upon it. The final concept is orientation. When planning a new ruka, the Mapuche would orientate the entrance towards the East, meaning that the longest side of the building faced North and, as such, received maximum sunlight. Although the thermal benefit that this configuration yielded was more of a bonus than an intentional design feature, it points to the advantage that may be gained in modern-day architecture by the incorporation of north-facing apertures and bays which improve capture of sunlight and, by association, heat.

The ephemeral nature of the ruka derives from the fact that, historically, Mapuche culture consisted of a traditional society whose primary building materials were organic and therefore had a limited usable life. Most of these materials are biodegradable and, compared with modern equivalents, have a small carbon footprint.

A study of the physical medium in which Mapuche construction takes place reveals a number of points. Firstly, modes of construction vary according to place or territory. Techniques and styles in coastal areas differ from those found in the foothills of the Andes [19], making architecture far from uniform across their territory. Secondly, construction materials are generally obtained from the immediate surroundings, and it is this context that dictates architectural forms. Thus, architecture is born of its location.

Mapuche culture has great respect for the so-called “places of cultural significance”, such as majin (wetlands), preferring to leave them more or less untouched. Construction at these locations is thus avoided. The Mapuche approach to life imposes limits upon human activity within the environment, and in many cases these restrictions apply to natural sites which recent advances in knowledge have revealed are also environmentally important.
The Mapuche world view dictates care of the natural world and maintains that humanity is only a small part of a greater whole. We propose that Mapuche culture recognises a basic core principle expressed by Heywood [15]: “everything that human beings need to survive and prosper is provided by the natural world, and if we wish to endure, we must find a suitable balance with it.”

6. Discussion
The present work has covered a number of issues which we believe to be relevant to further development of the subject. We have focused not on quantitative measurements, but on perceptions based on the ideas, principles and interpretations that we have collected.

It is clear that Mapuche architecture is the product of an elaborate thought process that draws from its surroundings and involves both technical and spiritual elements, and we believe that it is the spiritual aspect which motivates and guides care of the lived environment.

We have also highlighted the considerable overlap in the reflections of certain authors in their study of the links between vernacular architecture and sustainable building principles. Vernacular buildings around the world have many aspects in common, differing primarily in terms of those elements that relate to climatic conditions. Our primary conclusion, therefore, is that we may benefit from looking to both the past and future, and that these complimentary perspectives will help us to achieve balance and wisdom, ultimately improving the way we live and build.

References

[1] Whitman C and Turnbull N 2014 Environmental comfort in the living heritage of the Chilean Araucania: The Ruka Lafkenche and the Fogon Pehuenche. In: Nicol F, Roaf S, Brotas L, Humphreys M, editors. Windsor Conf., 2014: Counting the Cost of Comfort in a Changing World [Internet] (Network for Comfort and Energy Use in Building). p. 1126–396. Available from: http://orca.cf.ac.uk/69732/

[2] Whitman C, Armijo G, Turnbull N 2014 The Ruka Mapuche: clues for a sustainable architecture in southern Chile? In: Vernacular Architecture: Towards a Sustainable Future [Internet] (CRC Press) p. 759–61. Available from: http://orca.cf.ac.uk/69730/

[3] Neira Z, Alarcón A, Jelves I, Ovalle P, Conejeros A, Verdugo V 2012 Espacios ecológico-culturales en un territorio mapuche de la región de la Araucanía en Chile. Chungara Rev Antropol Chil. 44(2):313–23.

[4] Antivil W 2018 Dibujando la Araucanía: la construcción, la forma y el dominio de un territorio Doctoral Thesis, Universitat Politècnica de Catalunya https://www.tdx.cat/handle/10803/462096 pp 9-13; 43-45

[5] Dillehay T 2011 Monumentos, imperios y resistencia en los Andes. El sistema de gobierno mapuche y las narrativas rituales (Santiago de Chile: Universidad Católica del Norte, Quillqa, University of Vanderbilt, Ocho libro editores)

[6] Claude J 1931 La vivienda araucana (Santiago de Chile: Establecimientos graficos “Balcells & Co.” Publicado en los “Anales de la Universidad de Chile”) pp 14-15; 12-13

[7] Domeyco I 2010 La Araucanía y sus habitantes: Recuerdo de un viaje hecho en las provincias meridionales de Chile, en los meses de enero y febrero de 1845 (Santiago de Chile: Cámara Chilena de la Construcción: Pontificia Universidad Católica de Chile: Dirección de Bibliotecas Archivos y Museos) p 54

[8] Coña P 2006 Testimonio de un cacique (Santiago de Chile: Pehuén editores) pp 186; 185-194; 94-95

[9] Mariño P 1865 Crónica del reino de Chile (Santiago de Chile: Imprenta del ferrocarril) p 124

[10] Pinto J 2015 La formación del Estado, la nación y el pueblo mapuche. De la inclusión a la exclusión (Temuco: Universidad de la Frontera)

[11] Comisión de trabajo autónomo mapuche COTAM 2009 Segunda parte del Informe Final de la Comisión de Trabajo Autónomo Mapuche. In: Informe de la Comisión de Verdad Histórica y
[12] Grebe M E, Pacheco S, Segura J. 1972 La cosmovisión mapuche. *Cuad la Real Nac.* No 14:46–73.

[13] Ministerio de Obras Públicas 2004 *Guía de participación ciudadana mapuche en obras de infraestructura. IX región.* (Temuco, Chile: Imprenta Austral)

[14] May J. 2011 *Casas hechas a mano y otros edificios tradicionales. Arquitectura popular.* (Barcelona: Blume) pp 42; 6; 7; 44-45; 45

[15] Heywood H 2017 *101 reglas básicas para edificios y ciudades sustentables* (Barcelona: Gustavo Gili) 120; 120-121; 6

[16] Serra R and Coch H 2001 *Arquitectura y energía natural* (Barcelona: Edicions UPC)

[17] CEV 2017 *Informe técnico 2017 calificación energética de viviendas* (CEV Chile)

[18] Neila F 2004 *Arquitectura bioclimática : en un entorno sostenible* (Madrid: Munilla-Lería)

[19] Ministerio de Obras Públicas 2003 *Guía de diseño arquitectónico Mapuche para edificios y espacios públicos* (Temuco: Ministerio de Obras Públicas de Chile) p 95