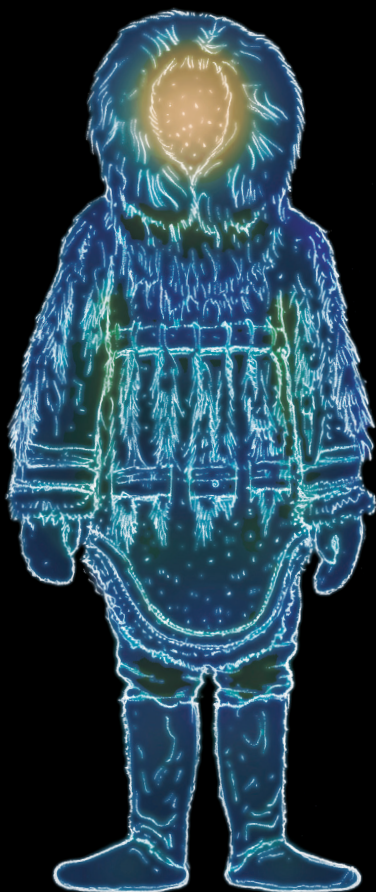


# EMBODIED ENERGY





2025, Eva Collier

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# **Embodied Energy**

## Unravelling Nomadic Strategies

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Before any level of design, the specific way in which a collective of individuals carries out its activities in a constrained space is the first source of energy with both benefits and costs to that group. Energy resilience starts by making the most of that, before adding any other input of energy. The word “endosomatic” (Georgescu-Roegen 1978) describes the type of energy that species absorb through food and transform into heat and movement. Endosomatic energy is the output of humans as biological machines and it fuels space.

# Introduction

# Objective

## How can one design shelter and equipment radically tailored to the gestures of a group of bodies?

Making the most out of endosomatic energy in architecture implies designing extensions or infrastructures that are meant to complement the human body in its activities, with as few losses as possible. It is time to stop designing polyvalent architecture that is static, all-purpose and therefore energivorous, and start designing buildings that are more modest and mechanically adaptable. To begin this reflection on the role of architecture, adjustment strategies and the role of the body, I am interested in exploring nomadic designs.

More specifically, it is relevant to study pre-industrial communities that are established in extreme climates. Such communities are necessarily highly adaptable and built on the essentials. They are resilient enough to take advantage of the ecosystems that nurture them without altering them, and they are complex, knowledgeable and enduring, thanks in particular to the strengths of collectivity.

To understand the way of life of those communities, it is necessary to examine the human body's relation to energy inputs and outputs, through traditions and habits relating to food, clothing, activities, climate,

and architecture. How are these different layers geared together and what can one learn from their interdependency? With those findings, I hope to extract strategies for adapting to different climates that are inexpensive in terms of materials and energy, exploiting as optimally as possible the characteristics of the body and the benefits of communal living.

# Framework

**This research will be structured as a comparative study between the Inuit of northern Quebec, the herders of the Mongolian steppe and the Berbers of southern Algeria.**

The first part of the essay will dig into their respective climates in order to later identify the strategies that allow their adaptation at different scales. Examination of their garments and shelters will provide information about layers of materials and their deployment, whereas community rituals will lay out data on body dynamics and fundamental functions or preoccupations. These rituals mirror and shape the way of life of the communities that engage in them. Exploring how they compare or diverge according to environmental conditions will offer a broader view of the different strategies at play.

Given the versatility of the aspects addressed in the energetic portrait of the studied communities, a significant consideration was how to document the data for this project. Sources have been selected from a wide range in order to avoid cultural bias or second-hand sources as much as possible. Documentaries, testimonies and photos were favored, followed by local studies and maps, and then articles from various magazines or travel guides to fill in the gaps.

Most of the material was compiled throughout the research in the form of hand drawings, with a degree of detail that could be adjusted as the research progressed. All drawings were later colored according to a predefined gradient, reflecting the temperature of the featured elements. This systematic representation of color allows for a direct link between space and temperature, consistently evoking the energy relationship between the drawn elements and homogenizing the various graphics created for this research.

# Drawings

**Analogue drawing works like a custom map, helping to organize known information and expand as new data is added. It serves both as a tool for documentation and the preferred method of representation for this research.**

Computer designed graphs were also used to display schematic or summarized information about known climatic and geographic conditions.

Graphic representation was central to this work. The study of different garments, structures, movements and spaces becomes much more tangible if rendered visually. However, most of the illustrations I was interested in could not be found. The task of composing them on the basis of available documentation therefore fell to me. Also, the comparison of different case studies becomes accessible only if the material is referenced in a comparable way, in this case by drawings respecting the same rules and presenting equivalent information.

The choice of analogue drawing does not simply serve to show a working process as an end in itself. It reflects the inevitable imperfection of my perspective on the elements drawn. These are carefully documented, drawn from the cross-referencing of numerous sources, and yet they only represent what my eye, as a

young European architect, perceives from my documentation. It may seem audacious to study societies as complex as they are different from my own in such a short span of time, and I claim nothing more than a comparison framed by an introduction to the energy of the body in different environments.

As a side note, the representation of movement, energy, experience of space, and ritual performance led me to take an interest in research carried out in the '60s, at a time when performance art emerged as a prominent artistic tendency. In that period, when many were experimenting with process, temporality and interaction, the American landscape designer Lawrence Halprin combined art, landscaping and geography to create a series of walking maps both documenting and organizing places, proposing series of actions to inhabit them (Christmann 2012). This ambivalence of the cartographic tool, inevitably evolving midway between description and action, imposes a back-and-forth between writing and discovery, between experience and



its graphic expression. Based on this work, some ten years ago, the research group “Écrire le sensible. Laboratoire itinérant de recherche-cr  ation” (Itinerant research-creation laboratory) proposed research-creation schemes articulating experimentation and the documentation of experience, including the notion of flexibility, or rather room for improvisation (Christmann, Olmedo, and Poisson 2018). Transcribing this concept to the planning of architecture somewhat inspired me.

The climates of the chosen case studies are very different, although they have in common that they are extreme and subject to considerable variation. Before exploring the environments of the three communities, it is useful to understand the main constraints of their ecosystems, which are rainfall and temperature.

# Climates

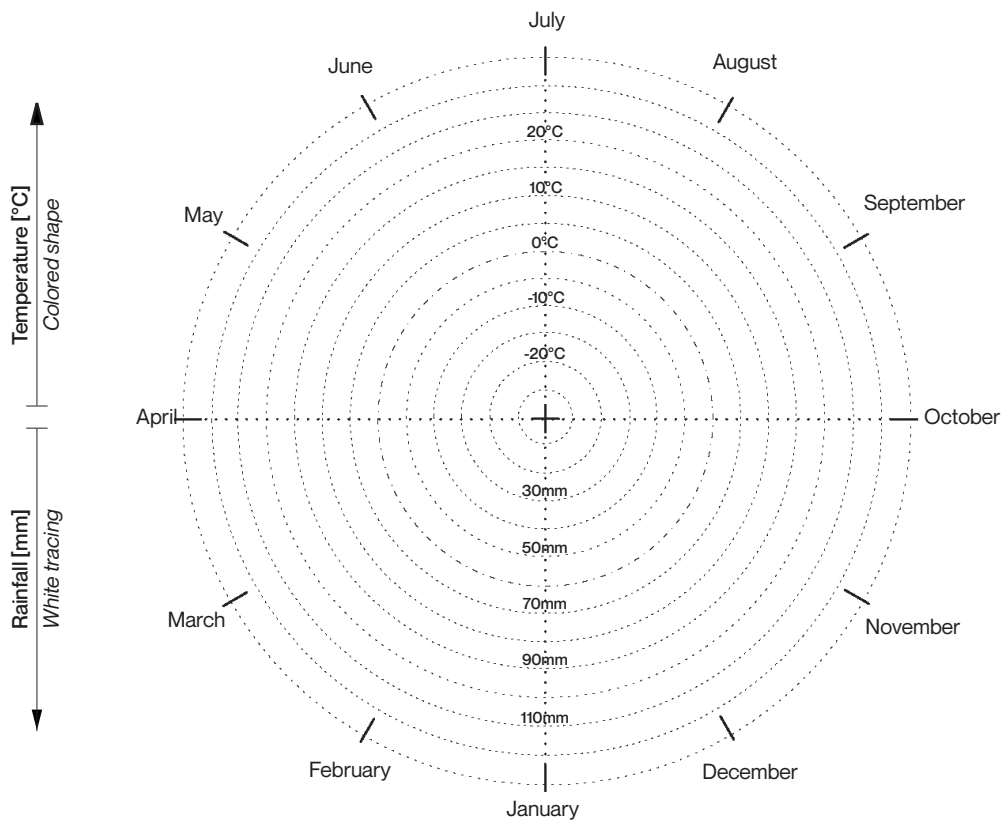


Figure 01 - Temperature Diagram Template (Collier 2025)

# Temperature diagram

**Thermal amplitude refers to the difference between the highest and lowest temperatures observed over a given period and in a given location.**

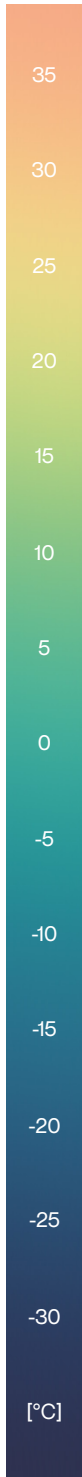
I created the diagram on the left as the starting point for this research to summarize climatic stability and comfort. It displays annual and daily thermal amplitudes, by tracing a circle of varying thickness covering the temperatures experienced over the course of a one-year cycle. It also indicates the amount of rainfall recorded monthly in millimeters, with a simple line.

The data collected for the following graphs come from meteorological measurements taken in the past three years (Climate Data 2022; Accu Weather 2024). Thus, these graphs serve as comparative indications of the studied climates today but they do not reflect on the history or future of these environments as average temperatures and precipitations change over time.

Temperature is represented not only by the distance to the center of the diagram, but also by the color of the tracing. The most comfortable temperatures are drawn in shades of bright green. The more concentric the tracings, the more homogeneous the annual measurements,

and the thinner the temperature tracing, the fewer the variations between night and day.

Measurements were collected for strategic spots that correspond to the environmental conditions in which the nomadic communities live. The climate diagrams drawn for these communities are preceded by world maps: they indicate the point where the measurements were taken with a white dot, the area covered by the studied population with colored highlighting, and the most densely populated areas of the globe with thin circles of a size proportional to urban density, indicating the level of remoteness.



**Here is an example of the climate  
diagram applied to Lausanne,  
Switzerland.**

The rather concentric tracing of color evolves roughly between 0 and 30 °C, mostly maintaining shades of green which indicate a comfortable temperature. The tracing thickens in the summer which reveals broader daily changes. Rainfall levels are stable at around 100 mm, allowing for abundant farming throughout the year.

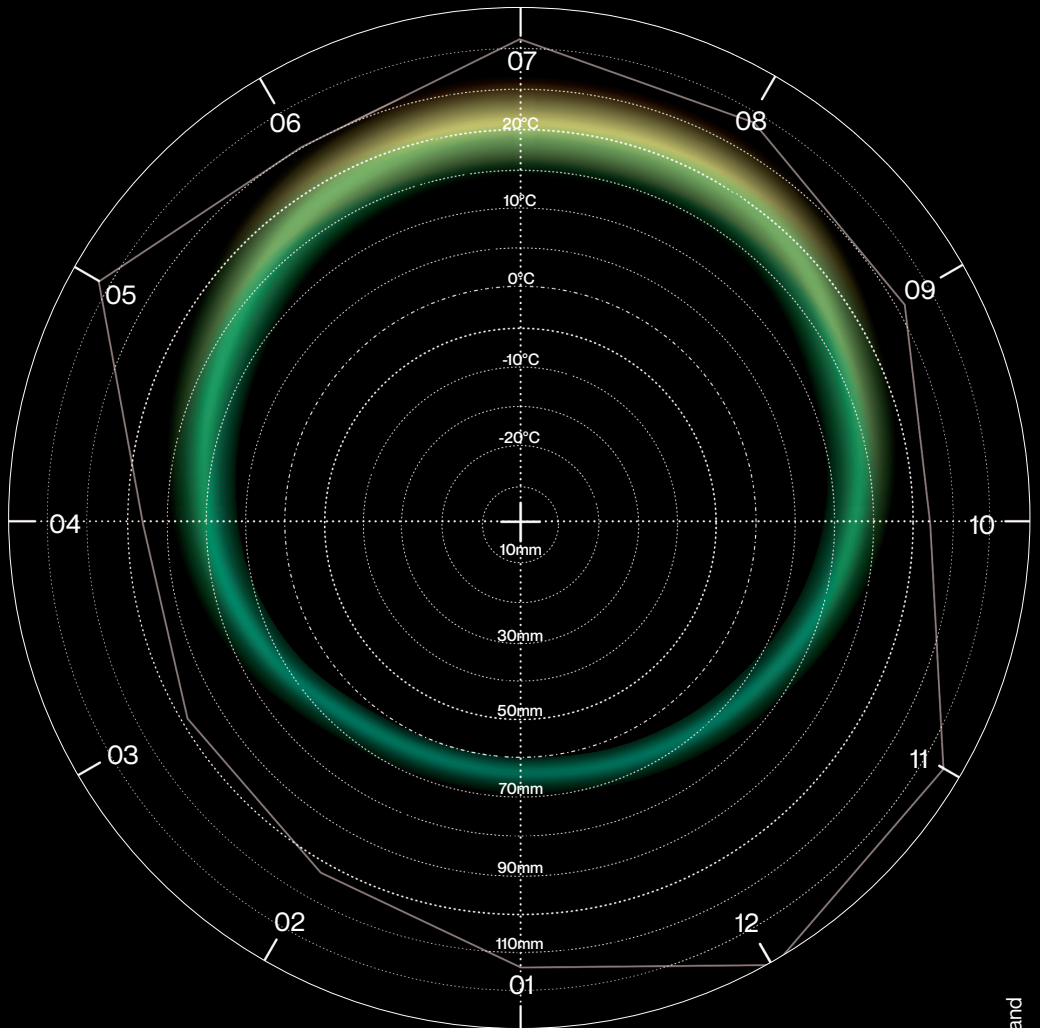
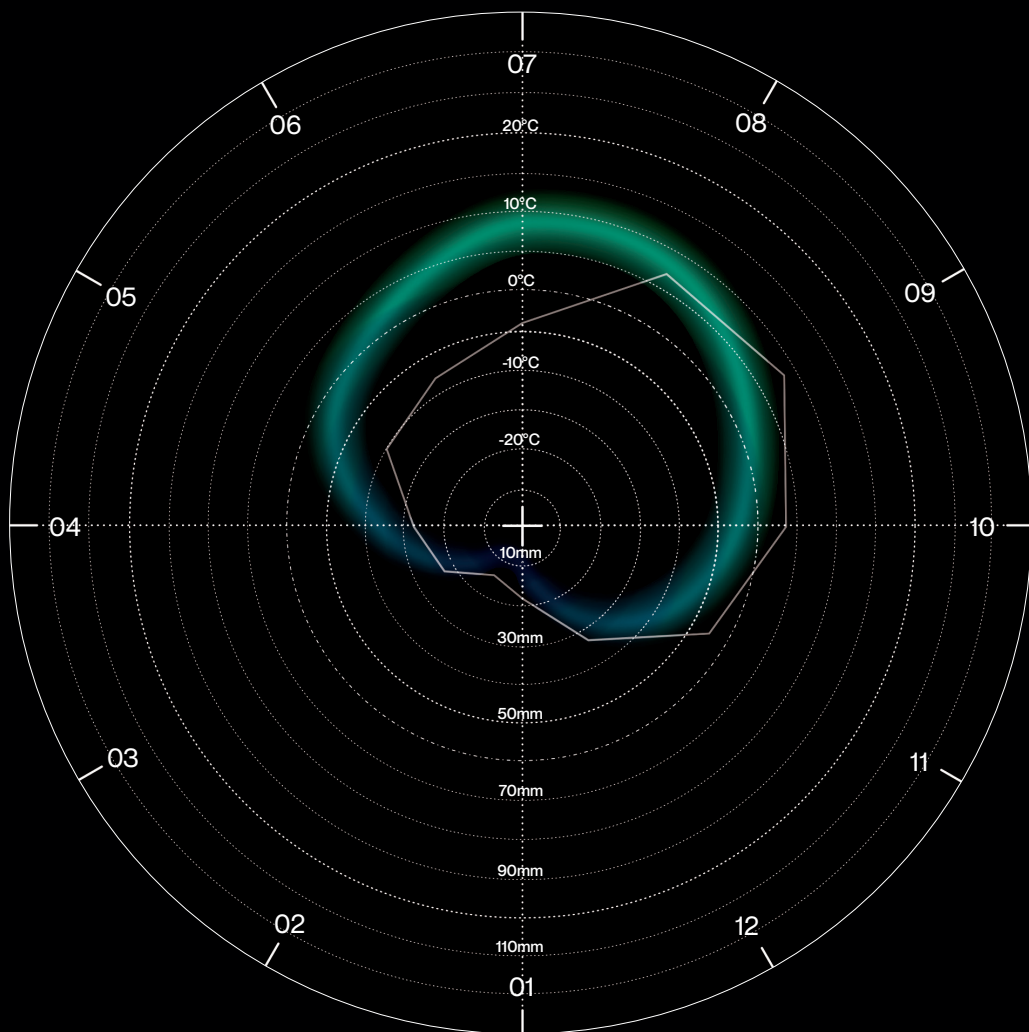


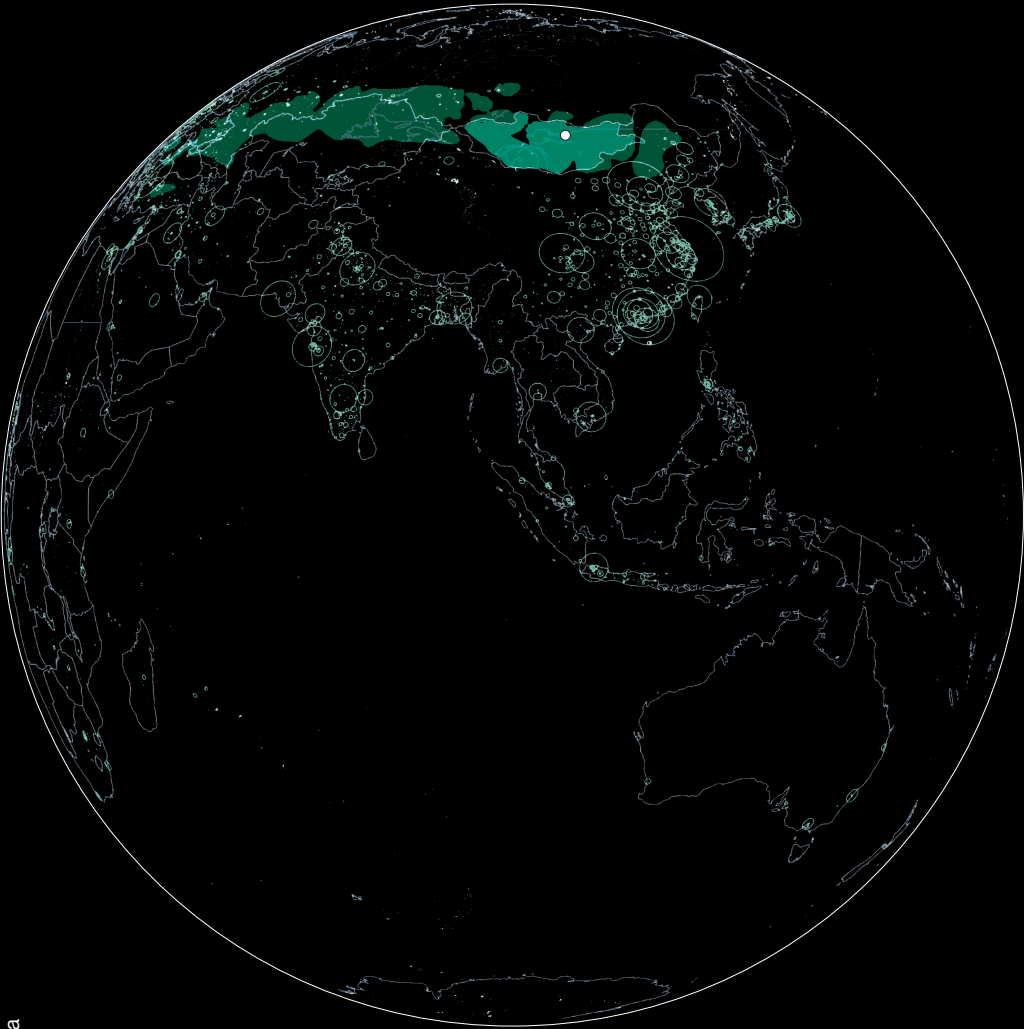
Figure 02 - Lausanne Temperature Diagram (Collier 2025)



Figure 03 - Locations of Inuit (Collier 2025)







Steppe herders, Mongolia

Figure 05 - Locations of Steppe Herders (Collier 2025)

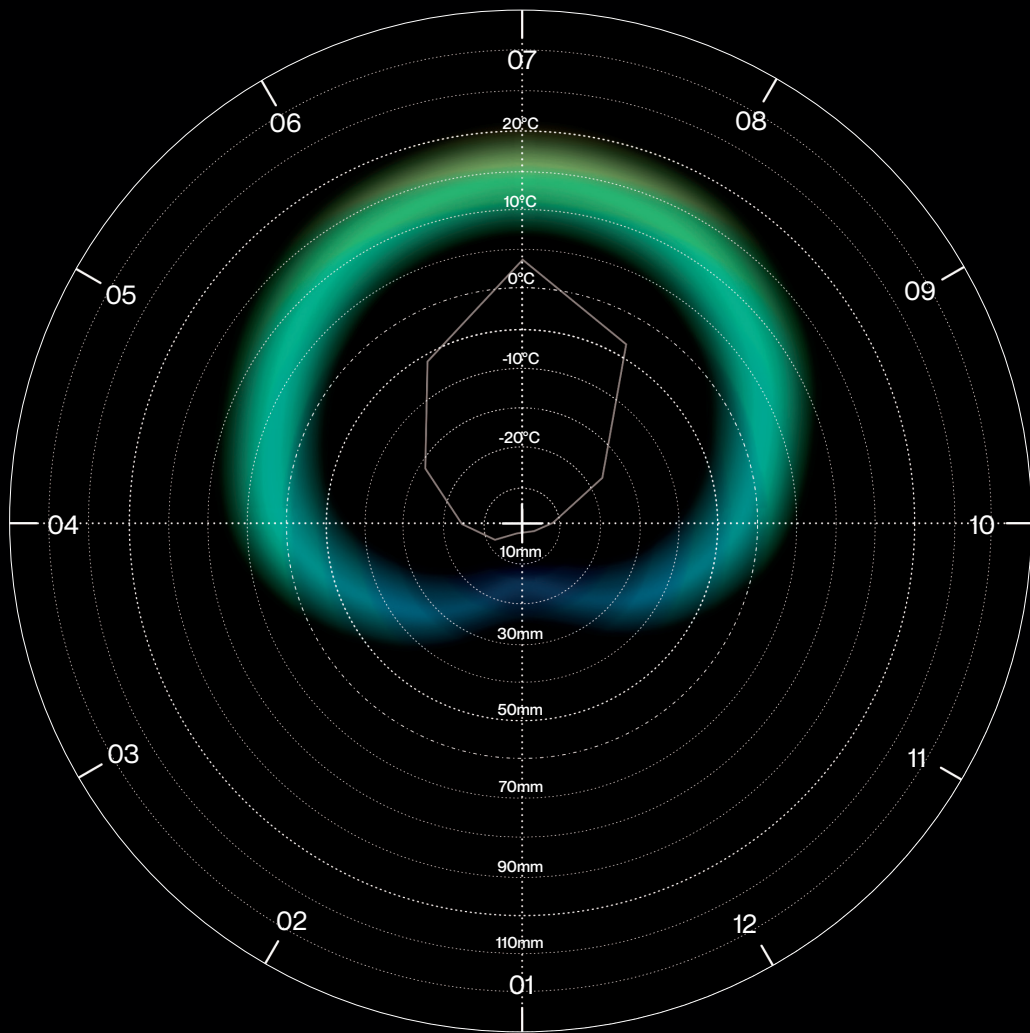


Figure 06 - Jargalant Temperature Diagram (Collier 2025)



Figure 07 - Locations of Tuaregs (Collier 2025)

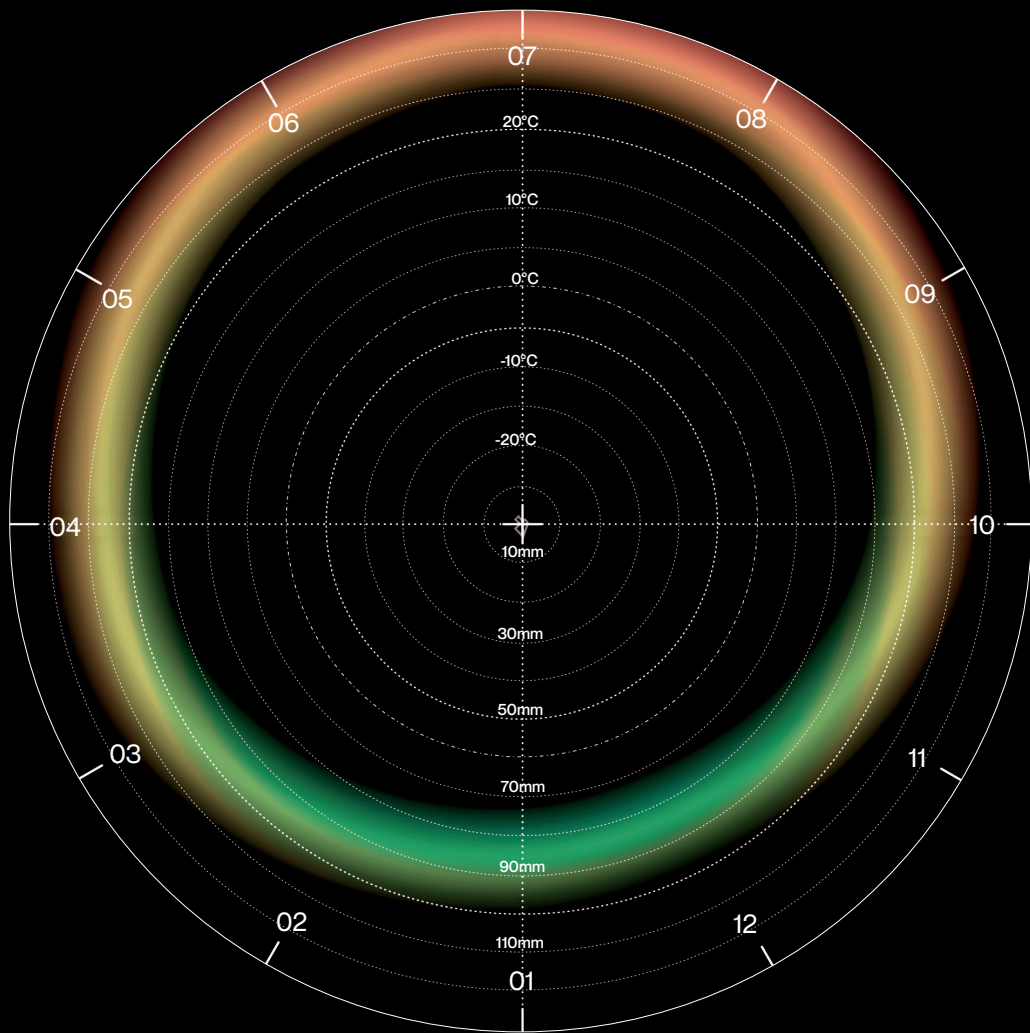


Figure 08 - Djanet Temperature Diagram (Collier 2025)

To understand the architectures and lifestyles of these three communities, the first step is to look at the ecosystems they inhabit and which inevitably shape them. Their harshness and resources not only define architecture, but also profoundly influence the cultural practices and social structures of each community. Therefore it is essential to examine their geographies, territories, climates, flora and fauna, and the emergence of these communities in the face of these challenges.

# Ecosystems

**Two types of diagrams were conceived to introduce and compare the three studied climates: A map showing the studied territory and a cyclical calendar.**

The maps are divided into climate stratifications based on altitude, temperature and rainfall which are identified in a legend by their color (assigned in correspondence with the project's color gradient according to the average year-round temperature at a given location). Nomadic communities are represented by dots. Although nomadic, these points are important landmarks, and have become partially sedentary in the last century. The calendar, meanwhile, situates the description of months in each culture in relation to resource cycles and climatic constraints. The further the appellations (in italics) deviate from what they describe, the more peripheral text is needed to visualize the community's activities over the course of a year. This diagram helps to clarify the cycle of activities practiced on the territory, and to locate the time of year when the studied ritual will be carried out.



# Nunavik, Quebec

Nunavik, ᓄᓇᐱᖅ, means “great land” in Inuktitut, the language of the Inuit in the territory claimed by Canada.

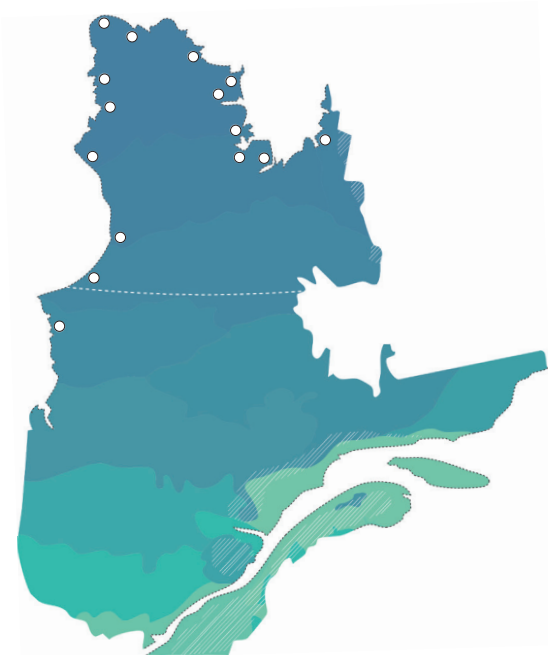
The Inuit of Nunavik are known as Nunavimmiut, ᓄᓇᐱᓂᓄᖅ. Their land is located in northern Quebec above the 55th parallel, on a vast territory of some 507,000 km<sup>2</sup>. It is bordered by the Hudson Bay to the west, the Hudson Strait to the north, and the Ungava Bay and Labrador to the east. Because of its isolation, there are no roads or railroads to get there. Its climate is characterized by harsh arctic conditions, with winter temperatures often dropping to -30°C.

This territory is home to a diversity of ecosystems, including arctic tundra, boreal forest, mountains, rivers and lakes. Land animals include polar bears, musk oxen, caribou, foxes and arctic hares. Marine wildlife includes seals, whales, belugas and walrus. Numerous migratory birds and birds of prey also inhabit the region, although the Inuit's main sources of food are caribou, seals and fish.



Figure 09 - Photo of Sugluk Bay (Ozzello 2022)

500 km



	Temperature [°C]	Rainfall [mm]	Growing season [days]	
	-9.4 to -6.0	250 to 469	90 to 119	Nunavik
	-9.4 to -6.0	470 to 799	120 to 149	
	-9.4 to -6.0	800 to 1359	120 to 149	
	-1.5 to -1.9	> 1360	120 to 149	
	-1.5 to -1.9	> 1360	150 to 179	
	-1.5 to -1.9	800 to 1359	150 to 179	
	1.9 to 4.5	800 to 1359	180 to 209	
	4.5 to 6.6	800 to 1359	180 to 209	
	Higher altitudes			
	Inuit communities			

Figure 10 - Map of Nunavik Climate (Collier 2025)

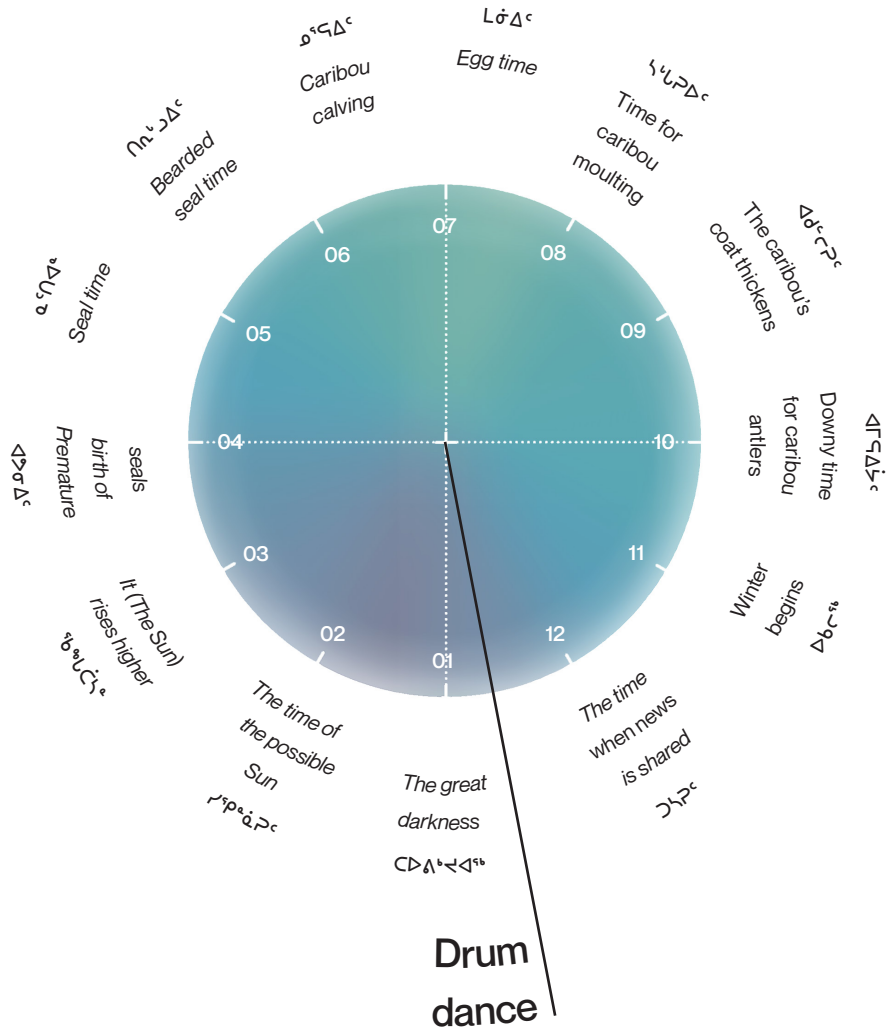


Figure 11 - Inuit Calendar (Collier 2025)

Some 14,000 people live in Nunavik, 98% of whom are Inuit (Pratt and Heyes 2022), spread across 14 communities, some of which are more than 150 kilometers apart. The Inuit of North America are descended from the Thule culture, emerging from Siberia around 1,000 years ago and migrated as far as Greenland (Rousseau 2021). Their traditional way of life was closely linked to the migrations of the caribou. Despite contact with Europeans from the 18th century onwards, certain Inuit communities remained unspoiled until the 20th century. This enabled the Inuit to preserve their culture and language.

Animal migration is irregular and dictates the timing of Inuit hunting practices. At the height of the whaling season, hunters could camp for a week without seeing a single whale. Patience and flexibility were essential. When Whites came into contact with Inuit cultures, they upset this balance by introducing Christianity. The Sabbath day imposed a weekly interruption in hunting practices and caused logistical constraints and consequent losses (Goguillon 2004). This was one of the first steps towards undesirable Europeanization for the Inuit.

In the past, Inuit built snow houses ᐃᓄᐃᓂᓂᓂ as winter shelters, a testimony of their fusion with the Arctic climate. Although they are less common today as communities have settled into sedentary villages, the Inuit continue to maintain a

strong link with their territory and traditions (Lang 2022). Their division of the year into lunar months is entirely based on the cycle of their resources, and the names given to those months are directly descriptive of this (Goguillon 2004). In this cycle, the drum dance takes place during the winter solstice period, when temperatures dictate staying in close proximity and tensions are therefore likely to build up within the group. The ritual of dancing and singing can then take the form of a competition, like a pacifist tribunal, which serves as conflict resolution (Conlon 2017).

# Steppe, Mongolia

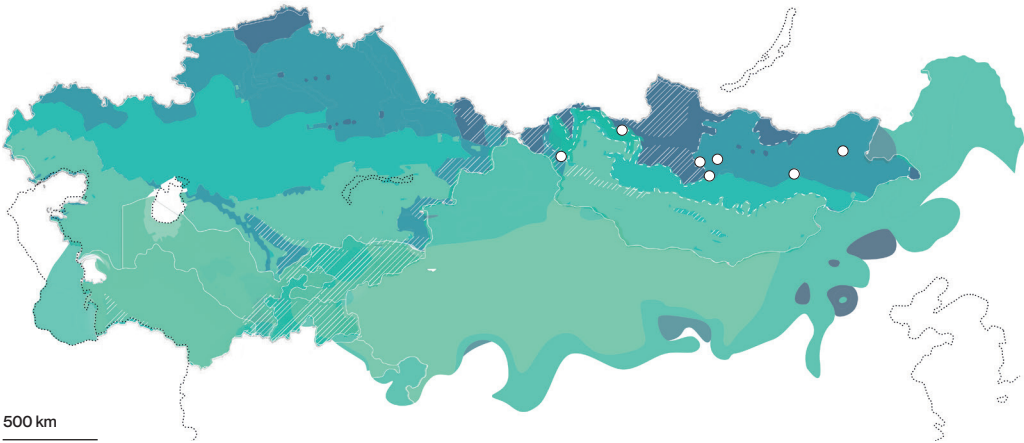
**75% of Mongolia's territory is extensive steppe land.**

In total, the country has an area of 1,566,500 km<sup>2</sup> with a wide variety of landscapes. The south is marked by the rocky, arid Gobi Desert, while the north and center are home to fertile valleys and river basins. Landlocked by Russia and China, Mongolia has no access to the sea, but its many rivers play an important role in its ecosystem. Its extreme continental climate is characterized by very cold winters and moderate summers, with low precipitation, very violent winds and daily temperature variations of up to 30°C (Cavalié 2009).

Mongolia's ecosystems include taiga forests in the north, grassy steppes in the center and east, and semi-deserts and deserts in the south, suitable for hardy plants such as haloxylon. Mongolia is home to a diverse fauna: snow leopards, ibex and bears in the mountains; marmots and gazelles on the steppes; and rare species such as wild camels and Przewalski's horses in the desert. Domestic animals — sheep, goats, horses, yaks and camels — are essential to the nomadic economy. Predators such as wolves and lynx live in the steppes and



Figure 12 - Photo of the Orange Sand of Tadrart (Emilie 2023)









	Temperature [°C]	Rainfall [mm]	Growing season [days]	
	1.0 to 9.9	30 to 150	0 to 110	} Steppe
	-0.5 to 3.0	150 to 220	120 to >160	
	-4.5 to 0.5	220 to 300	110 to 150	
	-7.7 to -4.0	300 to 360	110 to 160	
	Higher altitudes			
	Mongolian rural communities			

Figure 13 - Map of Mongolian Climate (Collier 2025)

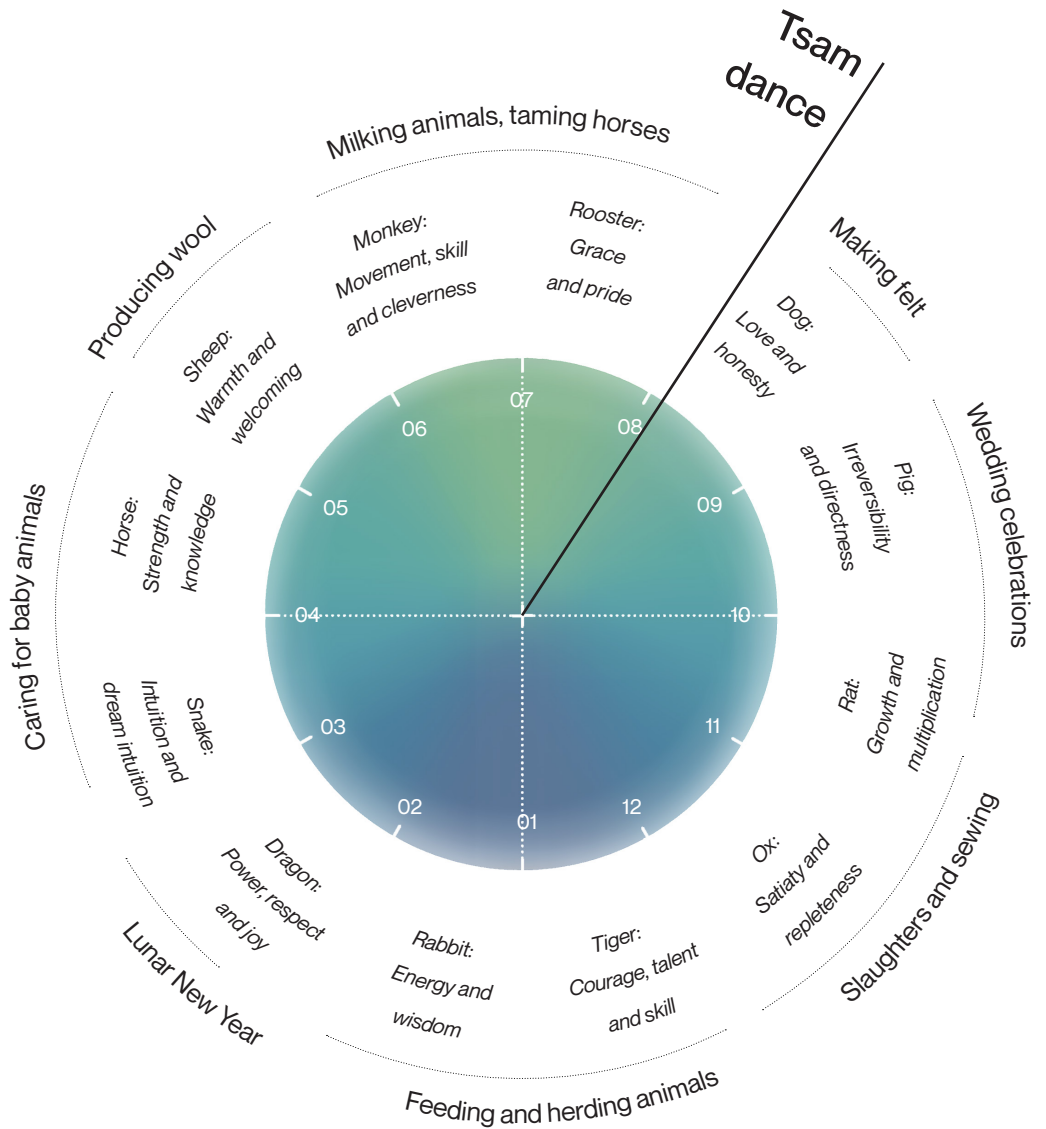


Figure 14 - Mongolian Calendar (Collier 2025)

mountains. Freshwater rivers and lakes are home to some 70 species of fish, including trout, salmon and pike. The country is very suitable for birds, with species such as falcons, cranes, snowy owls and golden eagles. The steppes provide pasture, forage and some firewood, but hardly any construction wood (Sanders, Harris, and Lattimore 2022).

The steppe territory is a vast belt that stretches on 8'000 km from Hungary to Manchuria. The eastern part of the Steppe, where Mongolia is situated, has a much harsher climate. Because of the openness of the plains, travelling through by horse is easy and necessary to access the scarce resources. The downside of this strong mobility is vulnerability to invasions, leading to important power shifts over the millennia (McNeill 2024).

Population density is low in Mongolia, concentrated in the north-central river basins. The cities are modern centers, densified and developed in the 20th century by the socialist regime, while the rural areas maintain a nomadic lifestyle. The modern way of life coexists alongside the country's Buddhist cultural heritage, thanks in particular to the restoration of monasteries and the promotion of traditional languages. Even though socialism has strongly sedentarized and modernized part of the country, almost a third of Mongolians still lead a traditional nomadic lifestyle (Sartore 2021).



# Central Sahara, Algeria

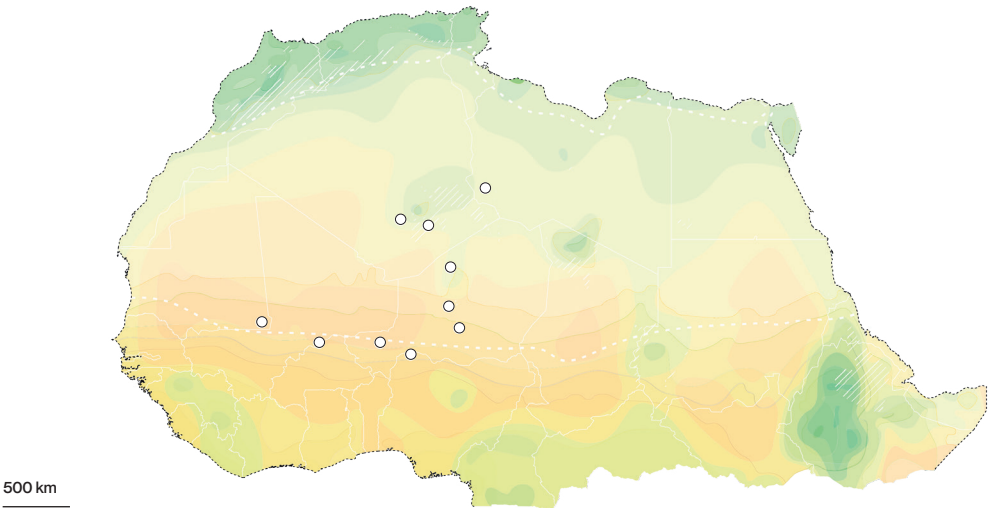
In the Sahara, the temperature difference between night and day is usually around  $20^{\circ}\text{C}$ , but in extreme circumstances it has been known to reach  $38^{\circ}\text{C}$ .

The Sahara stretches across nearly all of North Africa (Berrahmouni and Burgess 2000), covering an area of around 8,600,000 km<sup>2</sup>. It is bordered by the Atlantic Ocean to the west, the Atlas Mountains and the Mediterranean Sea to the north, the Red Sea to the east and the Sahel to the south. Difficult to access, it is traditionally crossed by camel caravans and trade routes.

The Sahara's climate can be divided into two main zones. The dry subtropical north has wide temperature variations, with cold winters, hot summers and an average annual rainfall of 76 mm. Dust-loaded winds are frequent. The dry tropical south, however, features mild winters but very hot and stormy summers, inducing annual rainfall of around 125 mm.



Figure 15 - Photo of A Flood Plain Near Karakorum (Huang 2015)













	Temperature [°C]	Rainfall [mm]	Growing season [days]	
	10 to 15	600 to 1000	120 to 180	} Sahara
	15 to 20	300 to 600	60 to 120	
	20 to 25	150 to 300	10 to 60	
	25 to 30	0 to 150	0 to 30	
	27.5 to 30	150 to 300	30 to 100	
	25 to 30	300 to 600	100 to 170	
	25 to 27.5	600 to 1000	170 to 240	
	20 to 25	1000 to 3000	240 to 270	
	Higher altitudes			
	Tuareg communities			

Figure 16 - Map of Saharan Climate (Collier 2025)

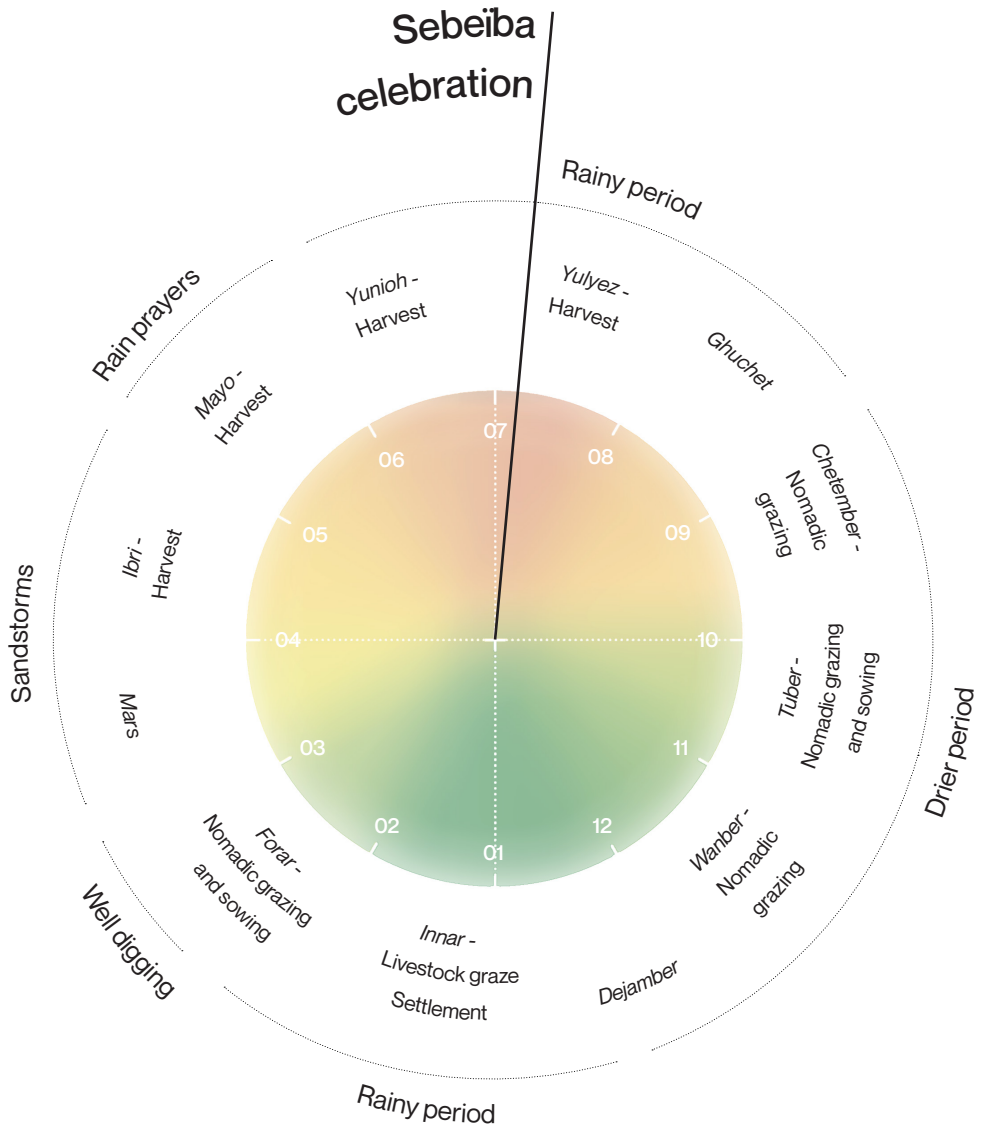


Figure 17 - Tuareg Calendar (Collier 2025)

The desert contains sparse vegetation including halophytes, date palms, acacia and olive trees concentrated in oases, mountains and wadis. It serves as the main resource for the local fauna, featuring desert hedgehogs, gazelles, reptiles and over 300 species of birds. They are all adapted to extreme conditions, thanks in particular to their tolerance of drought and their capacity for dormancy during arid periods.

The Sahara's mineral reserves are an important resource for both craftwork and trade. In the Algerian desert there is a notable abundance of copper (Hincker 2010).

Out of many Berber groups across North Africa, this study focuses on the Tuareg, who call themselves “Imûhar” or “Imuhagh”, specifically in the South of Algeria where the land is crossed by commercial routes. They number over 2 million, with settlements ranging from the desert zones of the north to the steppes and savannahs of the south, balanced between the Sahara and Sahel regions. The oases enable them to grow crops on a small scale, thanks to irrigation systems such as wells and gueltas. Those crops are primarily date palms and seasonal pastures to feed livestock. The Tuareg's nomadic heritage includes caravan trade and herding. They retain the use of the Tifinagh alphabet, traditional crafts and Islamic practices, while preserving unique matriarchal social structures (Gritzner and Peel 2019).

# Ecosystem Findings

**In this study of the territory by stratification of climatic characteristics, it becomes clear that nomadic communities privilege positions that allow them to oscillate between different land qualities according to the seasons.**

Depending on hunting seasons, the Inuit will favor either shore or in-land settlements. Depending on the intensity of winds, Mongolian herders may prefer land that has less forage but offers more shelter near the mountains. The Tuareg move across the land depending on growing and herding seasons, mostly according to the availability of water.

Originally, all calendars are practical and therefore descriptive of breeding cycles, agriculture and meteorological trends. It seems likely that the longer a culture occupies an accessible territory, the more distinctive and complex it becomes, hybridizing with neighbors or invaders. The simplicity of the Inuit calendar is without a doubt related to the remoteness of its territory. However, the Mongolian calendar is riddled with Buddhist symbolism originating from Tibet (Charleux 2012), and the Tuareg, in addition to having their agrarian calendar, come to use different month systems simultaneously depending on religious influences or administrative reasons, highlighting the complexity of being a

nomadic group on a claimed territory.

The rituals to be studied further in this paper are selected for their age and importance as heritage. It becomes clear with the calendar graphics that they all take place at key moments of the year, generally as a celebration of a new cycle. This is particularly the case for the Inuit Drum Dance and Tuareg Sebeiba. They both celebrate the coming of a new year which occurs when the climate is most extreme and provisions have been gathered, late December for the Inuit and early July for the Tuareg. This is not the case for the Mongolian Danshig Naadam festival (during which the Tsam Dance is performed). It is interesting to note, however, that this ritual is rivaled in Mongolian culture only by the Lunar New Year, which takes place six months earlier at exactly the opposite end of the annual cycle, in the coldest part of the year. While the Danshig Naadam is more of an outdoor national celebration, the Lunar New Year has more of a care - maintenance purpose. It is a time when families share gifts, clean their households and settle debts (Smits

2024). Knowing this, one can conclude that ideal dates for rituals are in times of lower productivity, climatic discomfort, and abundance of stored goods - in other words, when there are both needs and opportunity for traditional gatherings.

### Interpreting Inuit perspectives

The Arctic tundra, home to the Inuit, is characterized by icy landscapes, extreme cold and dependence on marine and terrestrial wildlife that cannot be tamed. This leads to a high level of resilience and a unique perspective on the universe. Undoubtedly thanks to remoteness, there seems to be a great deal of consistency in Inuit spiritual beliefs over the last 5,000 years, prior to their presence in North America.

It is difficult to describe a worldview so different from that of Westerners, and therefore from Western lexicon. Psychologist Marcel Rousseau lived five years among the Inuit in Nunavik. He immersed himself in the community as much as he could before publishing a book about the roots, way of life, and challenges of today's Inuit. He started his book with a quote by Alooook that stated the Inuk artist's frustration with Whites studying and misunderstanding his culture, publishing errors of observation and interpretation (Rousseau 2021).

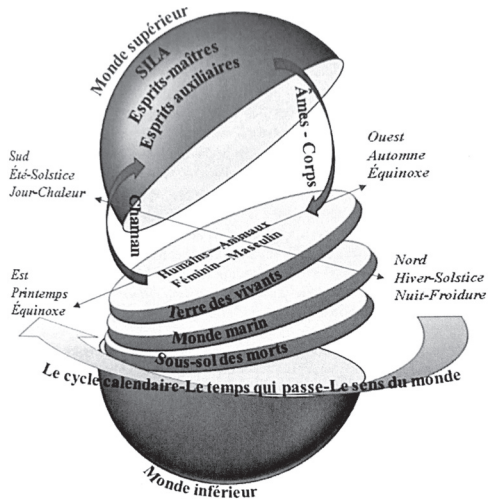


Figure 18 - Inuit Conception of the World (Rousseau 2021)

Given Rousseau's investment and sensitivity, I am inclined to value his rendering of the structure of Inuit beliefs. According to him, they are woven together as follows: the universe is perceived as a group of separate worlds, including the flat Earth world, inhabited by humans, animals and plants, as well as the domed Sky world, inhabited by spirits, and the lower world, below the Earth world, with which it can communicate, that shelters people who died of natural causes.

These worlds have no clear boundaries and are believed to be animated by a primal energy called  $\Delta\epsilon^{\epsilon}\Delta^b$ , pronounced Sila, which drives and organizes the universe. It feeds other energies, vital forces and spiritual essences that inhabit the elements and events of this universe, including celestial bodies like the Sun and Moon. These are seen as having a

conscience of their own, and run within the dome of the sky, which is itself believed to be perforated, allowing light to enter through points in the form of the stars (Rousseau 2021). All life is formed of borrowed spirits or energies entangled in a larger system that runs in cycles.

### **The Steppe, mobility and politics**

The steppe, home to Mongolian shepherds, is characterized by vast grasslands with marked seasonal variations, favoring nomadic pastoralism and horse riding. In a context of openness leading to mobility, migration and frequent invasions, a link can be made between territory and patriarchy. A defensive social model was necessary, with gendered kinship groups united into tribes, themselves gathered together as confederations governed by dominant male leaders selected for their military success (McNeill 2024).

The western part of the Steppe, near the borders of today's Moldova, is notably believed to be at the origin of European patriarchy. Indo-European tribes, known as "kurgans", migrated from there between the fourth and third millennia BC and evidence shows that, after their arrival, pacifist communities across Europe became hierarchized and competitive opponents (Gimbutas 1999; Collier 2023).

Buddhism has reached Mongolia in waves during the past millennium, adopted in a form that worships elements of the Mongolian landscape like mountains and rivers, blending with local shamanism. It has been spread by mobile monks and lamas that gather in monasteries that serve as spiritual hubs in the vast nature. Since the 16th century, Buddhism has brought structure and stability to Mongolia, embracing its history while introducing support for community moral values, leadership hierarchy, education systems and shared rituals for unification. In spite of oppression during the Soviet era, Buddhism has been revived and is still an important part of the Mongolian rural culture (McNeill 2024).

### **Survival and social discipline**

Finally, the desert environment of the Berber nomads necessitates a strong organization to overcome the scarcity of water and harsh climate. More specifically, the Tuareg have a rigorous caste system to divide tasks and access to resources in a predefined way. The impact of these castes on settlements and Tuareg culture will be further examined in the next chapters

### **A perspective by “Degree Days”**

Degree days measure the energy cost of a place to obtain thermal comfort, by summing the difference between the measured temperature of the days in a month and a threshold defined by comfort standards. Those measurements are compiled using an integration method. For offices or housing, today, 19°C is considered a minimum temperature and 24°C a maximum. The further the local temperature deviates from these values, the greater the number of degree days. If this deviation is caused by lower temperatures, we speak of heating degree days, while conversely, if the deviation is caused by higher temperatures, we speak of cooling degree days (eia 2024).

These comfort thresholds are evidently a modern construction, as the building temperature considered comfortable has increased over time. In the space of a century, the temperature considered pleasant for a bedroom, for example, has risen from 12°C to 18-20°C (Lemée and Paillon 2021).

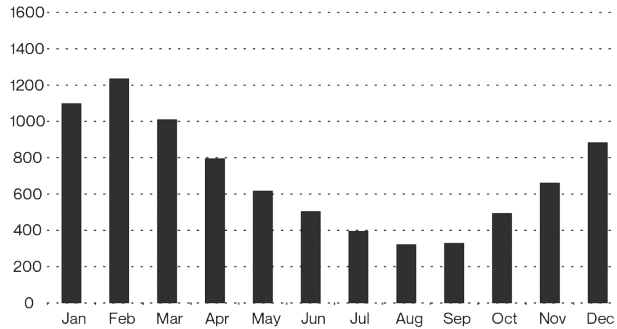
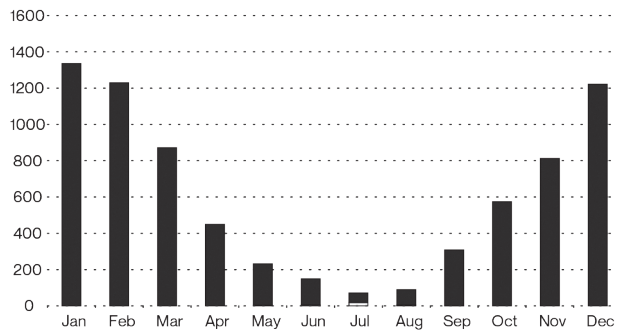
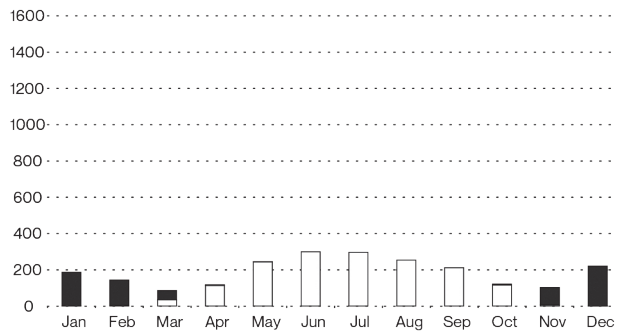
Just over 400,000 years after the domestication of fire, mankind moved from the high plateaus of East Africa to northern Europe around 40,000 B.C. and then to Russia in 25,000 B.C. This migration required progressive adjustments and increasingly refined technologies, notably through architecture and clothing, to overcome increasingly hostile climates (Rahm 2024). The further away from

hospitable regions, the greater the need to be strategic and able to compromise.

These adaptation strategies will be the focus of the next chapters.

The following graphs of degree days were created with data from 2024 (“Degree Days Calculator” 2024).



**Ivujivik, Quebec, Canada****Jargalant, Töv, Mongolia****Djanet, Illizi, Algeria**

For comparison, here are the heating and cooling needs for Lausanne as well as Beirut, whose territory was part of the Fertile Crescent, a region in the Middle East known as the birthplace of early civilizations and agriculture thanks to its rainy climate and cultivable land.

Lausanne requires moderate to more substantial heating all year round. Beirut, on the other hand, requires notably low adjustments, maintaining properties conducive to intuitive human settlements.

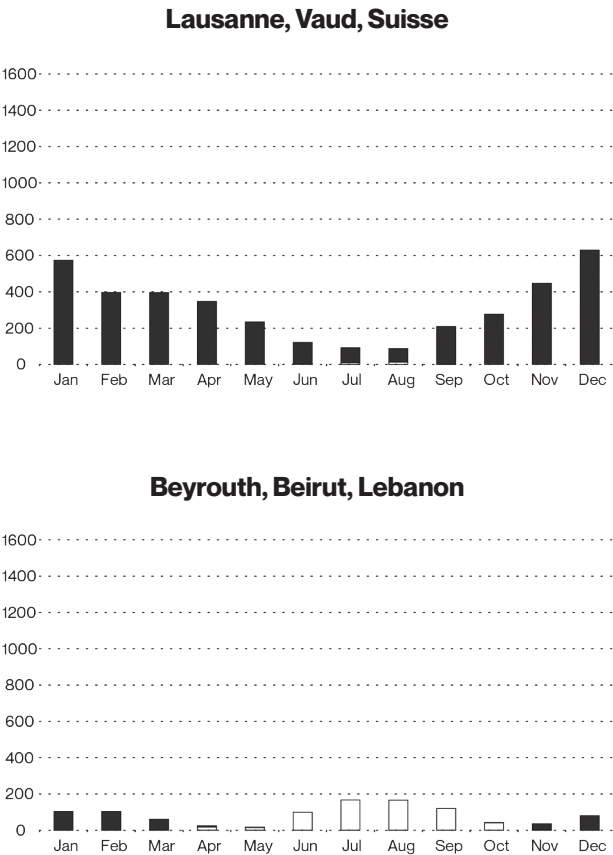
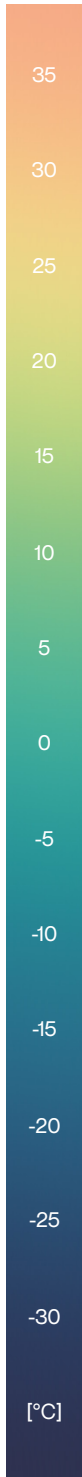


Figure 19 to 23 - Adapted Graphs of Degree Days ("Degree Days Calculator" 2024)



As they travel through the land and before building up their dwellings, nomads seek to choose an ideal site to settle in. They seek protection from the wind and access to resources like water, pastures or hunting opportunities, often favoring the same locations from one year to the next. This section will display the relationship of nomadic dwellings to each other and to the land. These settings are presented in a climate close to the yearly average.

# Settlements



**On the right are three gradients representing the average exterior and interior temperatures of the dwellings studied.**

The temperature reached inside is close to that in which human bodies are comfortable. This comfort is achieved with complementary garments or blankets and optimal ventilation management. The general space is heated by the bodies and by fires, especially in the case of the ger.

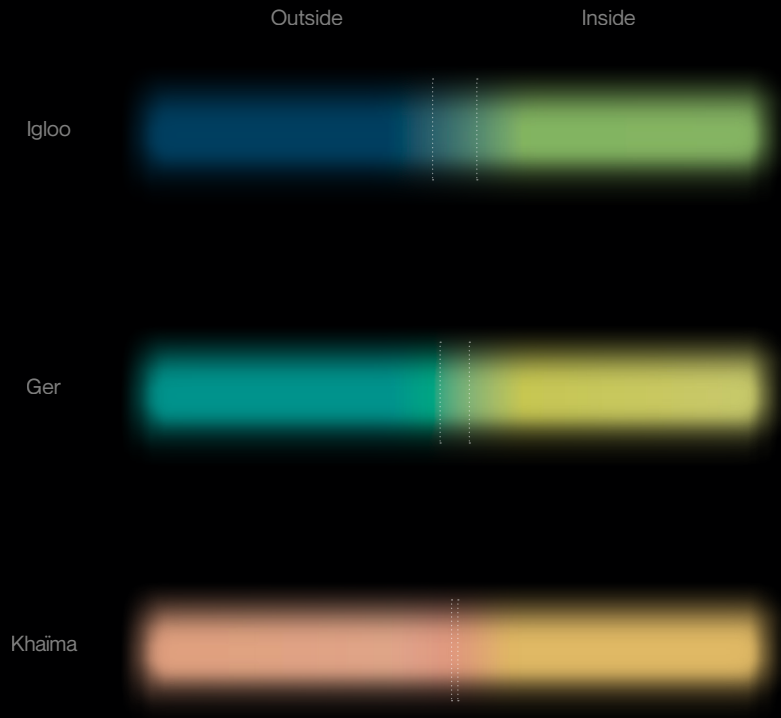
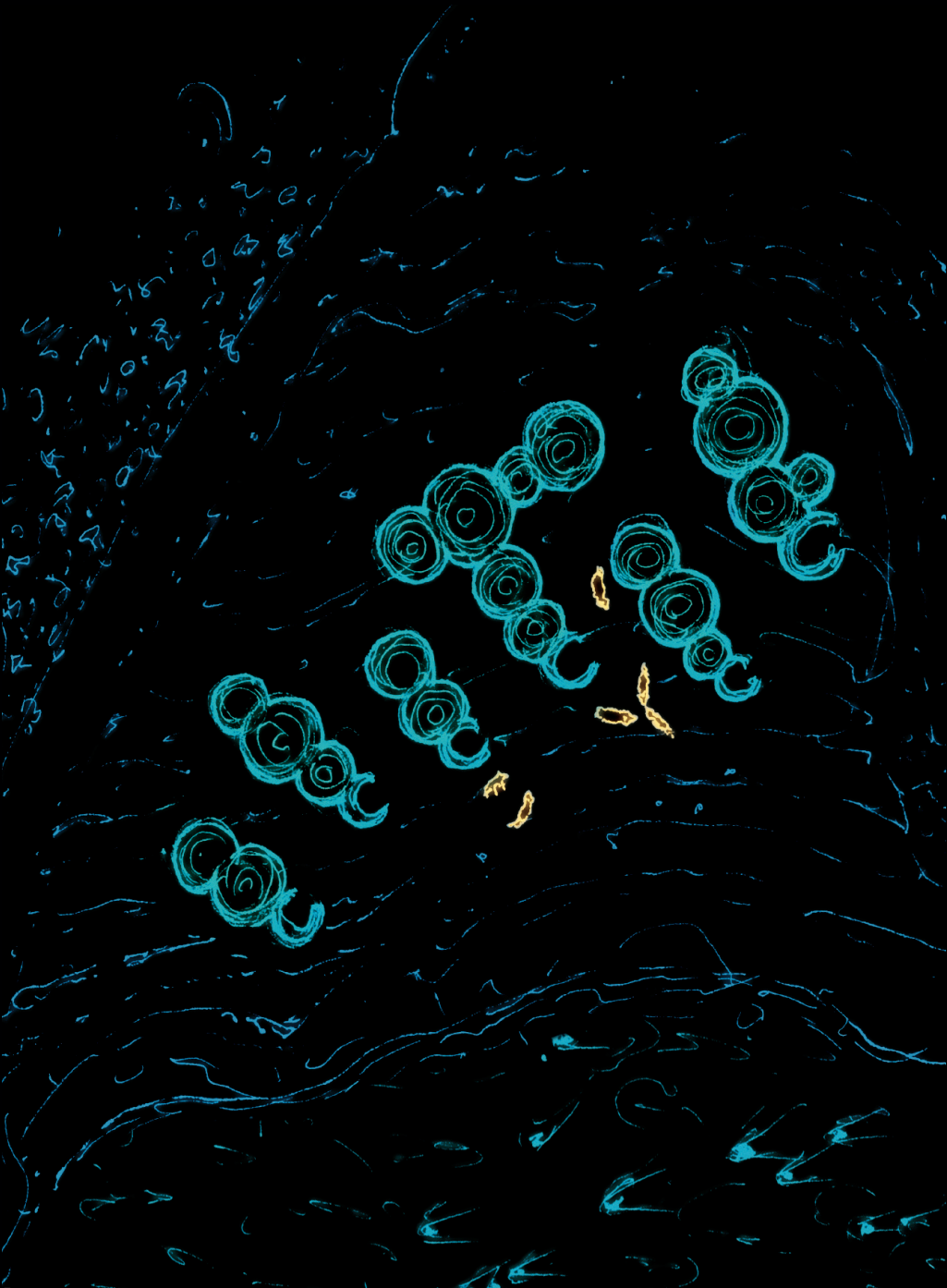


Figure 24 - Dwelling Temperature Changes (Collier 2025)



5m

Figure 25 - Inuit Settlement (Collier 2025)



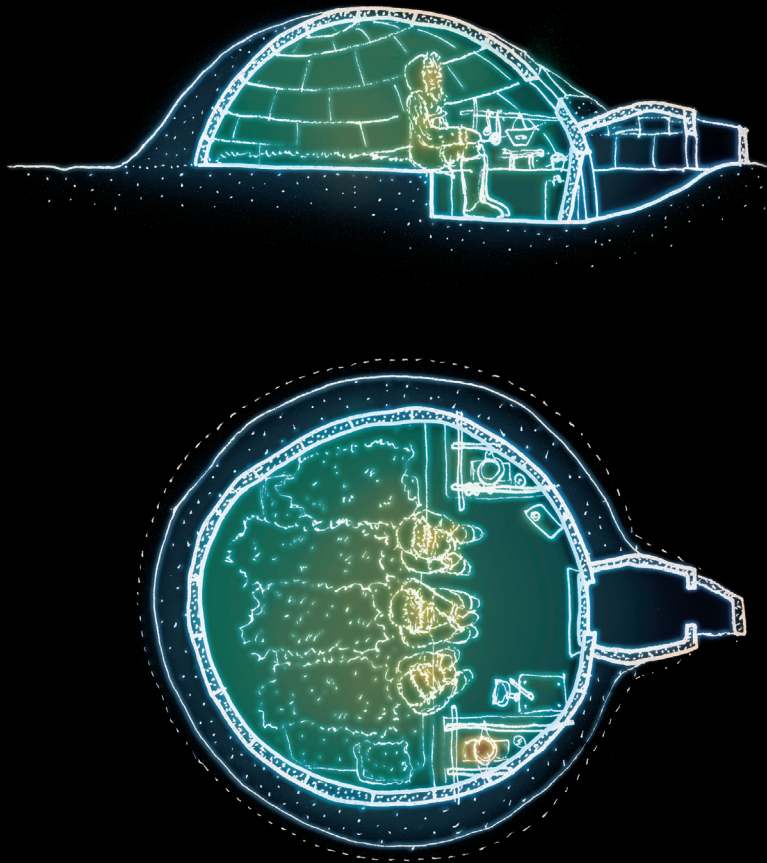


Figure 26 - Inuit Dwelling (Collier 2025)

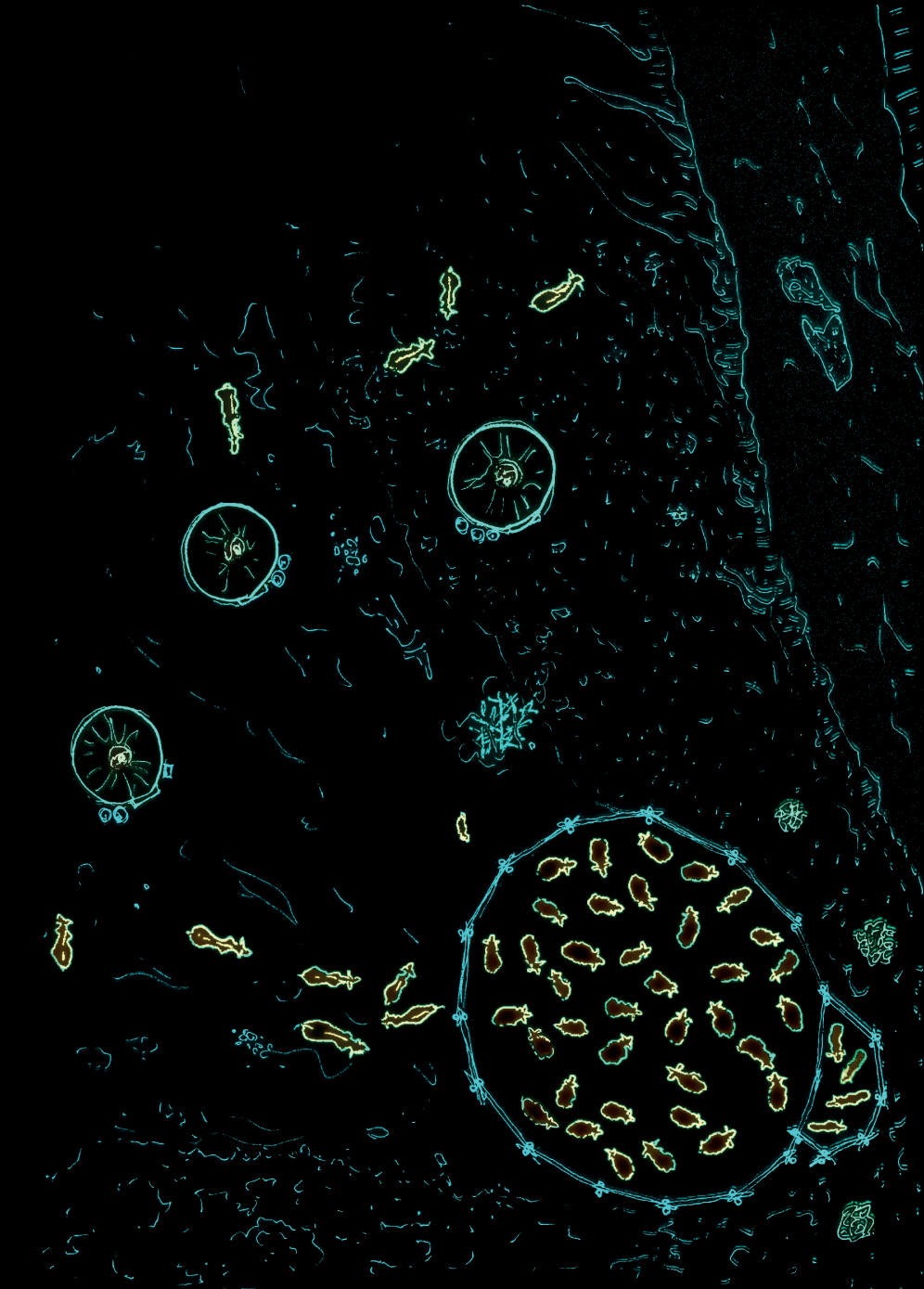
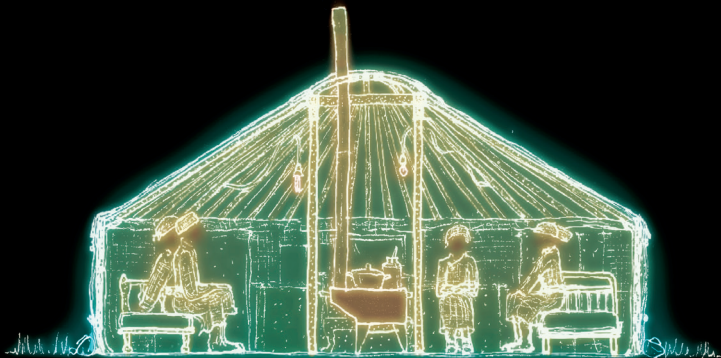
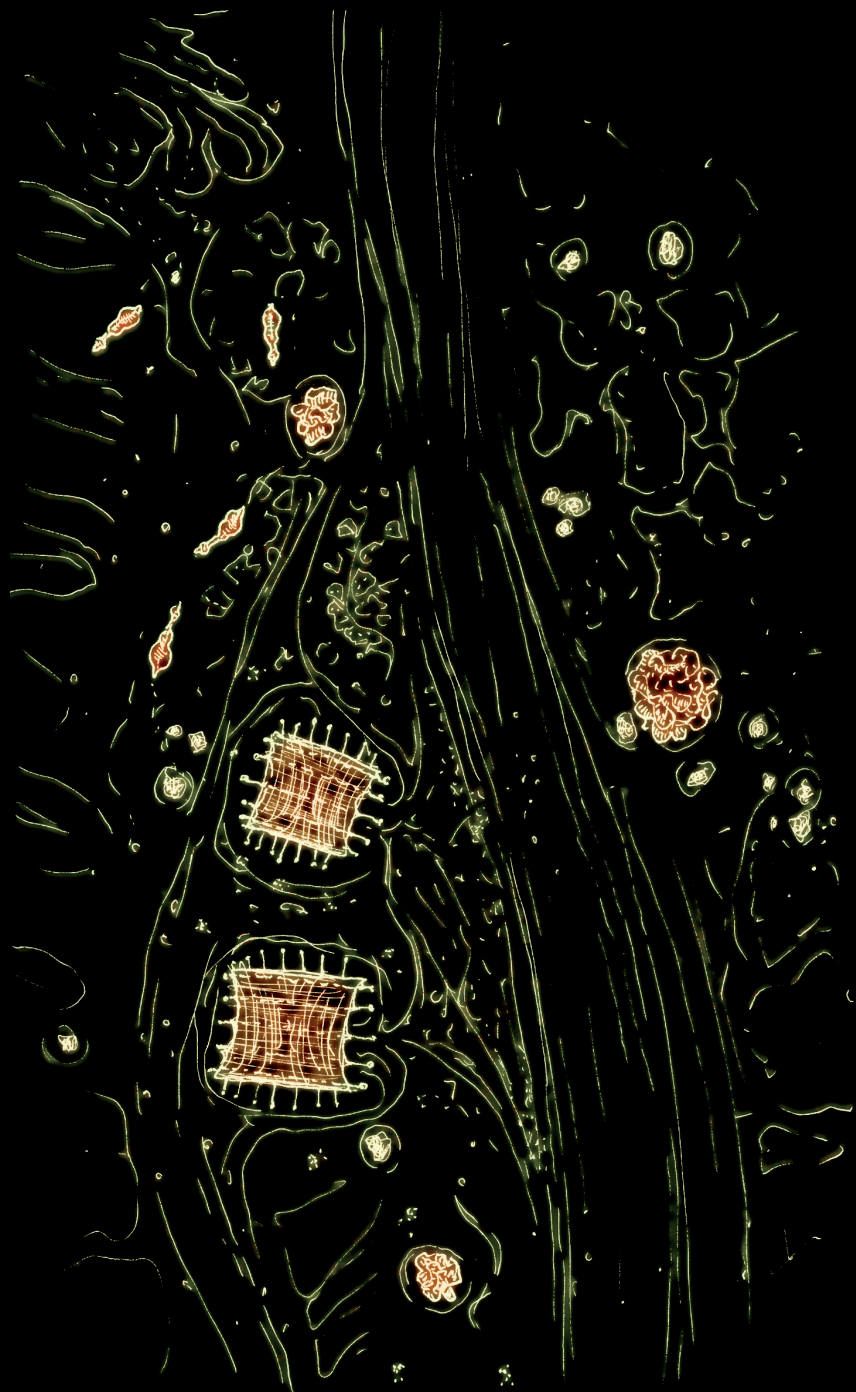


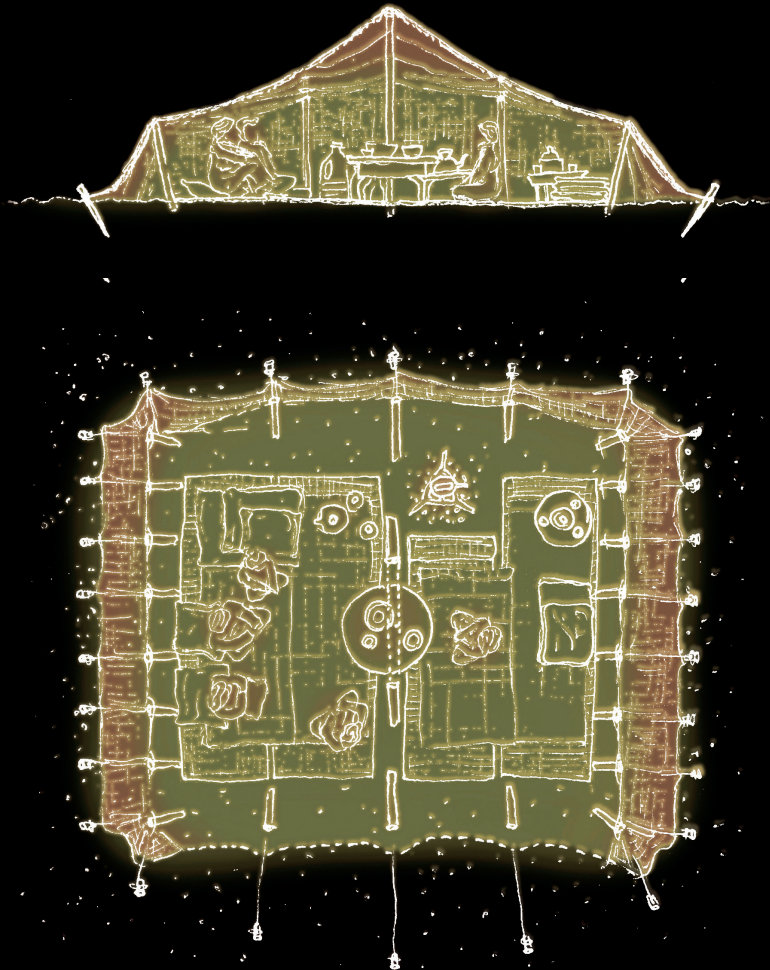
Figure 27 - Mongolian Settlement (Collier 2025)





5 m

Figure 29 - Tuareg Settlement (Collier 2025)

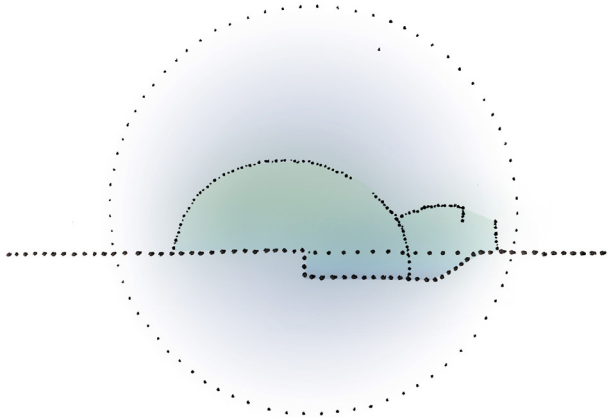


Nomadic dwellings promote the values of community, resilience and adaptability. In each case study, once their position has been established, they are assembled as a group to shelter an entire family. With their modular openings and small volume, igloos, ger and khaimas are all highly efficient at containing warm air or ventilating space.

# Dwellings



# Igloos



During the winter, the Inuit used snow houses, called ᐃᓄᓂ “iglu” or ᐃᓄᓂᐱᓂᓂᓂ “iglavigak”, built as soon as the first snow fell in October.

These temporary structures provided protection from the elements, conserved heat without fire, and made efficient use of materials available in a resource-poor environment. The Inuit led a nomadic lifestyle, living in igloos in winter and sealskin tents (ᐅᐱᓂ «tupik») in summer. They were not settled in centralized villages until the mid-20th century, under the influence of colonial policies aimed at regrouping populations for administrative and sanitary reasons (Pratt and Heyes 2022).

Igloos are built from blocks of compacted snow cut from frozen surfaces. These blocks measure around 40 cm in length and 15 cm in thickness, and are arranged in layers to form a helical structure. The construction technique involves placing the snow blocks at an inward angle to form a dome. A small igloo can be built in less than 30 minutes. When they were built regularly, igloos were generally 3 to 4 meters in diameter and up to 2.5 meters high (Pratt and Heyes 2022). The last step was to light whale-blubber lamps and leave the igloo blocking its



openings. The accumulated heat would melt the surface of the walls, securing them by removing joints and saturating the snow. After reopening the igloo, the cold air would freeze the saturated walls resulting in a monolithic structure. Ropes could run inside the walls to hold animal skins against them on the inside, trapping air and improving thermal insulation (Daignault 1973). Skins were also used to cover surfaces for seating and sleeping. Wind-blown snow gathered on the outside of the igloo over time would also increase its insulation.

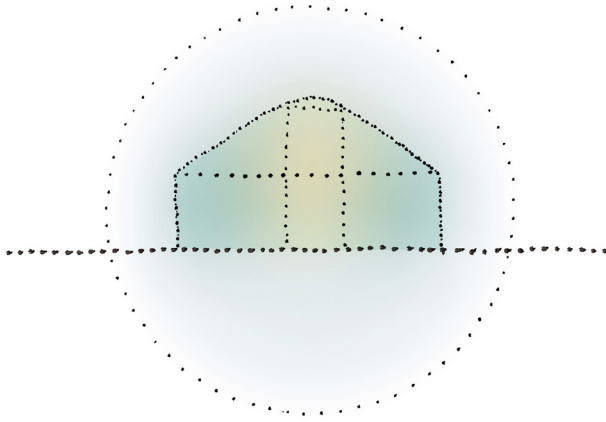
Some igloos housed several families, with separate sleeping compartments connected to a main bedroom. The

tunnel-shaped entrance was designed to trap cold air, ensuring better thermal insulation. Slabs of ice closed the passage at night. Igloos were mainly used as temporary shelters, especially during hunting expeditions or snowstorms. Inside, the organization of spaces reflected Inuit social customs, with seating arrangements dictated by hierarchy and family roles. Today, although igloos are rarely used, their construction remains a skill passed down from Inuit elders. They are sometimes built for educational purposes or to cope with extreme conditions in the wilderness.



Figure 31 - Snowhouses being built at Bernard Harbour (O'Neill 1915)

# Gers



**The ger, the dwelling of the herdsman of the Mongolian steppes, first appeared around the 15th century B.C. Easy to assemble, dismantle and transport on the back of animals, it also adapts easily to wide variations in climate.**

Each ger houses a family, who move it two or three times a year depending on the season. Their circular plan covered by a conical roof enables them to withstand both wind pressure and the weight of snow.

The gers always face south, for reasons of lighting and wind direction. Assembly and dismantling can take from 30 minutes to 3 hours, depending on the number of people involved. The floor is first positioned and held in place by

the furniture. The perimeter structure, a wooden lattice wall, is then unrolled. The crown, a wooden wheel that allows ventilation and lighting, is raised by four people and then held in place by two posts. Most of the wood is imported, as the steppes are virtually treeless. Joists connect the crown to the perimeter wall, then the ger is covered with felt held in place by horsehair ropes. Weights can be suspended from the center of the roof to hold the structure in place (Korteman 2021). The stove and fireplace are then

assembled in the center, and the furniture can be placed in its final position. The furniture consists of painted wood beds, small tables, stools and chests of drawers. Modern gers are often equipped with solar panels. Carpets are laid on the floor to enhance insulation and comfort.

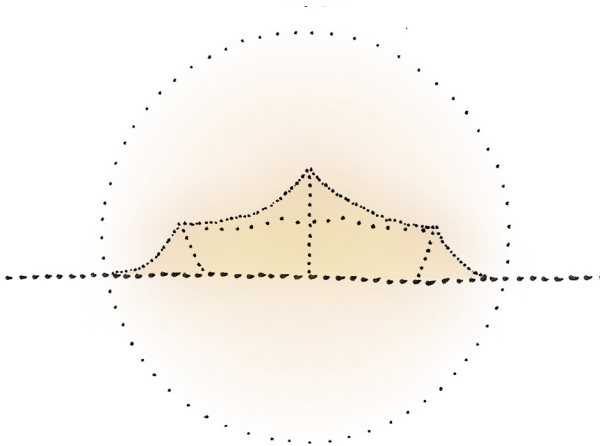
The enveloping felt can be layered to guarantee better insulation, or rolled and unrolled to allow ventilation. As felt has a low thermal conductivity ( $0.04 \text{ W/mK}$ ), the interior daily temperature can vary by up to 15 degrees. During the day, the peripheral areas of the ger are warmer than the center due to solar radiation. At night, however, the joints between the envelope and the floor let in the cold,

and it is necessary to keep the stove lit to maintain a comfortable temperature (Xu, Jin, and Kang 2019). Like the rest of Mongolian culture, gers incorporated elements of Buddhist culture from the 16th century onwards (Charleux 2012). To the north of the ger, opposite the entrance, is a sacred altar. It is in the direction of this altar that the occupants sleep, overlooking the entrance. The equipment for the activities assigned to men is arranged in the western part, while that reserved for women's activities is stored in the eastern part. It is customary to move clockwise in the ger, never crossing through the center.



Figure 32 - Interior of a Kyrgyz tent (Kun 1865)

# Khāïmas



**Historically, Tuareg families travelled with their herds in search of water during dry seasons. The Khāïma is their tent, designed to withstand sand storms and increase ventilation.**

In order to maximize lighting, the tents are usually oriented with their primary opening facing south (Fischer 2022). They are pitched by families, sometimes with neighbors, taking into account wind direction, availability of shade and ease of relocation (Steadman 2024). In Tamazight, the Berber language, “taxamt” means both “tent” and “family” (Erickson 2016), indicating the strength of their intertwinement.

Traditionally, the women hand-weave a strong canvas of black goats’ hair. It is stretched over two central pillars and

pulled on either side by camel-down ropes, which are anchored to the ground by stakes. Goat skin can add additional protection, especially during storms. The ground is covered with grass-woven mats that serve as wind barriers (Fischer 2022). The interior is divided into two distinct compartments, dividing the occupants by gender and reflecting Tuareg hierarchical organization and social relations. Milk and utensils are stored on the women’s side to the right, whereas men’s saddles and tools can be found on the left side (Bouazzaoui 2013).

The black fabric makes the *khaïmas* recognizable from afar, but its primary function is climatic. The absorptivity of black fabric for visible radiation is more than 2.5 times greater than that of white fabric. This doesn't change the heat gain experienced underneath, but the higher surface temperature encourages heat loss through convection. This phenomenon is largely amplified by the air current induced by the through-aperture of the tent, maintained by a chimney effect that evacuates warm air through the fabric, drawing in cooler air from below (Shkolnik et al. 1980).

Droughts led the Tuaregs to combine semi-nomadic herding with agriculture in

oasis areas (Rasmussen 1992). Although many Tuareg families have settled in those oasis areas, they still treasure their tents for special occasions celebrating their heritage. These tents are an essential part of their cultural identity in a post-colonial context (Claudot-Hawad 2012).

### **Tuareg division and settlements**

As noted earlier, the nomadic Tuareg society was divided into castes. They have mostly disappeared with the predominance of sedentarization, but their vestiges nevertheless define more or less privileged living situations. These castes were the "Imajeghen" nobles, in charge



*Figure 33 - Tent with a leather roof (Nicolaisen 1997)*



of political and military responsibilities; the “Inaden” craftsmen or blacksmiths, who provided tools, weapons and jewelry with secret know-how; the “Ineslemen” marabouts, erudites who ensured social cohesion within a spiritual framework; the “Ikkan” slaves, who were responsible for the physical tasks of breeding, transport and domestic maintenance; and finally the “Ismkhan” vassals, in charge of agriculture.

Blacksmiths were the most marginalized, speaking “Tenet”, a language they alone understood so as not to share their knowledge. As they worked with fire and carved ornamental symbols, they were perceived as having mystical powers and being connected to spirits, in a more

ambivalent way than the marabouts, who were seen as wiser and impartial.

These castes were all interdependent through highly codified dynamics of authority and patronage. This stratification made it possible to prevent conflicts, with a pre-established and efficient division of functions that went unchallenged (Rasmussen 1992). It was this organization that determined encampments when the community gathered in the same place, offering more privileged positions to nobles and marabouts, surrounded by servants, and a slightly recessed site for blacksmiths (Smith 1978).

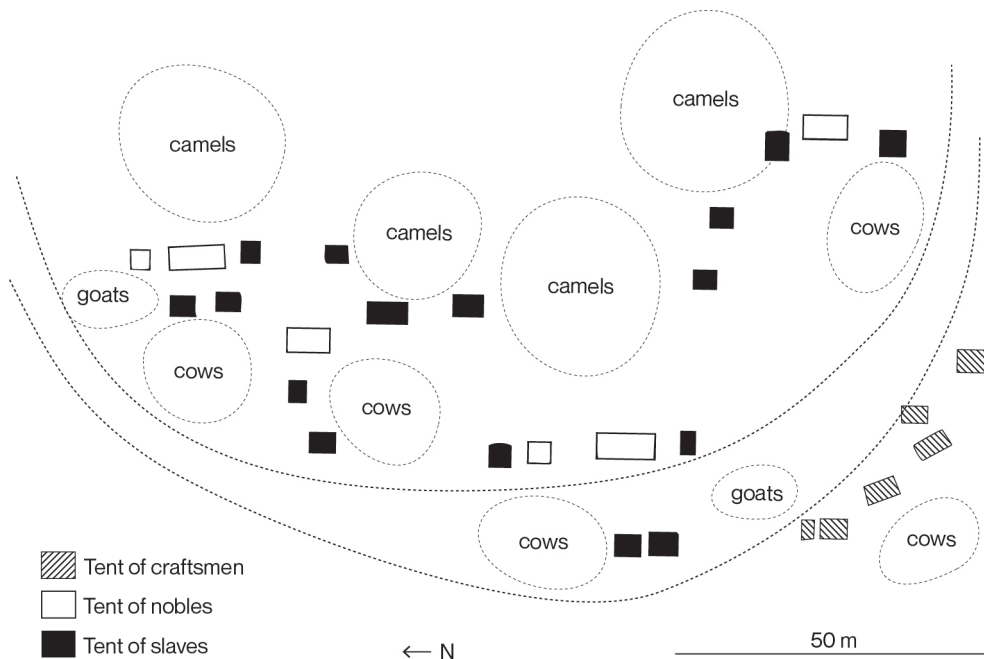


Figure 34 - Adapted From Tuareg Camp Plan (Smith 1978)

# Forced Sedentarization

About a third of the Mongolian rural population still practices nomadic herding, which has always been a pillar of the country's national identity. However, as minorities in the countries that claimed their lands, the Inuit and Tuareg people did not benefit from the same support.

In the 60s, the Canadian government relocated many Inuit families by force, grouping them in permanent settlements. They were promised access to social services including education and modern healthcare, but they were essentially disconnected from their sustainable roots and forced to rely on a system poorly adapted to their land and needs. In addition to this major cultural disruption, the inhabitants of Arctic regions suffer the impact of climate change more than most. Winter has lost six weeks and sea ice coverage has melted by a third in the past ten years. The impact on local ecosystems is drastic, considerably reducing opportunities for hunting and fishing and subsequently adding to the Inuit's reliance on expensive store-bought foods (Mercer 2018).

With the help of NGOs and support from the government, Mongolian nomadism has survived economic and

climatic pressures but it still suffers. With climate change, Mongolia's seasonal balance has been especially disrupted. The country's average temperature has risen by 2°C since the 50s, making both summer droughts and winter frost even harsher than they used to be. The start of this phenomenon was accompanied by the collapse of Soviet structure and support in 1990. The severe cold conditions, named "dzud" (UNDRR 2023), have become so extreme that livestock mortality has tremendously increased. In 1999 and 2009, dzuds killed respectively 10 and 8 million animals. This has forced many to move to urban areas, doubling the population of Ulaanbaatar in the past 30 years (Kingsley 2017).

Other pressures have befallen the Tuareg population of southern Algeria over the past century. Colonization policies imposed rigid borders to North African countries, restricting considerably

the lifestyles of caravanners. After decolonization, new states marginalized nomadic communities which, in addition to being far from the new centers of power, are not represented in governments. In the 70s and 80s, rigorous sedentarization policies were applied to keep track of the population as well as profit from the region's underground mineral resources, especially in Algeria and Libya. Major droughts in the same decades (1974 and 1984) were the final blow to the nomadic lifestyle of Tuaregs. Remaining nomadic herders have had to restrain their yearly mobility radius from 900 to less than 100 kilometers (Claudot-Hawad 2012).



# Dwelling Findings

As Mongolia has very versatile seasons and lands, there are overlaps between the materials found in the Steppe and those found in Nunavik and the Sahara.

Material	Community	Application	[W/mK]	[mm]
Felt	Mongolian	Ger insulation	0.04	1 - 2
Camel wool	Tuareg	Khäima tents	0.04	1.5 - 2
Snow	Inuit	Igloo envelope	0.05	150
Wood	Inuit, Mongolian, Tuareg	Structural elements, piles	0.04 - 0.12	-
Seal skin	Inuit	Tupik tents (winter)	0.16	3 - 5

Figure 35 - Table of Dwelling Materials (Collier 2025)

Here is a compilation of the thermal properties of materials used for the dwellings of the three communities, from various sources (Forostyana et al. 2020; Krishnaraj et al. 2012; Sledd et al. 2024; Liwanag 2008)

Low conduction allows for low thermal inertia and better conservation of temperature. For comparison, air at 0°C has a conductivity of 0.024, industrial building insulators are around 0.03, organic building insulators 0.06 and modern polyester is around 0.09. Examples with higher conductivity are

water with a conductivity of 0.60 (at 10°C), stones of 2.2 to 3.5, and iron of 79.5 (Marti 2022).

Given the rather similar organic origins of the materials used by the three communities, their conductivity is in a shorter margin, varying from 0.04 to 0.16 [W/mK]. Many of the differences that they offer in practice come from the way that they are used and layered, benefiting from properties other than conductivity like water permeability or emissivity, the reflection of thermal radiation.

## Harsh climates and wood

All three communities are settled in climates where few trees can grow. Wood is very valuable as it is light, structurally strong and easy to sculpt. Given its scarcity, people treat it with great care in order to preserve it and pass down wooden elements from one generation to the next. Mongolian furniture is painted in red and embellished with fine motifs, whereas Tuareg tent stakes are meticulously carved with traditional patterns.



Figure 36 - Tent Piles (Unknown Tuareg 2020)

## Fire and heat

Both the Inuit igloo and Tuareg tent use flames for cooking but not for heating, as they regulate their temperature independently with dwellings that intrinsically operate on convection, conductivity and emissivity. Mongolian gers, however, rely on constant stove heating in the winter. Although construction wood is extremely scarce in the Steppe, driftwood is rather common, allowing this form of heating. The Mongolian ger is exposed to climates that differ colossally over the course of a year, so it cannot operate as efficiently as others year-round.

## Living units

One dwelling, in all three cases, generally serves one family that shares the interior space at night. All of the three studied societies separate tasks by gender, with women being more inclined to weave or fix fabrics and prepare food while men are more implicated in hunting and breeding. In both the Tuareg tent and Mongolian ger the entrances serve as the main light entrance and are always facing south, and there is evidence that the shared space is divided by gender. Interestingly, in both cases, the men's side is west and the women's is east; perhaps this is because light is needed more in the morning for men and in the evening for women.

Families are always stronger in small groups, sharing tasks and resources. In all three cases, extended families reunite at least once a year to share strength and knowledge in traditional settings.

### **Ground floor**

All of the dwellings studied are limited in volume and height to a one story space, close to the ground. This not only represents an advantage for transport, as the resulting structure is necessarily light; it also maximizes the positive effects of wind and sunlight (Vassileios and Ioannou-Naoum 2024).

The three different clothing modes regulate body temperature by playing on the blocking or circulation of air. They play on the assembly and tightening of layers of skins or fabrics with distinctive properties. Providing comfort and mobility, they are the first line of protection from the climate. A lot of time and skill go into their upkeep every year.

# Garments



35

30

25

20

15

10

5

0

-5

-10

-15

-20

-25

-30

[°C]

**Here are examples of cuts for the main piece of each traditional outfit: the Inuit parka, the Mongolian deel and the Tuareg daraa.**

These reconstructions are based on the observation of many different garments, and aim to provide comparative information on what would be a neutral clothing item, representative of the sewing techniques and climatic properties sought by each community. Although the daraa is traditionally worn by men, these compilation results are intended to be gender-neutral.

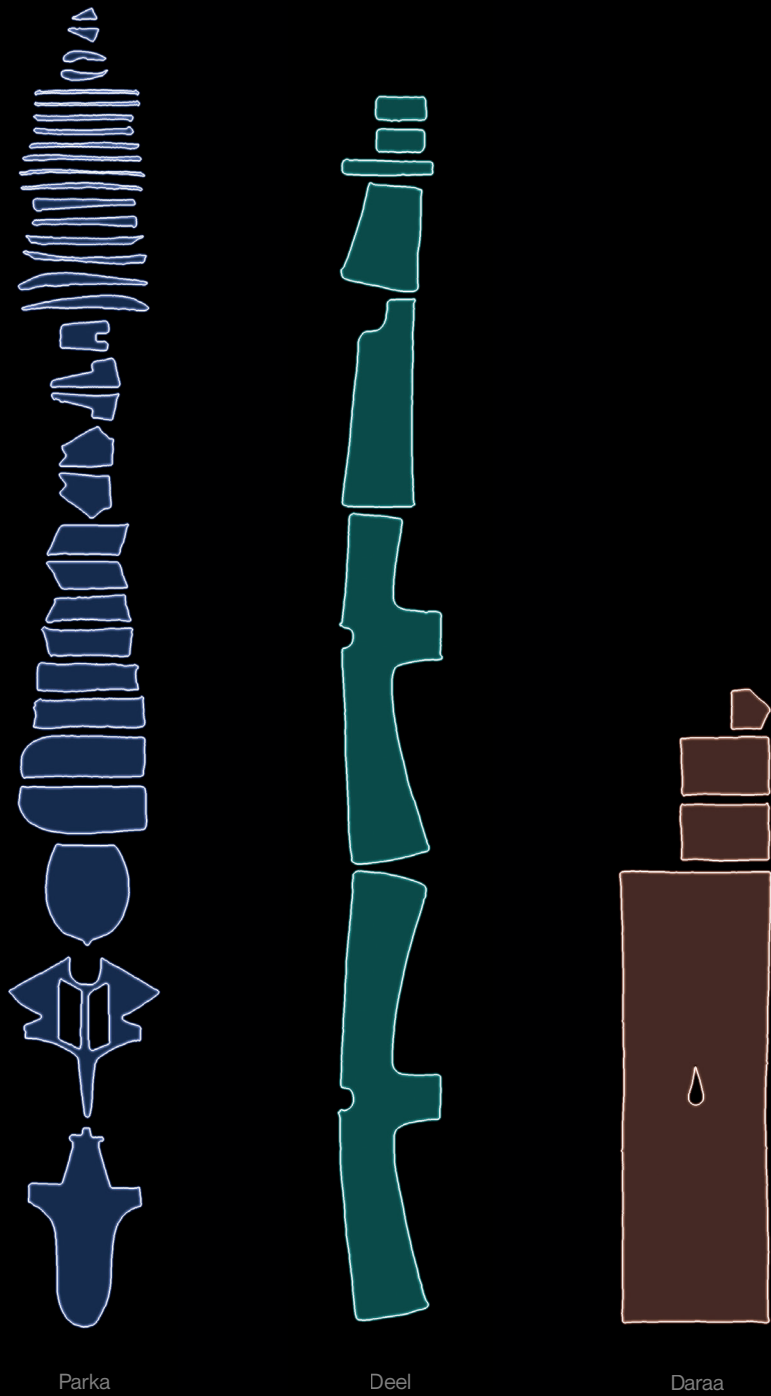


Figure 37 - Garment Parts (Collier 2025)

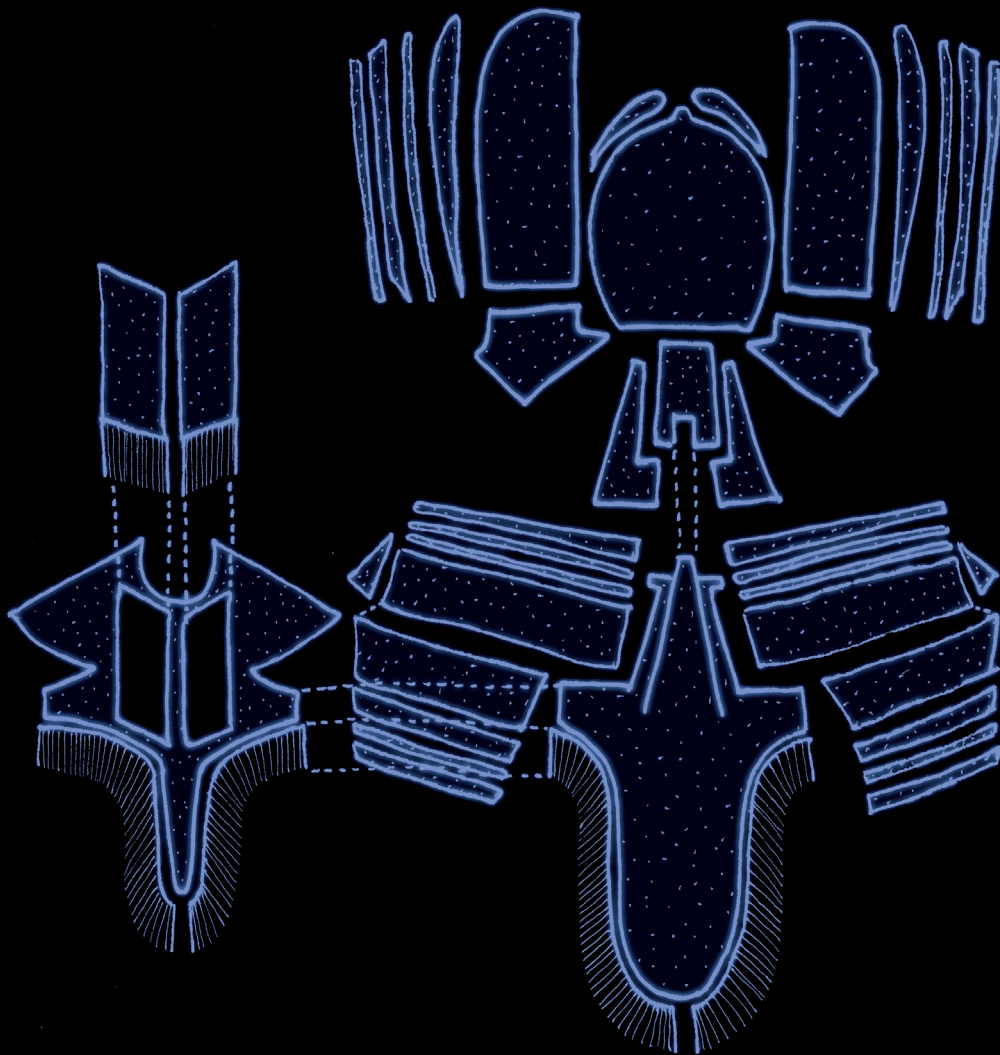


Figure 38 - Parka Parts (Collier 2025), based on Arctic Institute of North America 2014



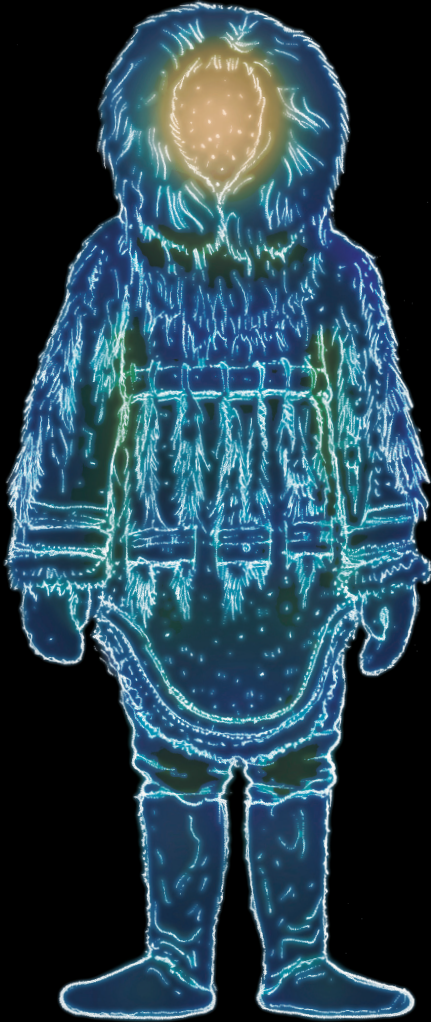


Figure 39 - Inuit Outfit (Collier 2025)

20 cm

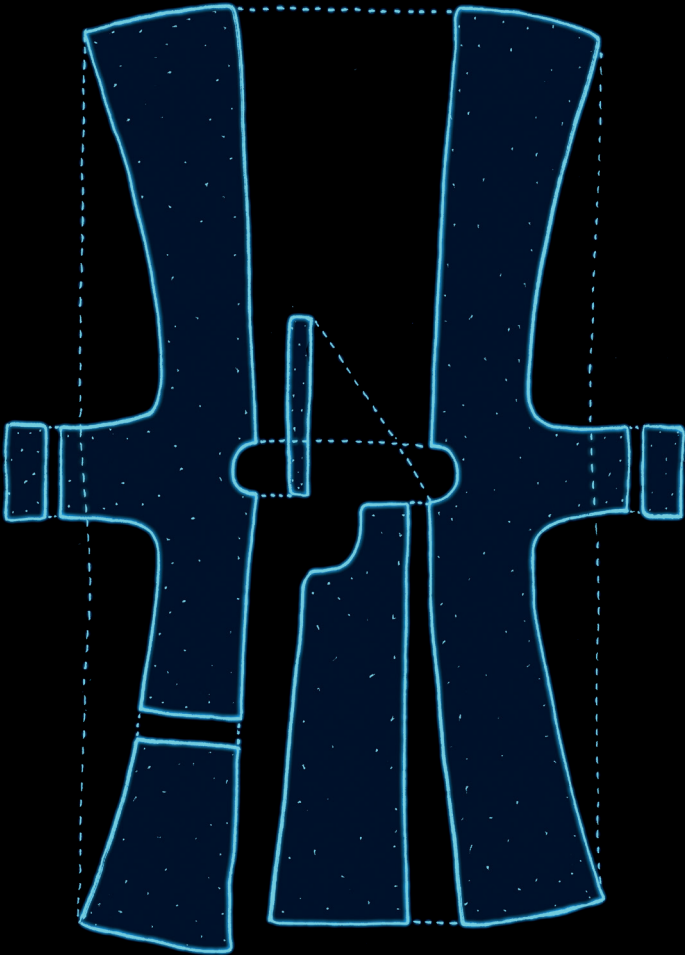


Figure 40 - Deel Parts (Collier 2025)



Figure 41 - Mongolian Outfit (Collier 2025)

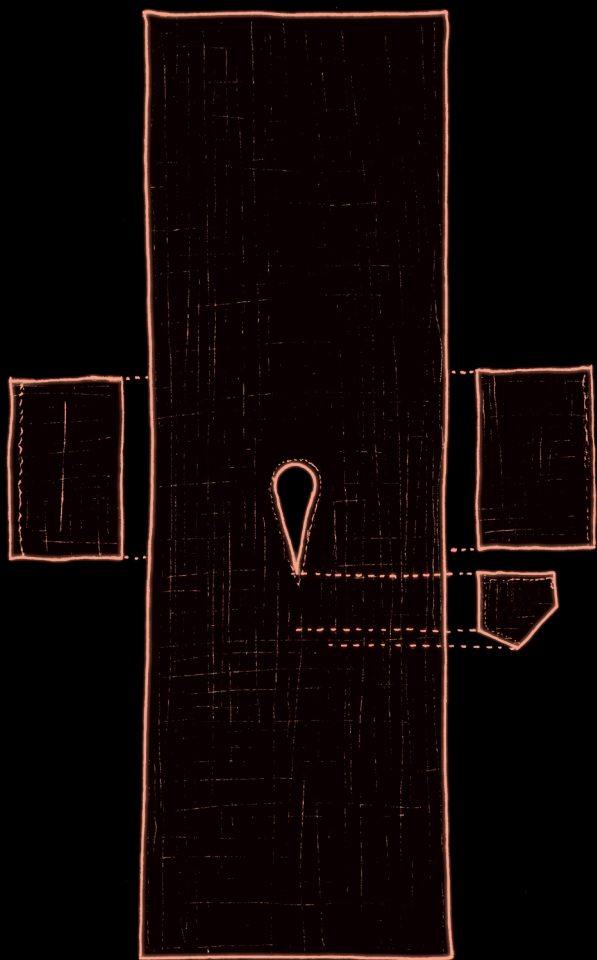


Figure 42 - Daraa Parts (Collier 2025)



Figure 43 - Tuareg Outfit (Collier 2025)



# Parka

**Assembled from various skins, parkas offer ingenious resistance to cold, wind and humidity.**

Parkas are often embellished with sewn-on patterns or beads. Although vaguely less thermally efficient, they can indicate a person's matrimonial status, seniority or social status (Zellner 2021). At the beginning of the construction process, the skins are traced with a pointed bone, then cut with a curved knife made of bone and antler. To double the insulation, they are assembled back-to-back, with fur on the inside and outside. The skins are minimally punctured for sewing, to avoid thermal bridges and better preserve them.

The garments are cut loosely to favor air pockets or chimney ventilation to prevent sweat from freezing. This airflow

can be adjusted with belts or cords to optimize the use of a single garment. The wide cut of the garments allows for greater flexibility of movement, particularly in adapting to the cold. Wider sleeves allow the arms to be pulled inside the parka to maximize warmth. Parkas for men, women and children are not designed in exactly the same way. Women, for example, may have a hood-pocket on the back for carrying a baby. Children wear coveralls to prevent their skin from being exposed (Obed and al. 2018). Openings are systematically limited to prevent heat loss; hoods, for example, are integrated into parkas wherever possible. Flaps are elongated and the garment is lined on the



*Figure 44 - Inuit Boots (Unknown Nunavimmiut 1976)*

hips and thighs. The design allows very little heat loss, compared with modern garments designed for extreme cold (Hill et al. 2020; Zellner 2021).

Caribou skin is particularly well suited for arctic conditions. Its hollow bristles trap air, forming close-to-body insulation, and it resists wind well while absorbing little water. Snow and ice are easily removed by tapping. It is versatile, and its properties depend largely on the season in which the caribou is hunted. In summer, the fur is short and ideal for light clothing. In autumn, the fur becomes fuller and is used for parkas and pants. In winter, the thicker skin can be used for bedding, shoes or mittens. In spring, it is used less, as it is more often damaged by parasites (Obed and al. 2018). Caribou tendons can be separated into threads for sewing; when in contact with moisture, they swell and seal the sewing holes (Arctic Institute of North America 2014). Bear skin, like caribou skin, can be used as the outer layer of a garment: The whiteness of the polar bear fur has a high emissivity level, making it possible for UV rays to penetrate to the deeper layers. Sealskin is waterproof but porous. It is used for summer clothing or as an inner layer for mitts or pants, allowing perspiration to evaporate. Bird feathers or the skins of other mammals, such as wolverines, wolves or foxes, are used to cover the edges and deflect the wind away from one's face (Zellner 2021). Seal intestines, which are extremely waterproof, are ideal for the outer layer of coats in humid conditions.

Parkas require great care. If clothes are not beaten to remove frost and dried inside, they risk rotting. They require constant maintenance, including the softening of hardened skin by massaging or chewing. This task is usually assigned to women. Friction between the arms and body means that new garments have to be made every year (Obed and al. 2018). Snow goggles carved from bone, ivory or, more recently, wood, adjust to the shape of the face, with two horizontal slits at retinal level. They protect the eyes by considerably reducing the glare caused by the high level of UV rays reflected by snow or ice when hunting or travelling. They can be even more effective if soot is applied to the outside, darkening the slits. As well as protecting the eyes, they can concentrate vision in the manner of a permanent crease, enhancing visual acuity (Metcalf 2012).



# Deel

**The traditional Mongolian dress is designed to allow flexibility of movement for nomadic horsemen in different climates.**

The deel is worn by both men and women, and its design may include small variations according to occasion and season. It is complemented by a belt, usually 3 to 4 meters long, which acts as a corset and support for various tools. The upper part of the deel can also be used as a pocket. It is worn with a scarf and leather boots, for greater mobility and comfort in steppe conditions.

Deels work in layers. In winter, they are thicker, generally sewn from sheepskin or goatskin. They are worn with a wolf- or fox-skin hat for protection from cold winds. In spring and summer, deels are more

likely to be made of wool or light cotton, for greater breathability and protection from insects (Feed 2022). On excursions, deels can also be used as blankets, pillows or rugs. A perfect reflection of the pastoral way of life, the deel is a garment made from and for livestock.

As a garment with great heritage and symbolic value, deels are often handed down from one generation to the next, and ceremonies and blessings accompany their inauguration when new. Different sets of deels and hats carry different significations and are regulated (Munkhzul 2020), indicating social



*Figure 45 - Mongolian Boots (Langaa 2005)*

class, seniority or tribal identity. These distinctions are made firstly by the type of fabric, its pattern and colors, then by the headdress, jewelry or belts that are ornate with semi-precious stones, coral or precious metals indicating an individual's rank. These formal indications have slightly evolved with changes in political control. The preservation of traditional clothing, in everyday use for shepherds or on ceremonial occasions for city folk (Lehrmann 2017), highlights a practical and cultural heritage likely dating back to the time of the Huns (Orgi 2018).

# Daraa

Depending on the thickness and amplitude of the garment, the fabric layers provide optimum ventilation on hot days and thermal insulation on cold nights.

Daraa fabric is woven from wool and sometimes silk, or camel hair for warmer garments (Boudaakkar 2023). Men traditionally wear loose pants with several dresses, the main tunic of which is called a daraa. It is embroidered around the collar (Vogelsang 2014), which fastens with a pocket on the torso. It is worn with a veil called a tagelmust, which can be used as a turban or facial protection against the abrasion of sandstorms.

Tunics are the central element of Tuareg outfits. They are made from long, light fabrics. Sewn at the sides, they flare out at the bottom. They are loose-fitting,

with wide sleeves to allow better air circulation. This circulation is driven by a combination of a bellows effect, which pumps air through the undulations of the fabric, and a chimney effect, whereby warm air under the garment rises and draws in cool air from below. This airflow cools the body by transferring heat through convection (Shkolnik et al. 1980). The body can thus conserve water in arid conditions.

Tunics are often worn underneath an exterior veil, which acts as a barrier and captures sunlight heat. It may be held to the body by jewelry pendants, usually silver



Figure 46 - Tuareg Sandals (Unknown Tuareg 2007)

engraved with crosshatching or geometric shapes signaling social status, particularly among noblewomen (Boudaakkar 2023). The Tuaregs classify silver into «feminine silver» (azruf n tamet) and «masculine silver» (azruf n ahalis) based on copper content. Feminine silver, with up to 10% copper, retains brilliance and resistance. Masculine silver, with over 10% copper, becomes dull and brittle, especially above 30%. Jewelry for men and women is crafted from their corresponding alloy (Hincker 2010).

Initially, the fabrics making up all of these garments were black or white, depending on a person's status and occupation. Natural indigo dyeing, however, has become emblematic of the Tuareg. It has both an esthetic and practical function, making maintenance easier than for white garments (Martinez 2021).

# Garment Findings

The physical principles at play in the dwellings are mirrored in the garments; they are two complementary systems that operate individually or overlap if necessary.

Material	Community	Application	[W/mK]	[mm]
Camel wool	Tuareg	Warmer robe layers	0.04	0.5 - 1
Wolverine fur	Inuit, Mongolian	Trim for garments, hats	0.05	20 - 30
Sheep wool	Mongolian	Deel fabric	0.06	0.8
Bear skin	Inuit	Outer garments	0.07	30 - 50
Silk	Tuareg	Lighter robe layers	0.08	0.1
Wood	Inuit	Snow goggles	0.12 - 0.04	6.5
Seal skin	Inuit	Summer clothing, mitts	0.16	3 - 5

Figure 47 - Table of Garment Materials (Collier 2025)

This overlap is highlighted by the similarity between materials used for the dwellings and garments, which are mostly used in the same way. However, they need to be more finely crafted to fit their owner's body and allow good mobility. In all three communities, the task of making and tending the clothes falls to the women.

Most clothes are the result of a combination of skins or hairs available to

the community. This may change or be very composite. This diversity of materials is amplified by the ornamentation, which generally includes smaller, more precious elements, such as beads on parkas, corals and semi-precious stones on Mongolian belts and hats, and metal (mostly silver) jewelry maintaining Tuareg scarves.

In all three communities, these ornaments indicate an individual's status, whether matrimonial, tribal or social.

### **From igloo to parka**

As with the igloo, the aim of the parka is to trap air or control its circulation to form a warm habitable microclimate (Davey-Quantick 2024). Both the dwelling and the garment are resource-efficient with fully optimized management of heat, humidity and wind. The flip side of this conscious and sensitive resilience is a great effort of craft and maintenance, with some women who have chewed skins all their lives to soften them having their teeth eroded down to the gums by the end of their lives (Obed and al. 2018).

### **From ger to deel**

The deel, just like the ger, is primarily meant to allow great mobility and polyvalence. They both work with stackable layers of fabric or skin that allow insulation, ventilation, or both. As previously mentioned, because of the extreme variation of weather in the Steppe, just like the ger the deel can be seen as a hybrid overlapping mechanism with both inuit and tuareg technologies. Its cut is similar for both genders and all seasons, however materials change to properly fit the climate. Depending on layering and tightness, it can either trap warm air in the

winter or pump fresh air with a chimney effect in the summer.

### **From khaïma to daraa**

The khaïma and daraa are both extremely lightweight and accelerate heat loss through convection while blocking UV input. For both tents and garments, ornamentation is mainly carved as geometric shapes into the rigid elements that hold the fabric in place punctually, such as the tent stakes or the pendants on the veils covering the tunics.

### **Cutting patterns**

The Tuareg dress is almost simply one large rectangle of fabric, cut to the neck and sewn on the sides. This gives it maximal amplitude in order to avoid trapping air and benefits from the pumping effect that draped fabric generates. In contrast, Inuit parks are composed of many more components, ingeniously pouching air and covering linings to avoid heat loss through the punctured skins. Both garments are layered to manage perspiration and amplify the desired effects.



Among the many essential contributions of dance rituals to a community, they have a practical educational force that transcends time, immortalizing gestures and legends across generations. If one is interested in a community's relationship with space, energy and territory, dance rituals are a crucial source of information. In cases where groups have experienced a restriction of their identity, the traditional rituals that have persisted are celebrated at a key moment of the year when youths are exposed to the art, clothing, techniques and narratives of the past.



# Rituals



35

30

25

20

15

10

5

0

-5

-10

-15

-20

-25

-30

[°C]

**The drawing section that follows is both the most narrative and the most documented of this project.**

This analysis is the result of in-depth observation and sketching of documentary photos and videos, aimed at unravelling the temporal and spatial significance of the rituals. It seeks to identify the scale, setting, organization and tools of the three dances, in order to map out the movements performed, the limits (material or intangible), and the relationship between actor and spectator.



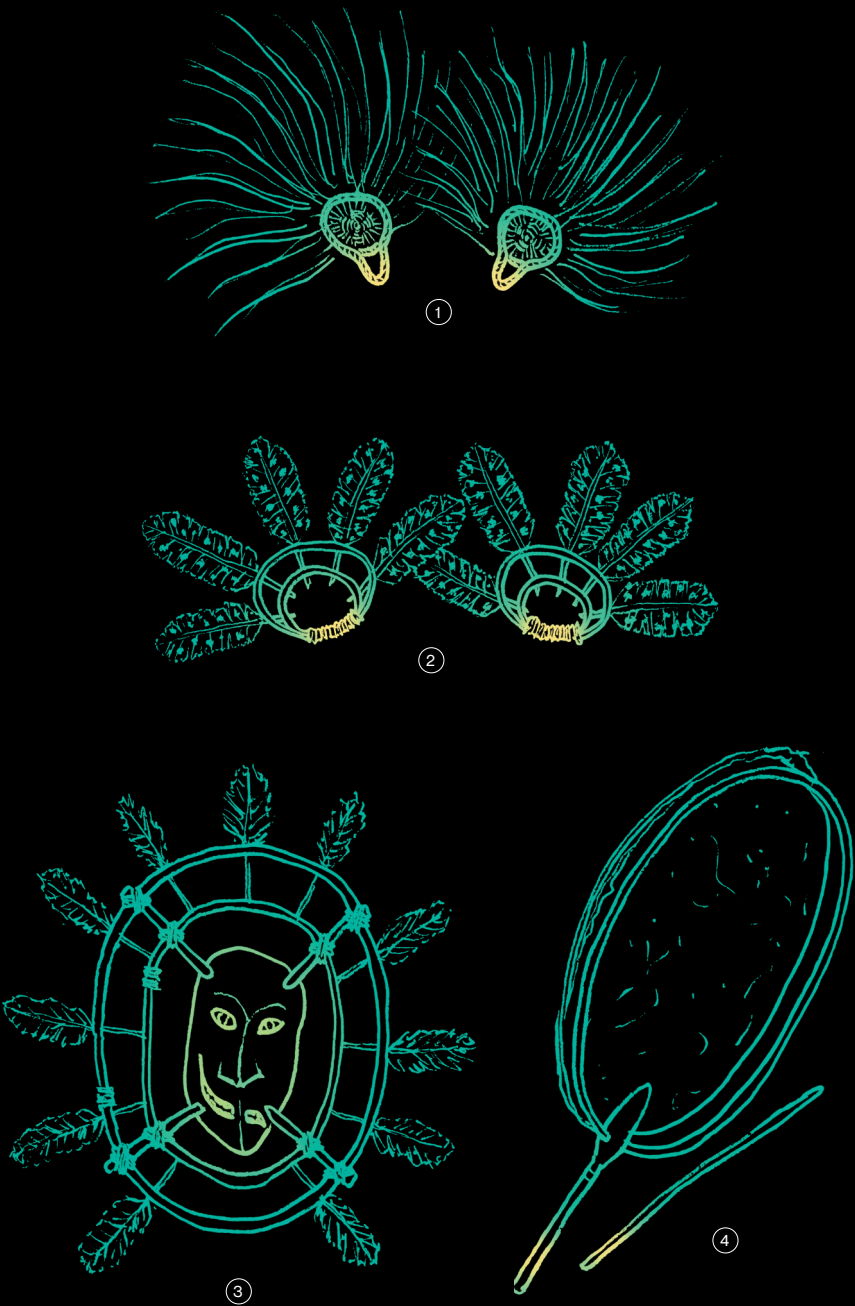


Figure 49 - Drum Dance Artefacts (Collier 2025)

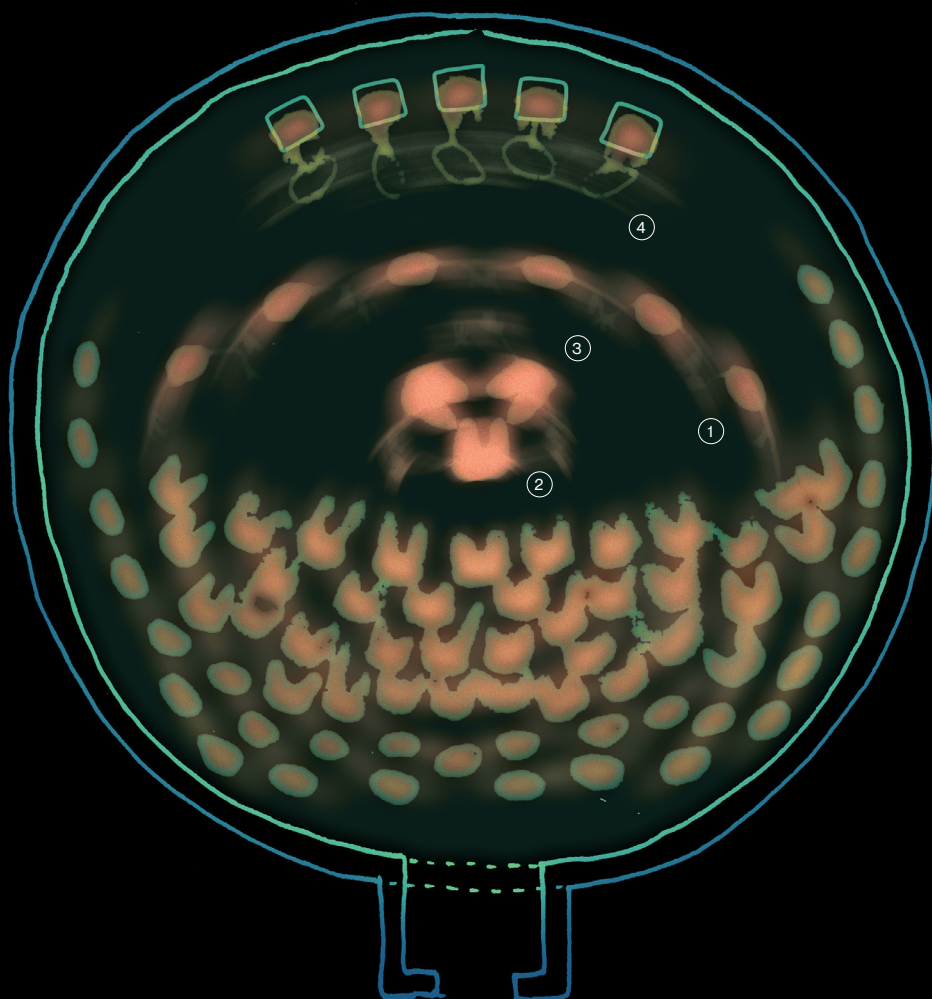


Figure 50 - Drum Dance (Collier 2025)

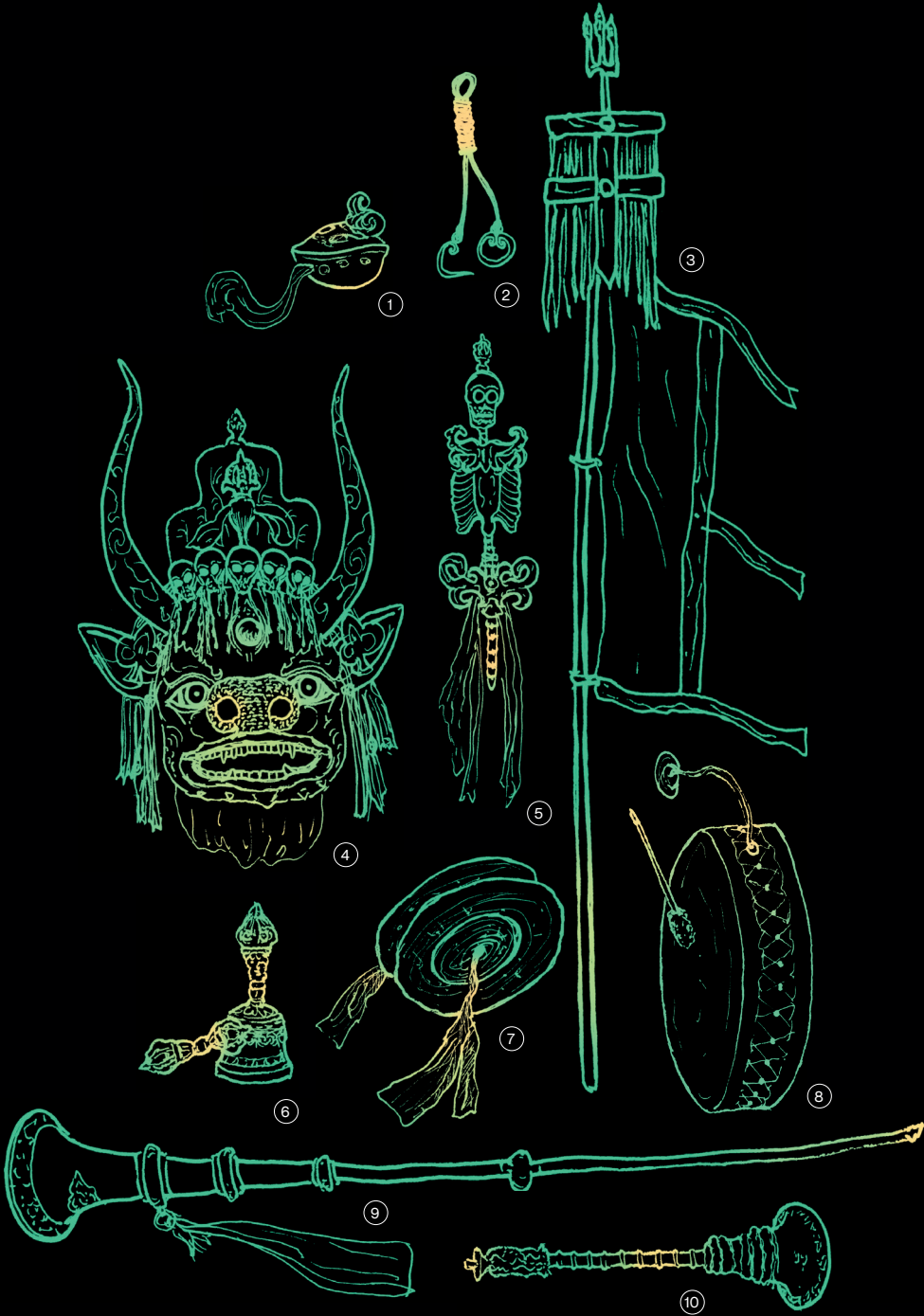


Figure 51 - Tsam Dance Artefacts (Collier 2025)

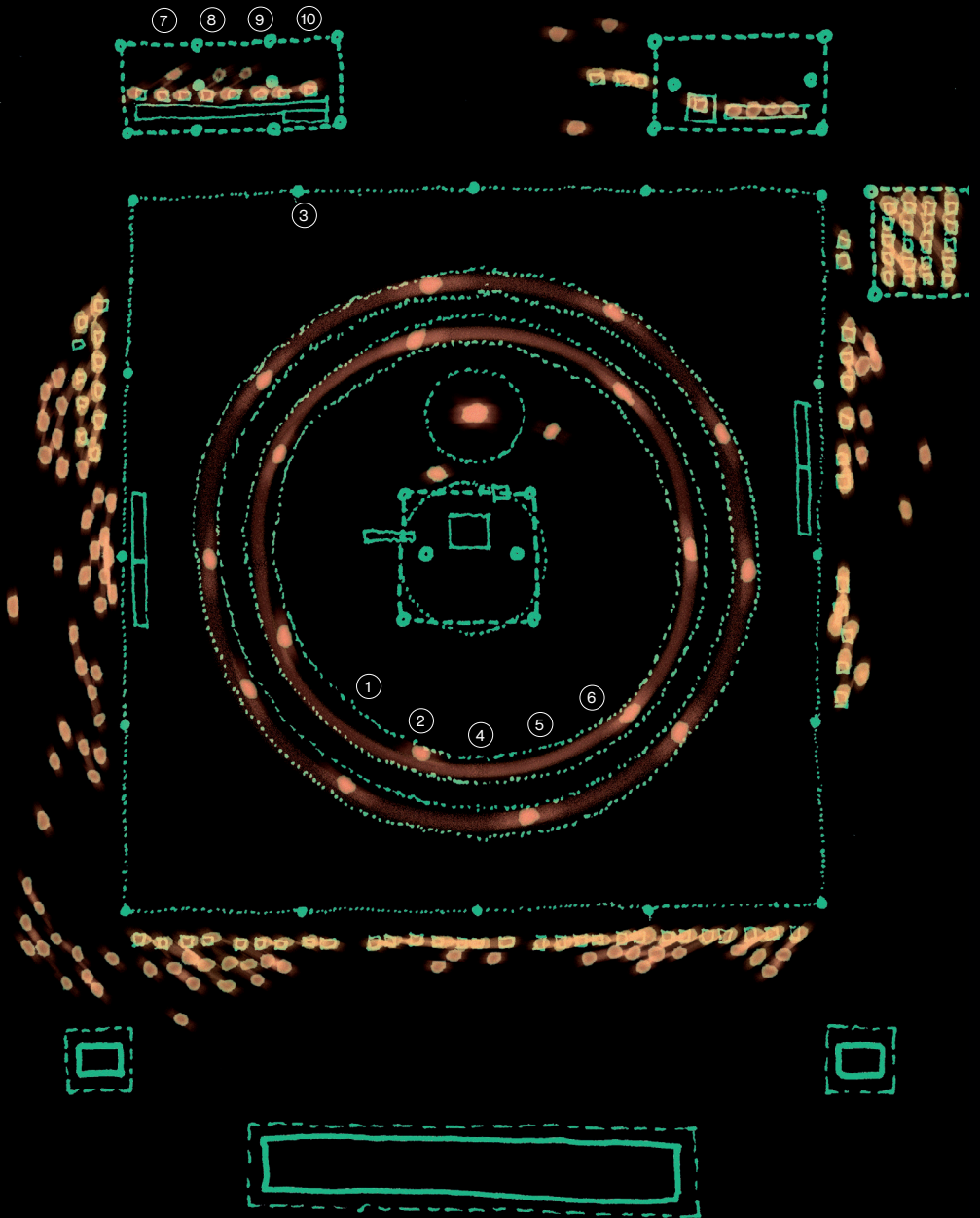


Figure 52 - Tsam Dance (Collier 2025)

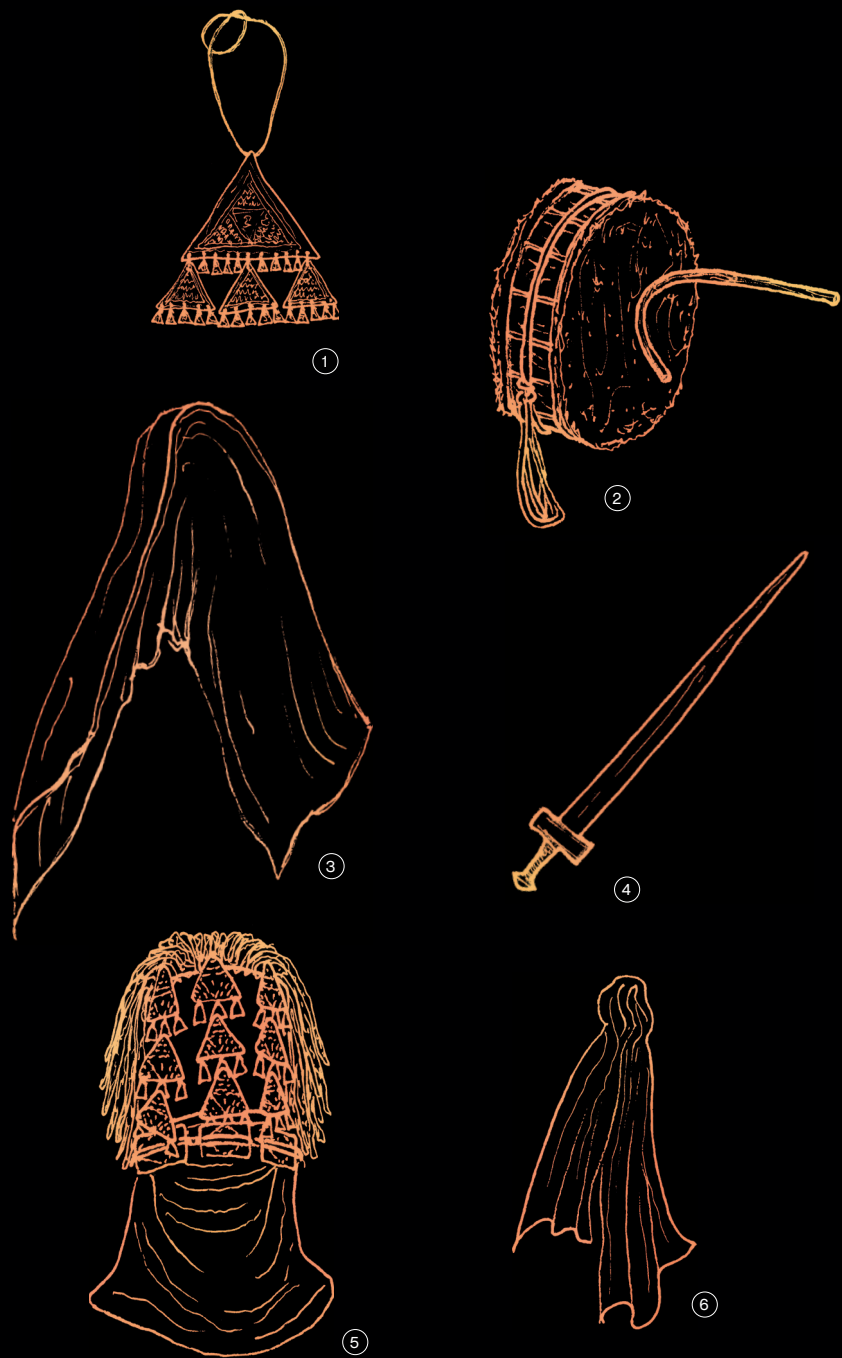


Figure 53 - Sebeiba Artefacts (Collier 2025)



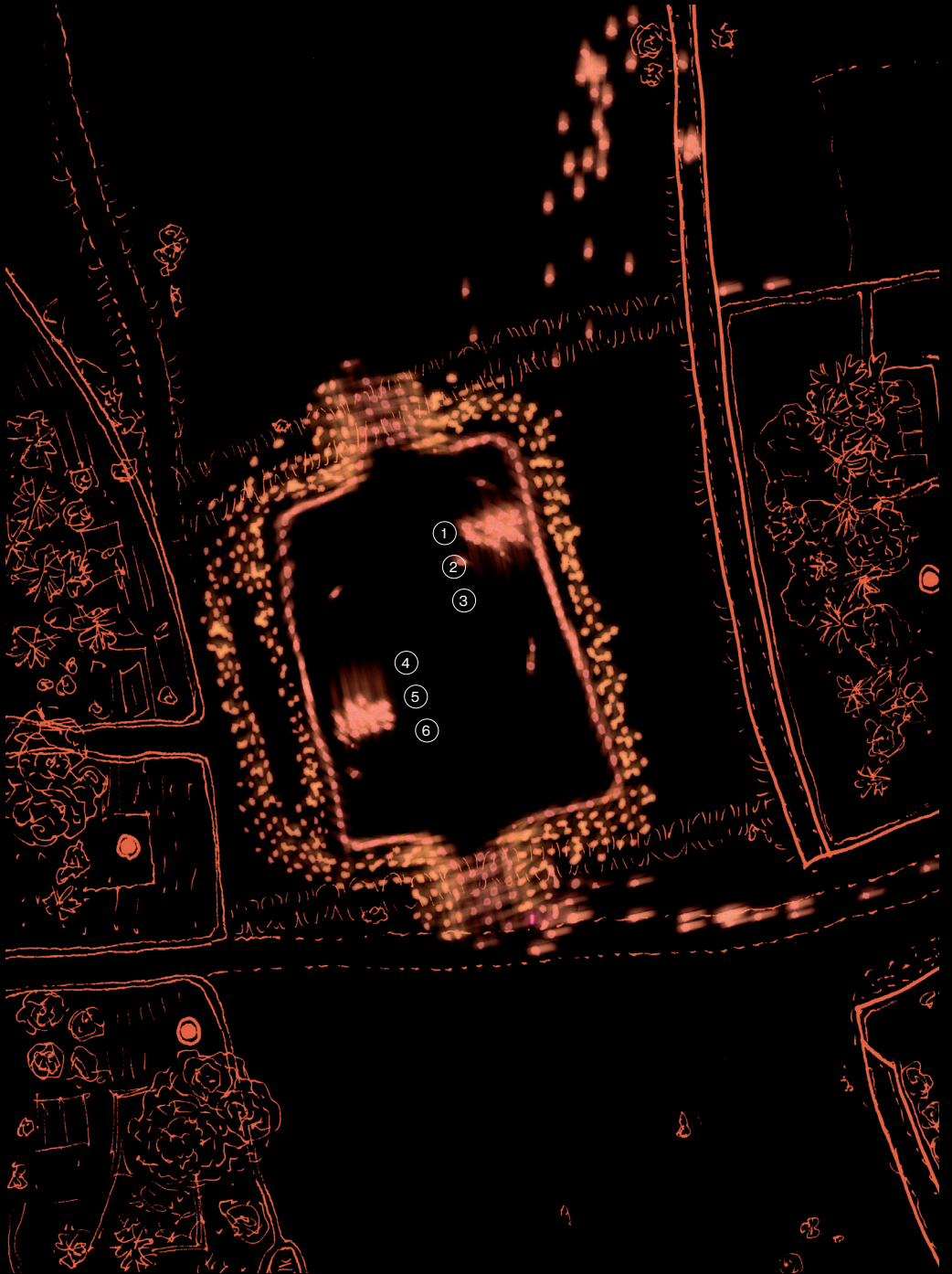


Figure 54 - Sebeiba (Collier 2025)



# Drum Dance

**The drum dance is a tension-relieving, prosperity-promising gathering that brings the community together on the longest night of the year.**

The dance takes place in the winter, especially on one evening, near the winter solstice, marking the change of season (Obed 2018). It keeps the community busy when the extended family is gathered for the months of cold weather and seal hunting (Conlon 2017; Arima 1974). The gathering space is warmed up beforehand. It may be a large “qaggiq” snow house or a rectangular wooden dance house since the European settlers’ architectural influence. Up to a hundred people can gather inside, with some qaggiqs measuring up to 9 meters in diameter (Conlon 2017).

The drum skins are humidified and stretched until they provide a good resonance. The percussionists, essentially all men, then test their drums (Arima 1974). Once ready, the oldest, who will be the lead singer, begins to sing and beat out a rhythm for a few bars before being joined by the rest of the group. The male dancers then come to the center, position themselves on their knees, and begin to move their arms, extended with eagle feathers (Braun et al. 2005), to the rhythm of the percussion beat. They are followed

by the female dancers, who stand on the periphery, joining in the dance with similar but fuller arm movements extended by caribou-fur grips. Several minute-long pieces are strung together, addressing different themes in a narrative way and connected by fluid transitions (Demer 2017). Rhythm and movement vary but tend to increase gradually, from 75 to 110 bpm. The audience remains fairly passive, with the children at the front sometimes imitating the dancers’ movements. The more the ritual progresses, the more the audience is drawn in, dancing more or participating in the songs (Elder and Kamerling 1988; Isuma 2023). The last song, known to all, has a purifying role.

The dance lasts more than an hour, and if it is followed by other performances, the group may spend the night together. If this is the case, the roles of musician, dancer or audience can be swapped. Solo drum dances can take place, with a single performer taking on the role of percussionist and dancer. He or she moves from foot to foot, knees bent, turning the drum to strike it from side to side with a stick (Arima 1974). Challenge

dances can also occur, if one member of the community wishes to confront another to resolve tensions. Conflict resolution is achieved through rhythm and song, and the ritual acts as a pacifist trial (Elder and Kamerling 1988).

The themes addressed in prepared dances may be recurring folk myths or come from shamanic visions, providing good luck for the hunt by invoking spirits, incanting prayers for the weather, or preparing for future challenges. Above all, dances can address any topic relevant to the community, including sentimental reflections for the deceased, or celebrations of travel experiences or achievements (Arima 1974). They can also mark events such as the birth of a child or a boy's first hunt.

Songs, mainly those recounting folk stories or hunting tales, are passed down from generation to generation (Fauteux-Goulet 2019). They are based on catchy syllables, recounting all these events in a poetic way, using a number of synecdoches or metaphors. They are often sung with a throat singing technique, known as *katajjaq* (Obéd 2018).

The drums, called *qilaut*, are traditionally made with a wooden handle and frame, dampened to soften it and then shaped by hand to support a carefully stretched, depilated caribou skin sewn with tendon strips (Fauteux-Goulet 2019). Their diameter measures from 60 centimeters to one meter, with a frame

depth of 5 to 8 centimeters. They are struck with a 30 centimeter long wooden stick known as a *qatuk* (Arima 1974; Conlon 2017). The sound of the drum is believed to put performers into a trance-like state, enabling connections of energy and knowledge with the spirit world (Braun et al. 2005). The ritual is perceived as a bridge between the strength of individuals and the powers of the unseen world. Drums are heard as the cadence of the universe (Elder and Kamerling 1988).

The participants wear their usual garments, though enhanced with feathers, beads or even bones attached to generate visual and acoustic effects (Braun et al. 2005). In the past, the dancers' main costume was their mask. These were made from driftwood, feathers, caribou hair, tendons and natural pigments (Testu 2021). They are no longer commonly used in rituals, the Canadian government having banned them along with many other traditions in the 19th century. This ban was withdrawn in the 1950s, accompanied by extensive documentation efforts in compensation, but the fact remains that this period of interruption was devastating for the transmission of traditions. The masks carried a spiritual value that was threatening as a non-Christian religion. They embodied a shaman's vision, whether of a spirit, a past event or a prediction of the future. They were made by the shaman himself, or by a craftsman following his instructions. They had to be finished on the day they were imagined,



Figure 55 - Drum Dance Representation (Nigiyok 1994)

hidden away until used, and used only once. Their sacred significance became obsolete once the vision that had initiated them had been performed in dance.

Their most sacred feature was the eye hole, seen as the soul of the mask and a portal to the spirit world enabled by the performance. After use, they were burned or abandoned, with some children keeping them as toys (Alexie 1984; First Alaskans Institute 2019).

# Tsam Dance

**Tsam dance promotes peace of mind, social cohesion and fertility, through a warrior-like and generally Manichean expression.**

The festival has been held since 1639, the date of the first Buddhist sovereign's consecration in Mongolia. It is now an annual celebration (Temuulen 2018) taking place in summer, on a date fixed according to the lunar calendar. Preparations in the monastery begin several months in advance, with prayers, meditation (Khulan 2023) and food offerings to invoke friendly spirits as well as the deities who will be incarnated (Mroczynski 2008).

After the Lunar New Year, the Naadam festival is the most important cultural event of the year, taking on the role of national holiday, religious ceremony and sporting competition. It includes various competitions representative of the nomadic traditions of the steppes, such as horse racing, wrestling and archery. The event is also marked by performing arts, traditional cuisine, craftwork and harmonic singing. Everyone is welcome and encouraged to take part, with the aim of uniting the community. The various events, rituals and performances target youth in particular, to foster awareness of their cultural heritage and educate them in the values of solidarity and care for nature.

The aim is to promote harmonious national cohesion based on cooperation and community enhancement (Bataa 2009).

The Tsam dance, adapted from a Tibetan dance, was introduced to Mongolia in the 18th century and is performed on the second day of the Naadam festival (Temuulen 2018). It can take place on the plains, on the perimeter of a monastery (Ketpradit 2023) or, more contemporarily, in a stadium. It is a masked, pantomimic show. The spatial organization of the ceremony is both spacious and extremely geometric. A small ephemeral temple stands in the middle, containing various sacred artefacts or offerings and housing the monk who will sing Buddhist hymns. Several concentric, equidistant circles are drawn around it with chalk, and will delineate the dancers' circular movements. They are then surrounded by a perimeter religiously framed by flags at posts guarded by costumed monks. The orchestra is assembled to the north, and the audience can move around and settle in outside a boundary marking the perimeter.

When the ritual begins, wind instruments, harmonic chanting and percussion are first heard. The dancers walk around the Buddhist temple, then enter the stage accompanied by music. The instruments used are double-headed “Khengereg” drums, “Damar” tambourines (Munkhzul 2020), brass cymbals, bone flutes, violas, “Vajra” bells and different types of horns. Once positioned, the performers oscillate, stamping their feet, gesturing with their hands, tilting their heads back and forth and swaying in a synchronized, circular motion. This centrifugal formation is said to evacuate evil spirits and chase away evil. These movements are ordered by the sound of instruments and punctuated by the “Tarni” incantations whispered by the monk for specific deities. The dancers’ gestures symbolize the victory of Buddhism over pagan traditions, and the struggle of good against evil. The ritual lasts several hours and ends with symbolic sacrifices of “Linga” figurines to drive away evil spirits (Temuulen 2018; Khulan 2023), purifying participants and leaving them in a space suitable for meditation and the quest for enlightenment (Mroczynski 2008). Although poorly documented, it may be that this figurine sacrifice replaced an actual human sacrifice over time (Steiner 1999).

The costumes are made of embroidered silk, adorned with gold and coral jewels. They can be combined with traditional armor, worn so as not to weigh

down movements too much. Actors embody Buddhist deities, demons, animals or national heroes. The dance is supposed to call upon the forces of nature to restore peace and maintain order. Masks are made from ceramics, papier-mâché, embossed copper, leather or wood. They represent emblematic characters such as the lord of the underworld “Damdin-Tshojoo”, the god of war “Jamsaran” or a comical old man “Tsagaan Uuvgon”. The characters are embodied very sensitively by the dancers, the benevolent deities being interpreted in a calm, gentle manner, while the demonic figures are brought to life more briskly and energetically. Their masks are often adorned with five skulls, which could symbolize the conquest of poisons (Khulan 2023) or the five forms of sin (anger, jealousy, stupidity, evil desires and negative thoughts) (Mroczynski 2008).





Figure 56 - Buddhist Embroidery (Khuriye late 19th - early 20th century)

# Sebeiba

**The Sebeiba is a pacifist competition that celebrates exchanges, land, artisanship and artistic skill.**

The most popular and enduring Tuareg ritual is the Sebeiba dance, practiced in Djanet. They are now recognized as tangible and intangible heritage by UNESCO. Djanet is a small oasis town at the crossroads of two major caravan routes in the south-eastern Algerian Sahara. Now mostly settled, the Tuareg people have been farming there for thousands of years. The town lies in a valley carved out by the “Ijrïou” (Belarbi 2015), a wadi, i.e. a seasonal river whose bed is dry outside rainy periods (Ballais 2010).

Two communities have settled there: the Zelouaz to the north and the El Mihan to the south. These are historically ksour (plural of ksar), fortified Berber villages. Originally rivals, they gather each year to bond over preparations and channel their competitiveness into a dance and song contest. This shapes the festivities of the Sebeiba, which takes place during the first half of the first month of the agrarian calendar. The rock paintings of Jabbaren, in the Tassili Park near Djanet, show human figures in costumes similar to those worn today. We can therefore hypothesize that the Sebeiba ritual traces its roots over

3000 years ago (Bega 2014). It is said that the Sebeiba was first organized, among many other celebrations in the area, to celebrate the drowning of the pharaoh who was pursuing Moses (DZ Media 2023).

The first night of the festival is the launch, signaled by a few women passing through the village with their tambourines, inviting everyone to begin their preparations. Preparations for the following 9 nights keep everyone busy and encourage exchanges between communities. Young men practice dancing, and young women drum and memorize songs in public squares. Everyone makes sure they are well-equipped and well-maintained for the festival. Jewelry, accessories and costumes are repaired or replaced. This is a very busy and touristic time for craftsmen. In the last decade tourism has suffered, however, from geopolitical instability in the Saharan region (Belarbi 2015). At the end of the preparations, the elders select the people who will take part in the competition based on their technique and the elegance of their garments and accessories, marking the end of a first selection contest called

“Timoulawine”. It is desirable for as many people as possible to be selected to show the communities’ commitment. It is shameful for a family not to have any representatives (Bega 2014; DZ Media 2023).

On the day of the ritual, in preparation for the tenth and final night of the festival, the women prepare their jewelry, make-up and hair, while the men stand back and dress in costume, crowning themselves with a “Takambout”, an ornate hat or helmet inherited from traditional military dress. It is worn over a transparent blue veil that conceals the face and acts on the vision like sunglasses. While the selected women carry their “Ganga” tambourine made of wood and leather, the men hold a scarf in their left hand and a sword in their right, held by the blade so as not to appear aggressive. Swords are passed down from generation to generation, and are often centuries old (DZ Media 2023).

In the evening, everyone goes out into the Oued valley, to the “Loghya” site between the two ksour, near the wells where the “Doughiya” and “Tileline” gardens of the two communities are located. The audience forms a rectangular arena for the show. The dance takes place in four stages. During the first phase (“T-enfer”), the dancers enter the arena from their respective sides, followed by female musicians who dictate the rhythm and sing poems to tease their opponents in the Tamahaq language. The dance

gestures allude to a warlike confrontation between the two groups. The further they advance into the arena, the louder the songs and movements become. This is followed by a calmer phase (“Tekemsin”) of competition to determine the most beautiful capes, with the men parading with arms outstretched, holding hands and forming a chain of carefully chosen and proudly worn fabrics. The third phase is a celebration of the New Year, with the dancers making a rattling noise as they march in a circle, clashing their swords. The last phase (Araleï-n-awaleï “) resembles the first, with the dancers performing another round of the arena, but this time with gentler gestures symbolizing unity and reconciliation to bring the event to a conclusion (Bega 2014; Belarbi 2015; UNESCO 2014). Victory is announced at sunset, followed by a parade of the winning community (DZ Media 2023).





Figure 57 - Rock Painting (Bega 2014)

# Thoughts on Artefacts

The materials available guide the technique and therefore the esthetic of the various artefacts. The more accessible the territory, the more composite elements may emerge as a result of bartering or neighboring cultural influences. At the same time, the history and original function of the ritual define the form and the manipulation of the objects.

## **Drum dance and animals**

Living on the tundra, Inuit have the most limited access to materials. Their main source of materials and energy is wildlife, both marine and terrestrial. This guides their esthetic and beliefs, centered around life as a grand equation of energies and cyclical forces, where there is no distinction between humans and other forms of life. Knowledge and community ties, welded together by the shaman through spirituality, are of the utmost importance, and material goods are secondary, often renewed. The value of objects and artifacts lies in their use and nurturing.

Representations, as in the case of masks, are not intended to be faithful to a model, but to reveal spiritual forces and identity (Testu 2021). The result is an esthetic of anatomical simplification and distortion, embodying and exalting a variety of emotional states, fusing

human and animal features to give life to the invisible through forms that convey a sense of movement. This movement, like the discarding of masks after their sole use, echoes the fact that individuals or objects are ephemeral, ultimately restoring its value to a vital Energy above all else.

The historical function of the drum dance is to resolve tensions and bind the community together to tell commonly valued tales and, by embodying and communicating with the spirits, to give people confidence in the renewal of hunting and fishing in a trying time of darkness and extreme cold.

## **Tsam dance and elements**

Mongolians have scattered resources and neighbors, but a great capacity for mobility. They can therefore gather many different items, and as these are made valuable by their distance, assemble



them in such a way as to preserve them over time. As a result, there is both great richness and considerable care in the crafting of their artefacts and esthetic, which has had a major Tibetan influence for a millennium through the sharing of Buddhism. Materials used for clothing and artifacts include wood, coral, copper, gold, ceramics, papier-mâché, leather, silk and ivory.

The Mongolian Tsam dance is an adaptation of the Tibetan Cham dance. It originated in monasteries in the Himalayas (Puretz 2013), where conditions are as challenging as those in the Arctic. In their fear of the elements, it is certainly no coincidence that Cham/Tsam rituals, like the drum dance, are designed to appease the spirits by embodying them in masks. Cham/Tsam rituals also include offerings and sacrifices to obtain favors from good spirits and ward off evil ones.

### **Sebeiba and essentials**

The Tuareg maintain a distinctive style, using mainly fabric woven from the hair of their livestock and metal found in their territory. Some bartering may result in stronger alloys, but this does not compromise the sobriety of their craftsmanship. Few items are made, but they are done with great care and expertise. The quality of the fabric and metal is of the utmost importance. Their ornaments are essentially engravings of

very simple geometric shapes, mainly triangles or crosshatching. This sobriety is reflected in the ideals of the upper class, who aim to act as humble defenders of the community and must at all times be ready to sacrifice themselves for its sake (Rasmussen 1992).

The original context of the Sebeiba dance is a pacifist battle to channel the competitiveness and tensions arising from the rivalry between two communities occupying the same oasis, dancing and singing rather than hurting and ultimately destroying each other. This origin is not concealed, as the costumes are taken directly from traditional battle dress, and even if held by the blade, swords are part of the event. Beyond their cultural importance as heritage and traditional craftsmanship, the presence of these weapons is clearly a reminder of the importance of the ritual over its alternative.

# Thoughts on Limits

In this ritual sample, as the temperature rises limits become more and more agreed upon instead of physical.

## Drums in a bubble

To benefit from the heat of bodies, space is limited to its minimum in a circular arrangement of stage and audience. However, it is unlikely that temperature is the only reason why the community gathers in a qaggiq. While acoustics may be a second argument, isolation in a space away from everyday life is certainly a third. The qaggiq is built solely for the shared event of the drum dance, a special moment in the year because it brings everyone together and nurtures tradition. It is also an event where it is desirable to feel out of time, in a place set apart to open a door to the spirit world.

## Chalk boundaries

Like its ancestor, the Tibetan Cham, Tsam is traditionally performed by monks in the proximity of monasteries. Both are generally performed in circular movements, but the Mongolian dance is systematically staged on a precise layout of boundaries drawn on the ground, which guide the performers, highlight the temple at the center, and orient the audience around it. This structure allows the ritual to be

performed in the middle of the Steppe with just as much organization and sacred value.

## Battle on a border

Given the origin of the Sebeiba ritual, it would make no sense for it to be practiced anywhere other than on the border halfway between the two communities involved. The wadi gives way to a vast corridor that is clear when dry, ideal for outdoor gatherings. Furthermore, the gathering is held next to the community's gardens and wells, which can bring freshness and also provide a valuable presence to a celebration of peace and shared resources. The human arena naturally forms into a rectangle large enough to accommodate the actors and give the whole audience a chance to witness the ritual. To conserve water during the rainy season, dykes are maintained in the riverbed. It is these dykes that serve as the boundary on either side of the rectangle formed by the audience, helping to contain its organization from one year to the next, and also serving as raised bleachers allowing some to have a fine view of the event while still outside the rectangle.

# Heritage

Preserving a ritual when it has been taken out of context by a change in lifestyle is complex. Protecting it requires documentation and, often, tourist support, but in so doing, it is eventually denatured and folklorized.

## Memory through practice – Inuit

There are no detailed transcriptions of Inuit songs, nor comprehensive musical scales that allow a real understanding or external documentation of their nuances. In their musical complexity and in the experiences they sustain, they must continue to be performed if they are to survive the passage of time and Westernization.

These rituals have considerable potential for transmitting mnemonic knowledge and promoting active group cohesion. They turn interpersonal tensions into a new opportunity to strengthen collective commitment. Despite considerable restrictions on their traditions and way of life by white governments, the Inuit have been able to preserve drum dancing, and it has enabled them to resist in part the loss of their knowledge and cohesion (Conlon 2017).

## Reintroducing stability – Mongolians

The Tsam ritual has its origins in a form of Buddhism introduced in the 8th century, which spread throughout Tibet and then gradually permeated the Mongolian culture, reaching its apogee in the 18th century. It served as a unifying force against outside domination, notably Manchu rule. Despite a decline during the Soviet era, the legacy of Buddhism was restored in the 1990s and dance was reintroduced in the monasteries (Khulan 2023; Mroczynski 2008). Today, the Tsam ritual reinforces social unity against external influences, historically indispensable in the context of the steppes, where cavalier and patriarchal cultures have always engendered a climate of conflict and domination between successive powers.

## Cultural resistance - Tuareg

Sebeiba embodies the resilience and solidarity of the Tuareg cultural heritage. It is a reminder of the victory of cultural diversity and community cohesion in the



face of the pressures of modernity and the tensions caused by numerous religious and political influences (Belarbi 2015). The ritual persisted despite the pandemic in 2020, after months of anxiety at the thought of having to cancel it, interrupting a thousand-year-old tradition and losing a bond of harmony between rival communities (DZ Media 2023). In Djanet, it is said that one year, the ritual was not prepared following the notable death of an old man. On the evening it was due to take place, a dark and violent storm arose, calmed only by the sound of the drum of a woman bravely out to perform her part of the Sebeïba. This belief that a natural disaster would follow the cancellation of the ritual is still maintained today (Bega 2014), underlining the significance of its anchoring in the community.

### **Tuaregs and cultural encounters**

Metal and its alloys are very important in Tuareg culture, both culturally and economically. This is metaphorized in their philosophy of inclusion. Tuareg society is like silver, soft when pure. External elements, such as visitors, knowledge or beliefs, are like copper: if a certain amount is added, the silver becomes stronger and remains just as shiny. However, if too much is added, it becomes brittle and fragile (Hincker 2010). This underlines the Tuareg's openness, but also their reasonable wariness. This mentality is well reflected in the Sebeïba ritual.

It is difficult to identify all the activities that made it possible to live without petroleum, but they are still celebrated as heritage, and the rituals that celebrate them are therefore a major asset for unravelling the challenges and values that defined the architectures of the communities studied, particularly among the Tuareg and Inuit who have been most denatured for political reasons. These architectures, like all before the excessive use of fossil fuels, were not sufficient to ensure thermal comfort, and were highly dependent on the clothing and lifestyle of their inhabitants. (Rahm and Rahm 2023).

# Conclusion

# Closing Thoughts

The aim of this work, in a broader context, has been to consider the impact of western architecture and rethink the privileges that come with it, because they have an expiration date and are suffocating the roots of the variants on which we will inevitably need to build.

The topics addressed in this text call for important considerations. Ethical, because the aim is to document with rigor and sensitivity cultures whose memory is fragile and inevitably a little damaged by every external attempt to preserve it, and political. Two of the three communities studied have suffered territorial pressures as a result of colonialism, from which Europeans are still the beneficiaries today. The three communities studied have also suffered greatly from climate change, for which Westerners are also partly responsible, and which is the result of irresponsible practices maintained for their own comfort. I hope that this concern for responsibility has not escaped my documentation and analysis.

The portrait of communities such as energy systems satisfies me, the different sections continually echo each other and the analysis of rituals has consolidated the trends and habits already identified in the studies of territory, calendar, dwelling and habit. I would have liked to

go further in each section, to expand the documentation and connections, but the statement semester brings a multitude of new challenges that ultimately reduce the writing time considerably.

Before outlining my ideas for the continuation, I would like to end on some Tuareg values of power that particularly struck me. They are symbolically translated in the three types of camel saddles they use while roaming: the sober and basic “Taghéraft” represents the foundations, the worn but still usable “Eghastan” represents continuity, and the elegant and lighter “Tamzakt” represents temporal agility (Claudot-Hawad 2014). I would like to think that our foundations are the strategies of our past with which we need to refamiliarize ourselves, our continuity is our more recent heritage of infrastructures that we need to care for rather than deny altogether, and our temporal agility must be a working mode to be adopted from now on, more knowledgeable about our past and more concerned about our future.

# Next Steps

As this work was carried out in the lead-up to a master's project, it opens the door to consider the following topics:

## **Communal energy**

The aim is to design living spaces for a group, and make the most of the existence of a collective to save energy through the simple presence of bodies, but also in the sharing of tasks to optimize the use of resources, notably space. This has both environmental and social implications, including the need to consider, in the context of the project, how to build bridges between individuals or groups of individuals, both for and through the issue of energy. This could strengthen each individual, ensuring a place in the community and a rhythm of life guided by practical directives. It could also strengthen the community: It is by exchanging experiences and thoughts that a group evolves.

The task now is to propose an architecture that suggests a daily organization that plays on these principles, an organization that must be sufficiently qualitative and intuitive to encourage users to embrace it on their own.

Good examples of shared spaces are communal laundry rooms and vegetable gardens, both are traditional in and

around Swiss rental buildings and should be encouraged rather than phased out. Similarly, providing a guest room or a communal gathering space for the entire building, as seen in the development of eco-neighborhoods, offers numerous advantages.

## **The versatility of habitations**

If one lives in an area with great annual climatic fluctuations, it would be interesting to consider the mechanical adaptation of the habitation as an alternative to a multi-purpose box. Indeed, modern housing has been made too complex and far less efficient by its excessive technologization, which works by adding punctual, energy-intensive solutions to problems considered individually. For example, heating, often moved from a collective fireplace to wall-mounted radiators, has become globally inefficient in relation to its cost, generates large losses, and is even counterproductive when it comes to ventilating the space. (Grangeot 2021).

Rather than over-insulating buildings, we should be thinking in terms of potentially modular facades that play on

heating mechanisms, potentially using layers of curtains and the Albedo effect, and ventilation mechanisms, encouraging currents of air through a chimney effect and increased convection, as the Tuareg do, or by creating draughts with openings at different heights, as the Mongolian ger does.

### **The importance of clothing**

We currently live in a world where the importance of habits and the valorization of energy strategies without electricity have been forgotten. The role of the architect is to design and execute buildings, but in the present context, the architect might think not of the building but of the system of which it is a part to serve people. In this approach, the garment becomes an extension of the building; if it functions in layers, it fulfills its functions on the outside and complements them on the inside. This idea echoes that of the "Climatic Apparel", developed by Philippe Rahm Architects and the About A Worker collective to give the garment a primarily functional role as a protective suit. (Rahm and AAW 2020).

### **The perception of comfort**

Through its form and approach, an architecture that takes these aspects into account must be able to express that the user is active in his or her search for

comfort. This implies adaptive clothing and interactions between the user and its versatile architecture. As mentioned at the outset of this work, living in less hospitable environments requires adaptation strategies and compromises. These compromises do not necessarily lead to a less comfortable life, but they do impose a framework for the rhythm of life and the activities of the day, to ensure that energy needs are met as frugally as possible. This impacts not only architecture and its habitation, but also a community's calendar to adapt to and make the most of seasonal changes.



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In the spirit of full transparency, I would like to disclose that ChatGPT was used during the writing process for minor rephrasing. It is important to note that it was not used as a source of information, nor did it influence the methodology or ideas presented in this paper.

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