



ACADEMIC PORTFOLIO

Architecture and climatic design.
Facade design and engineering.

MA Architecture and Extreme Environments | The Royal Danish Academy
MEng Structural Engineering and Architecture | The University of Sheffield

Aimee Desert

Architect MAA

Passionate about sustainable design from an interdisciplinary perspective with professional experience across architecture and engineering. Specialised in facade design from concept to construction.

Keen to continue developing a multidisciplinary skillset and furthering knowledge of climatic design from an architectural perspective, particularly the ephemeral nature of the weather and our atmospheric perception as a design tool.

Architect | Façades Specialist
BIG | Bjarke Ingels Group
Sep 2020 - Present

Vola Award | MA Thesis
The Royal Danish Academy
2020

MA Architecture and Extreme Environments
The Royal Danish Academy
2018 - 2020

Peer reviewed publication
Energy and Buildings
2020

Junior Architect & Architectural Intern
Façades Specialist
BIG | Bjarke Ingels Group
2018 - 2019

Facade Engineer
BuroHappold Engineering
2015 - 2018

MEng RIBA Part 1 Structural Engineering and Architecture
The University of Sheffield
2011 - 2015

CIBSE President's Prize Runner-up
2015

Happold Foundation Scholar
2014 - 2015

01 : Atmospheric - thesis project

Design of a microclimatic bathhouse in the city of Antofagasta, Northern Chile.

Developing meteorological design methodologies informed by the fieldwork research and adopting a hypercontextual approach to both climate and community. Using CFD simulation in addition to grasshopper based analysis.



02 : Architecture and the weather

A research project exploring the visualisation of weather data sets using grasshopper and ladybug tools.

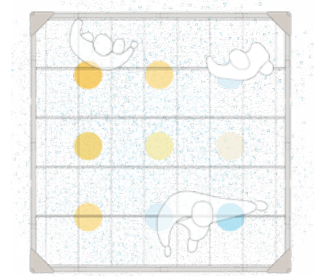
Aiming to bridge the gap between climatic design data and experienced conditions, visualising hourly and daily metrics across a broad range of meteorological variables.



03 : Constructing Atmospheres

An exploration into the environment of the city as an atmosphere, the construction of atmospheres and the notion of comfort in humid environments.

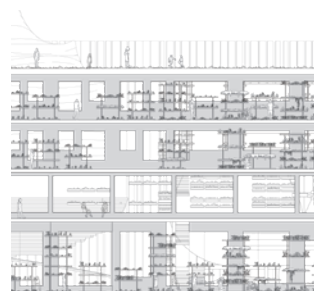
The design and fabrication of a 1:1 installation enabling the simulation of microclimates and observation of conditions and comfort within space.



04 : Cultivating Democracy

Design of a citizen's assembly for Alaska, situated in Anchorage.

The project explores the semi-conditioned and interstitial, assessing the potential for the habitation of these spaces in the Arctic allowing expansion according to season and occupation.



01 ATMOSPHERIC

Architectural design thesis | Antofagasta, Atacama, Chile | Meteorological building design

My design thesis explores the potential for meteorological design approaches which focus on passive strategies; considering the climatic and perceptive potential of materials.

The atmospheric effects of architecture are often a consequence of the design process rather than a methodology. Taking the opposite approach this project considers how architecture can amplify the weather of the city.

The project considers a community bathhouse which seeks to provide a series of luxuries to the diverse communities within the city, bringing together wealthy mineworkers and those living in the unauthorised campamentos through the shared luxury of bathing. Providing everything from luxury bathing to warm showers and laundry facilities. The spaces between provide a rich meteorological landscape which brings the community together around the luxury of the weather which cannot be experienced in the city.

Antofagasta is a unique context, the wider climate is extreme due to its location in the Atacama region but this is tempered by the coastal conditions, and results in an almost static weather with little seasonal variation.

View from the city



Architectural design, climatic design, CFD simulation, meteorological architecture

01 ATMOSPHERIC

Architectural design thesis | Antofagasta, Atacama, Chile | Meteorological building design

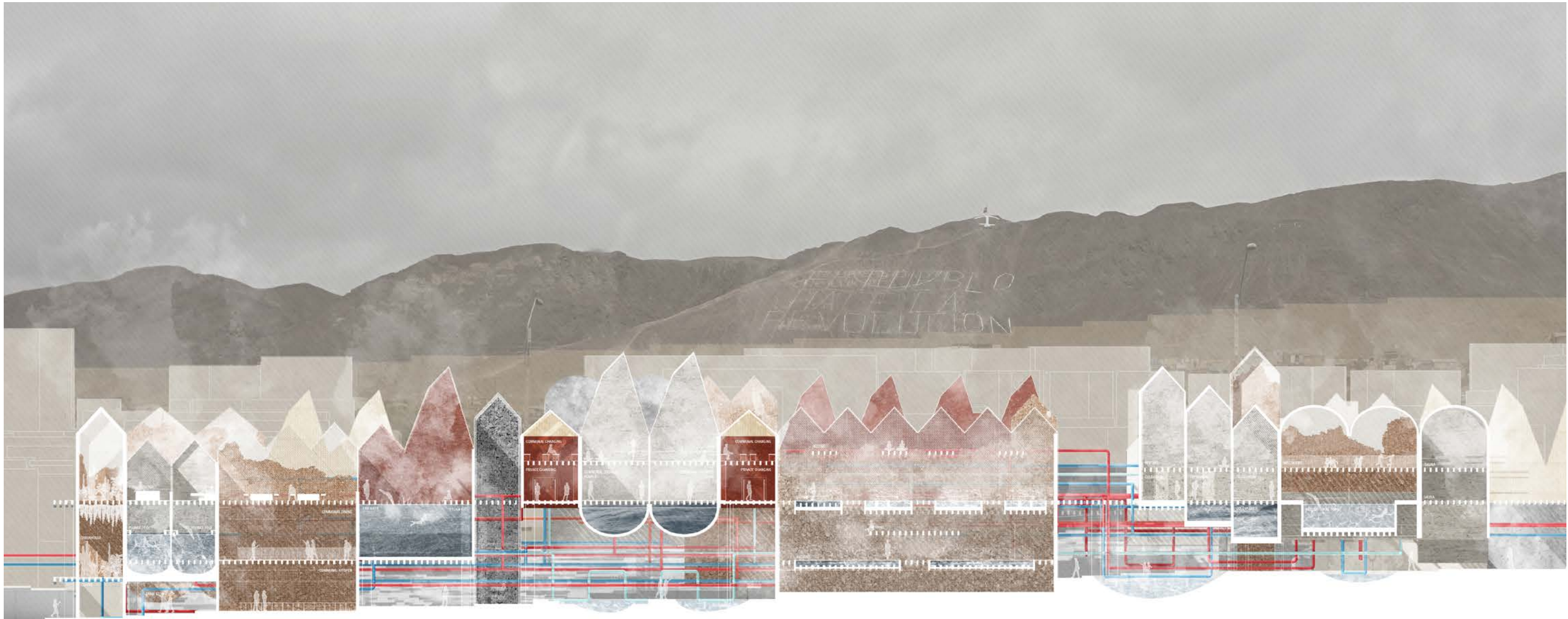
Elevated volumes curate a dynamic soffit condition, in both form and emissivity, shading the public space, key in a city where solar radiation is the main cause of discomfort.

The moderate climate enables them to be distributed with significant inhabitable spaces between. It allows the public space to be maximised and enables a series of interactions between the gradients of conditions and the occupant.

The structure is constructed from pre-tensioned stone sourced locally in the desert. Like many of the proceeds of the desert; copper, nitrates and lithium, the stone is usually exported out of the region for luxury construction.

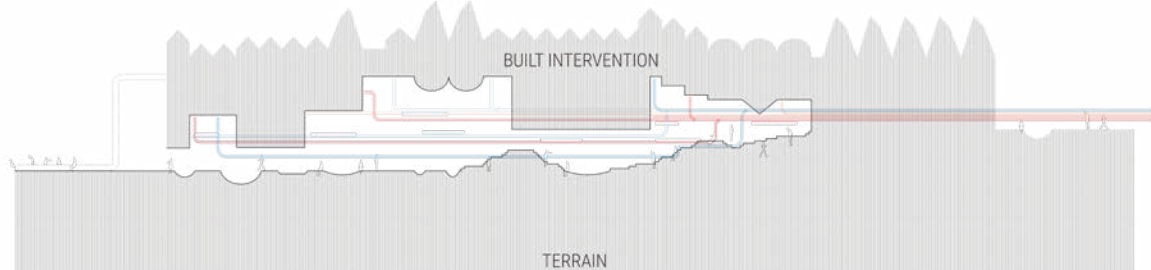
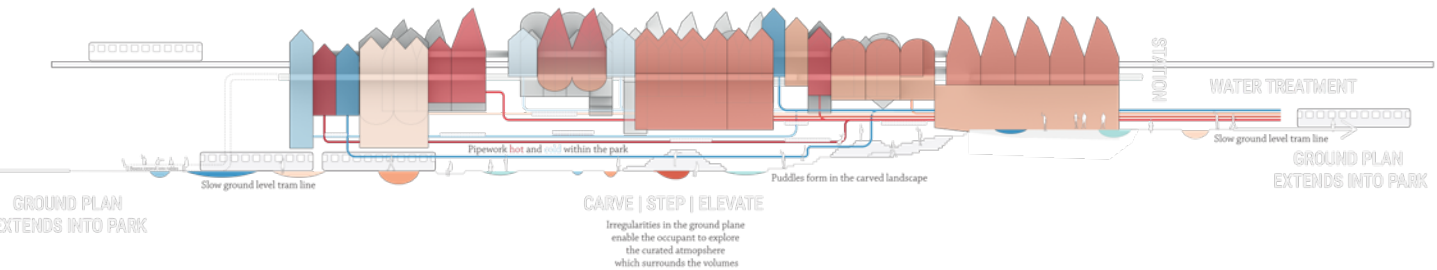
Instead this considers the potential of natural resources for the benefit of local communities, a democratisation of the commons.

Long section



Section diagram : strategic approach

Section diagram : landscape as a carved void



01 ATMOSPHERIC

Architectural design thesis | Antofagasta, Atacama, Chile | Meteorological building design

The public bathhouse was originally designed for the common when bathing facilities were a luxury afforded by few, since then it has become a recreational luxury. In the divided city of Antofagasta, where many do not have access to private bathing facilities, I consider whether the bathhouse can become a communal luxury once again.

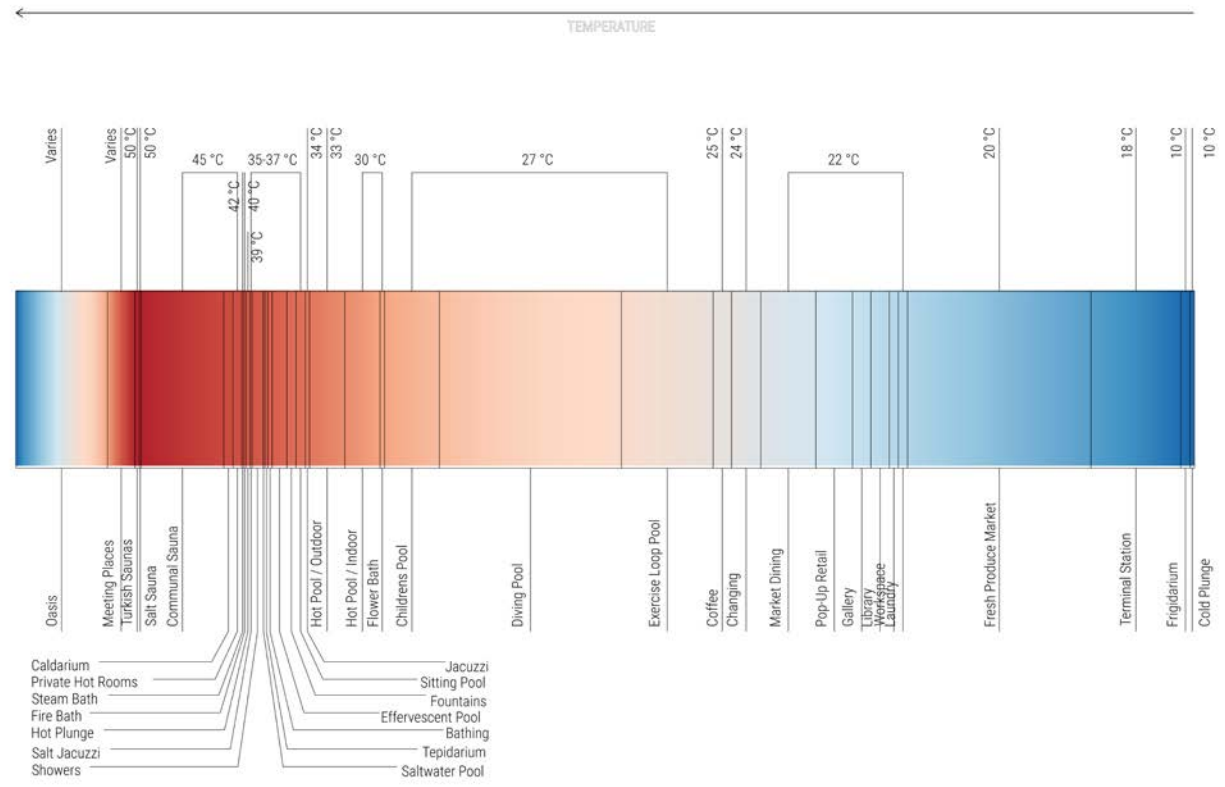
Thermal baths have a history of capitalising on climatic idiosyncrasies. However, through this project I will consider how the bathhouse volumes can act as climatic lungs curating the climate of the public space below. Generating heterogeneous conditions in an otherwise homogeneous city.

This conceptual section exercise explores this concept of 'climatic lungs' which distribute the luxury of atmospheric experience across the public park below.

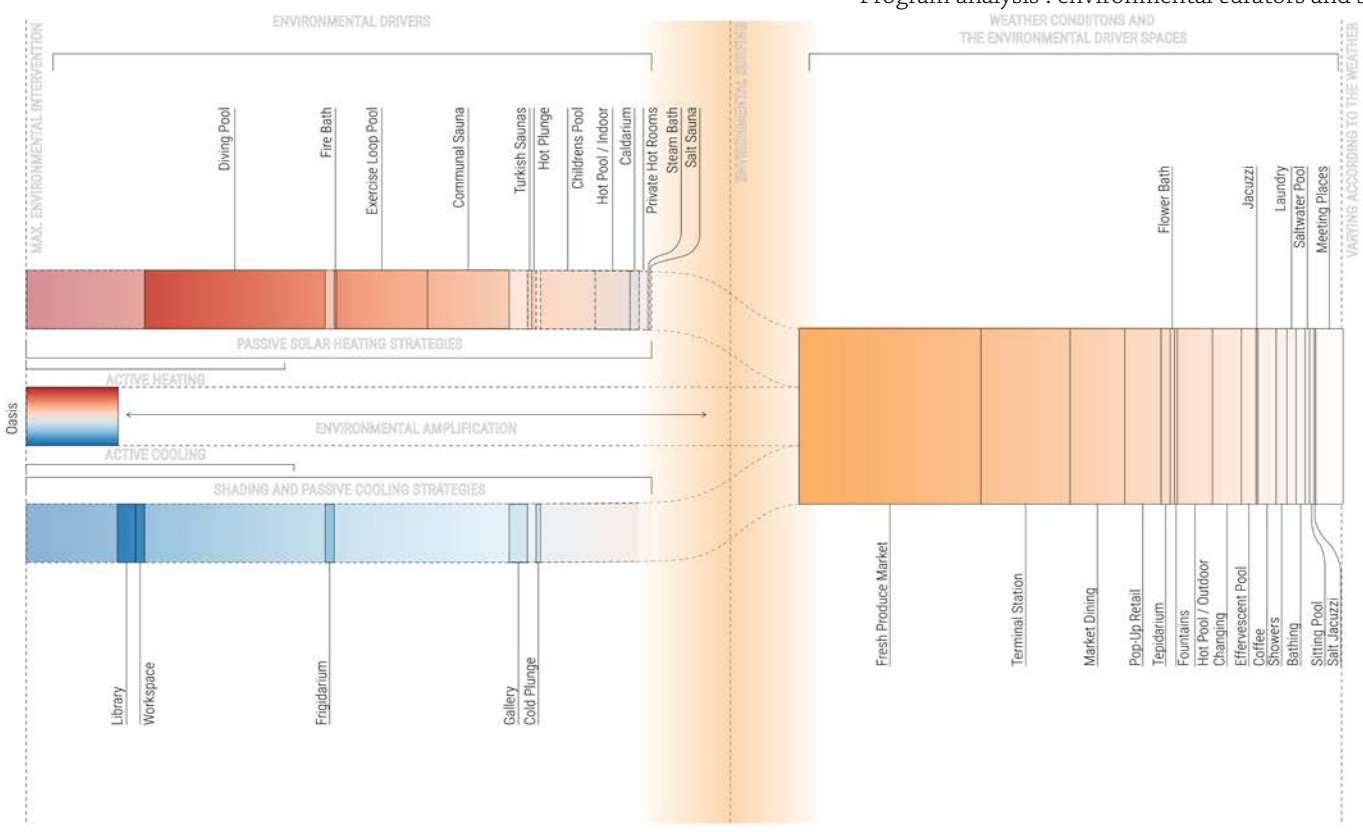
Conceptual sketch section



Program analysis : temperature conditions



Program analysis : environmental curators and surfers

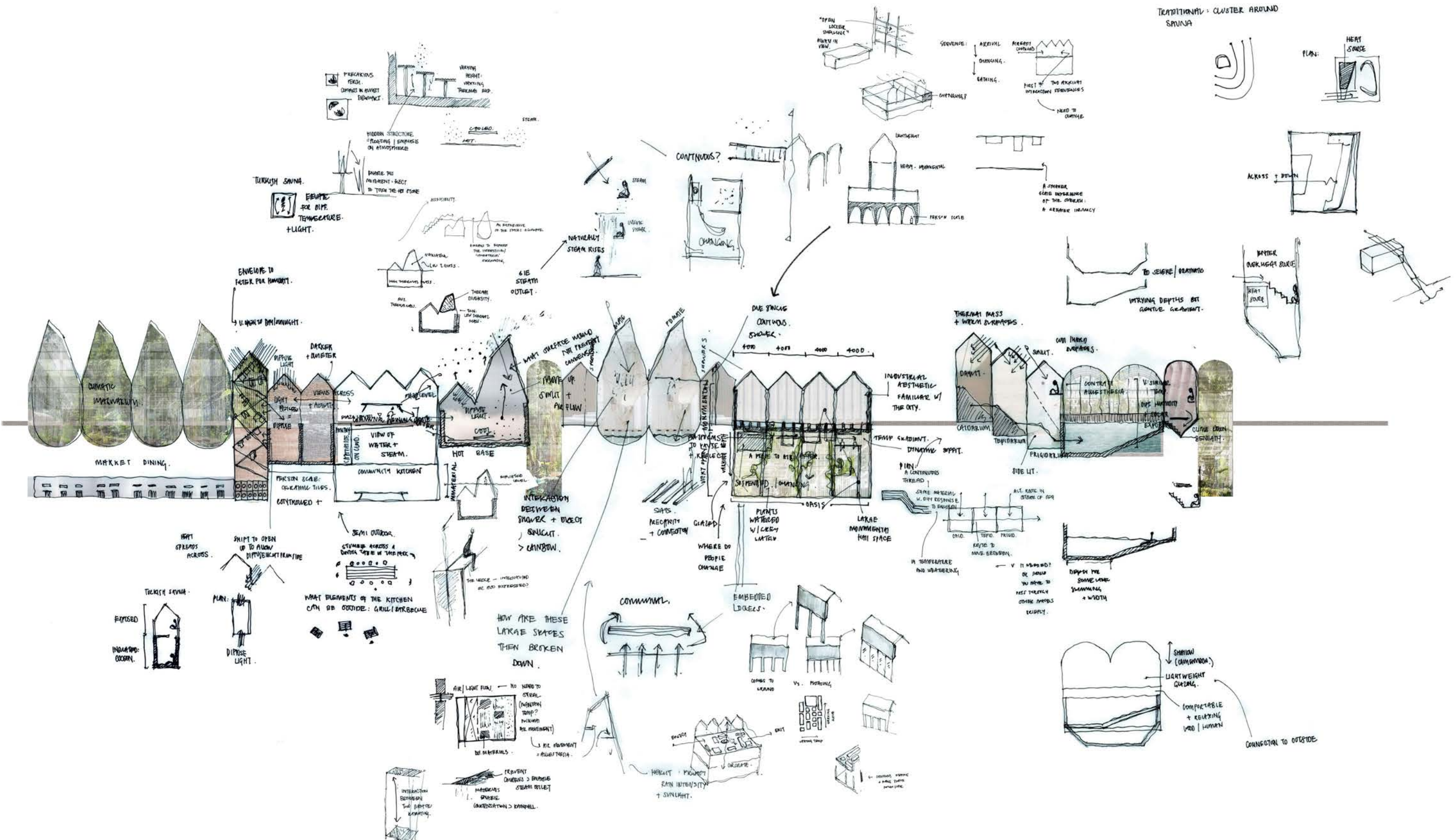


01 ATMOSPHERIC

Architectural design thesis | Antofagasta, Atacama, Chile | Meteorological building design

Individual spaces were explored from atmospheric and material perspectives, considering a series of adjacencies and interactions. Form is used to curate external airflow, creating areas of shelter and exposure, informed by CFD modelling.

Sectional sketch studies



Architectural design, climatic design, CFD simulation, meteorological architecture

01 ATMOSPHERIC

Architectural design thesis | Antofagasta, Atacama, Chile | Meteorological building design

Short meteorological section



The columns become places to gather around whether it is for a market, at seating or to experience the cooling from one of the water pipes. The market offers an opportunity for residents to get fresh produce, as well as providing a natural place for gathering.

Amenity cores connect the building to the public space and provide spaces for laundry, communal cooking and dining as well as libraries and informal reading spaces. The laundry core celebrates the everyday, with the tower taking advantage of the air movement to dry laundry despite the humid city.

The tram runs through and stops within the site itself allowing for produce to be moved from the market to the more peripheral communities. Between stops it is possible for these residents to enjoy a shower on the tram, or do their laundry closer to their home.



Architectural design, climatic design, CFD simulation, meteorological architecture

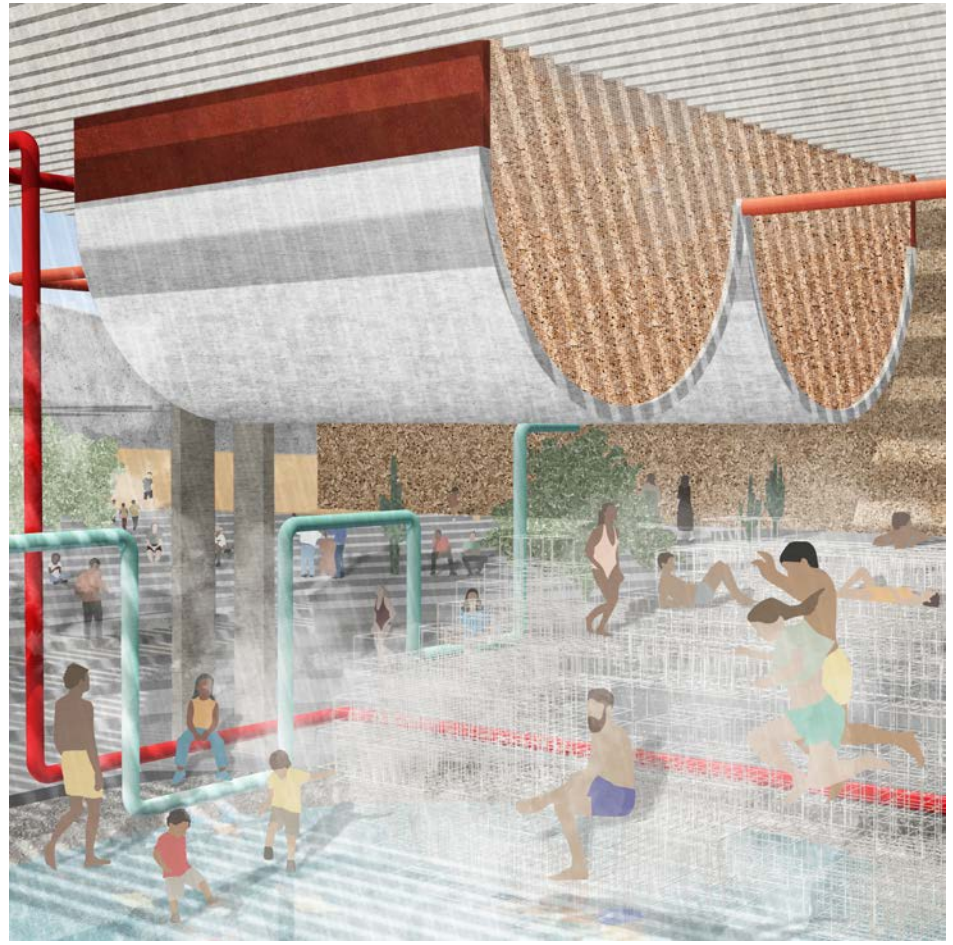
Aimee Louise Desert

01 ATMOSPHERIC

Architectural design thesis | Antofagasta, Atacama, Chile | Meteorological building design

Suspended volumes and curated clouds in the public space.

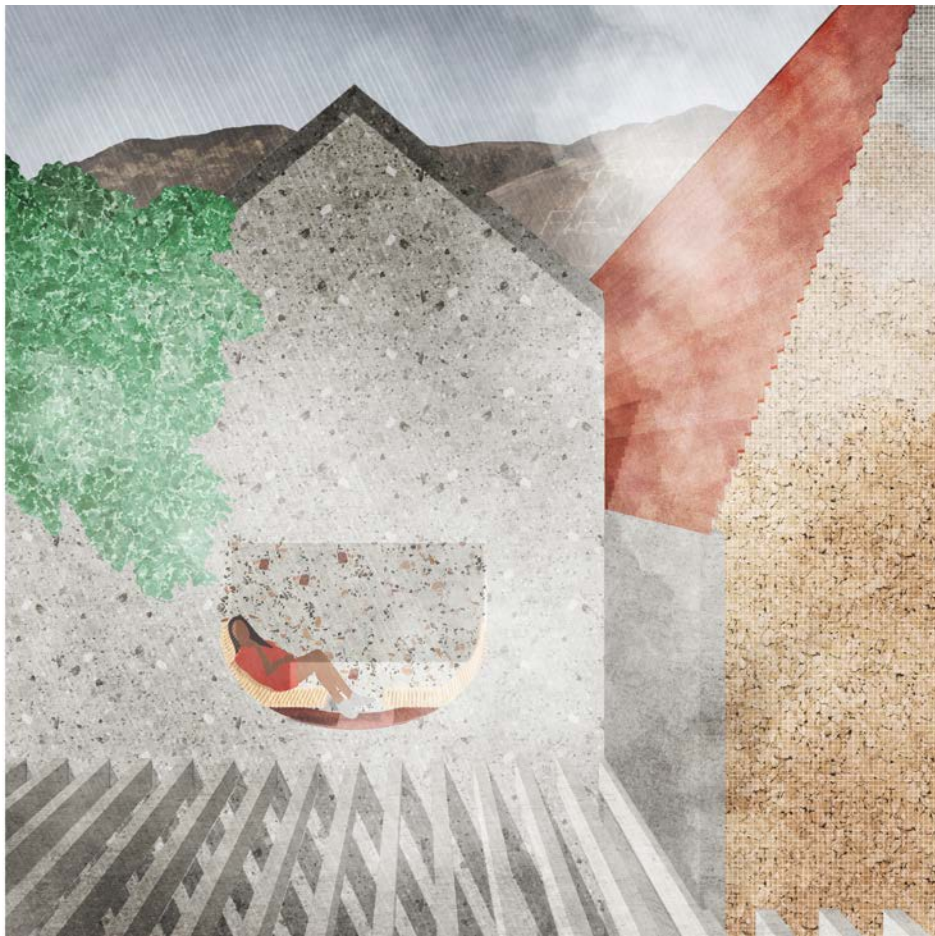
Cold leisure pool



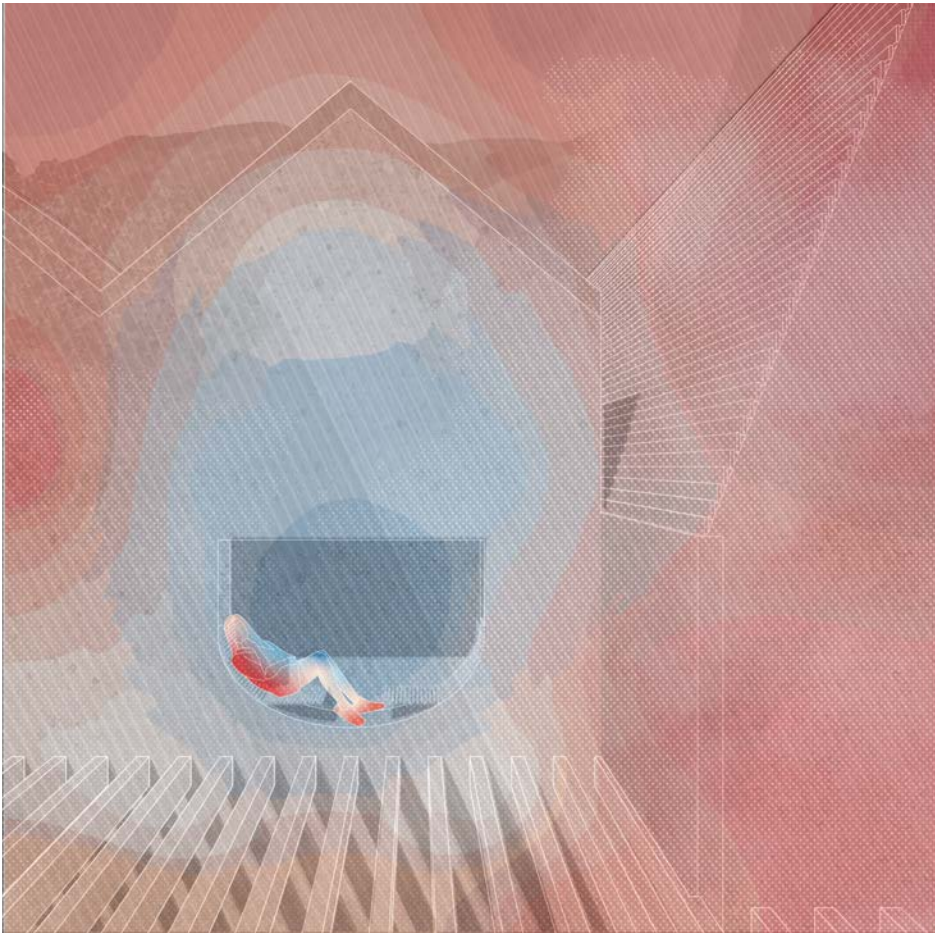
Architectural design, climatic design, CFD simulation, meteorological architecture

01 ATMOSPHERIC

Architectural design thesis | Antofagasta, Atacama, Chile | Meteorological building design



Thermal fenestration in the public space

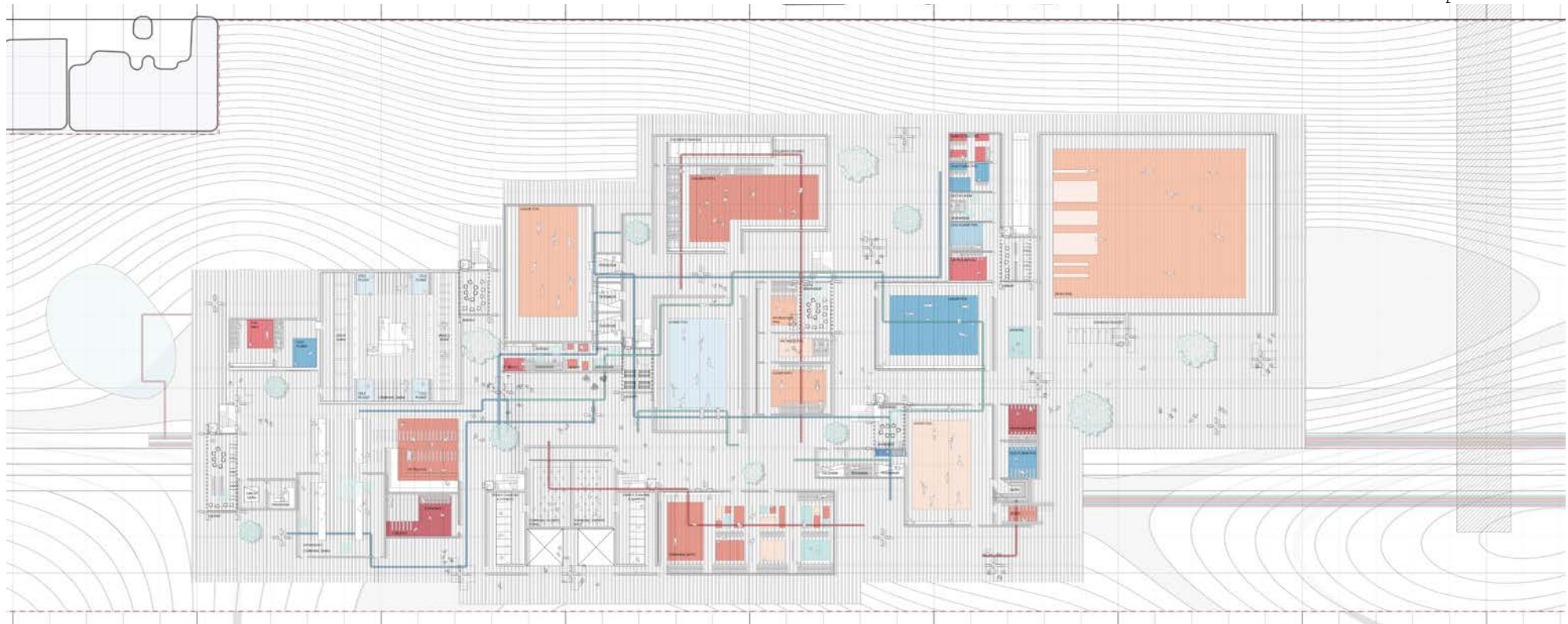


Architectural design, climatic design, CFD simulation, meteorological architecture

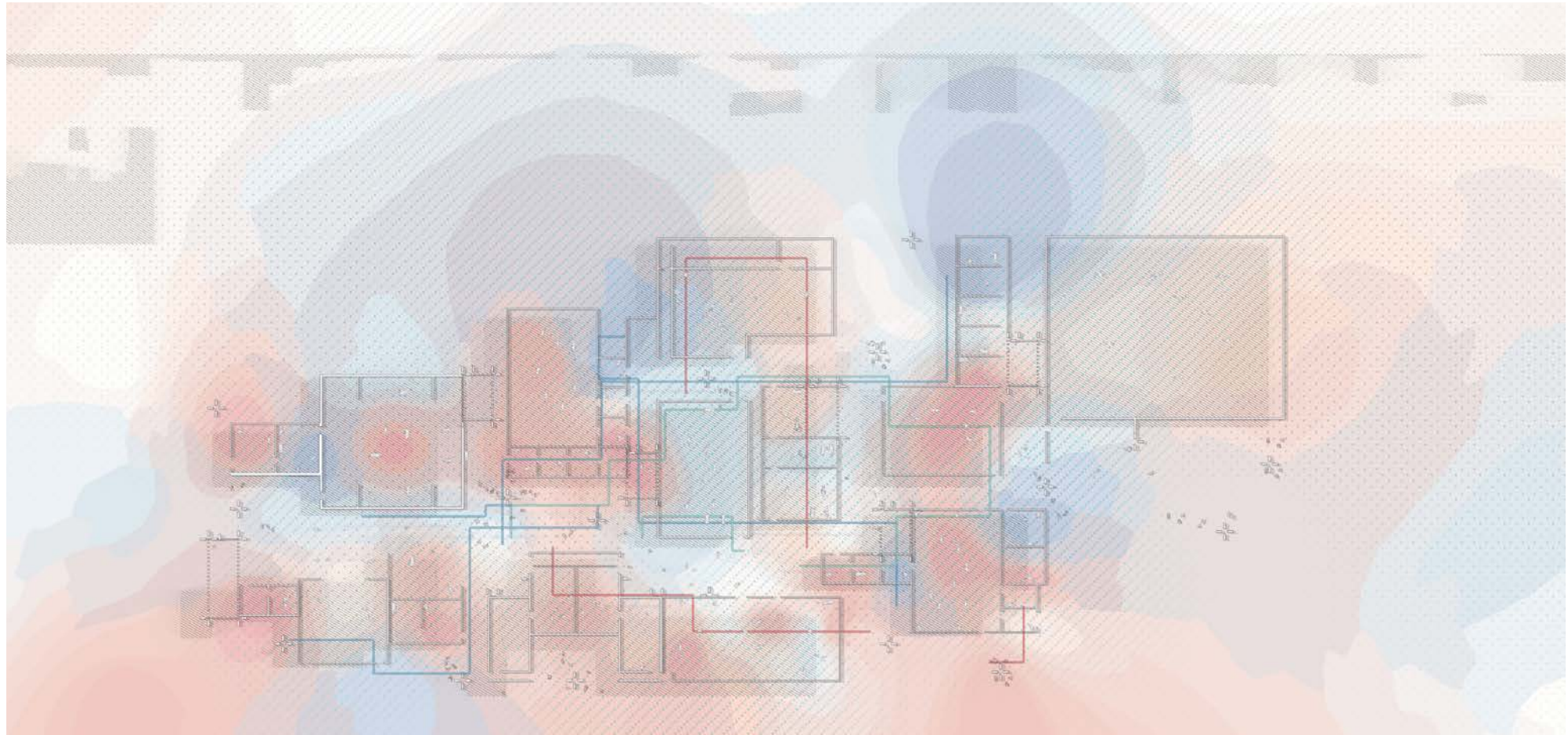
The majority of spaces are accommodated on the first floor maximising the climatic potential to the public space. Programs are arranged for climatic adjacencies as well as user sequences, focusing on fostering chance encounters and interaction with the unanticipated climate and people.

Unlike in a typical building the climatic exchange is decoupled from the envelope and pervades the plan. Walls indicate areas of diverse conditions rather than containing a climate – a manifestation of atmospheric boundaries.

First floor plan : material



First floor plan : atmospheric



01 ATMOSPHERIC

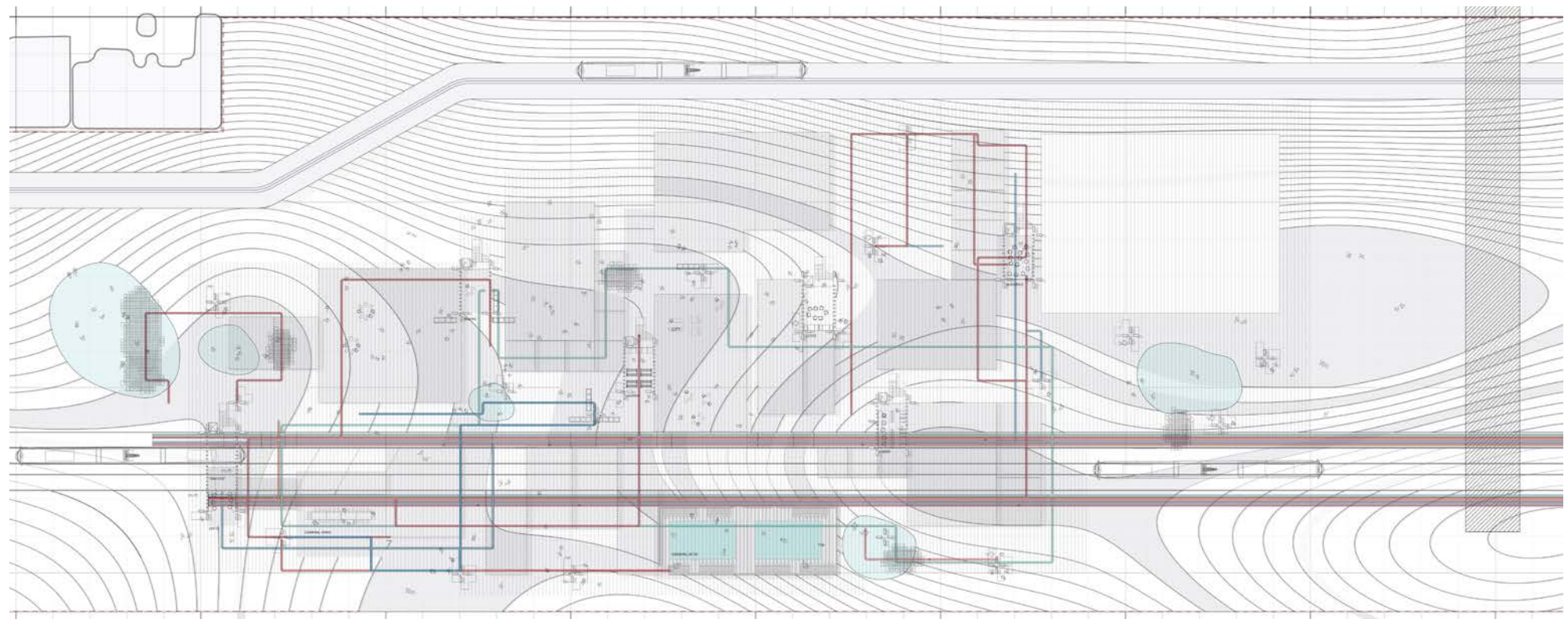
Architectural design thesis | Antofagasta, Atacama, Chile | Meteorological building design



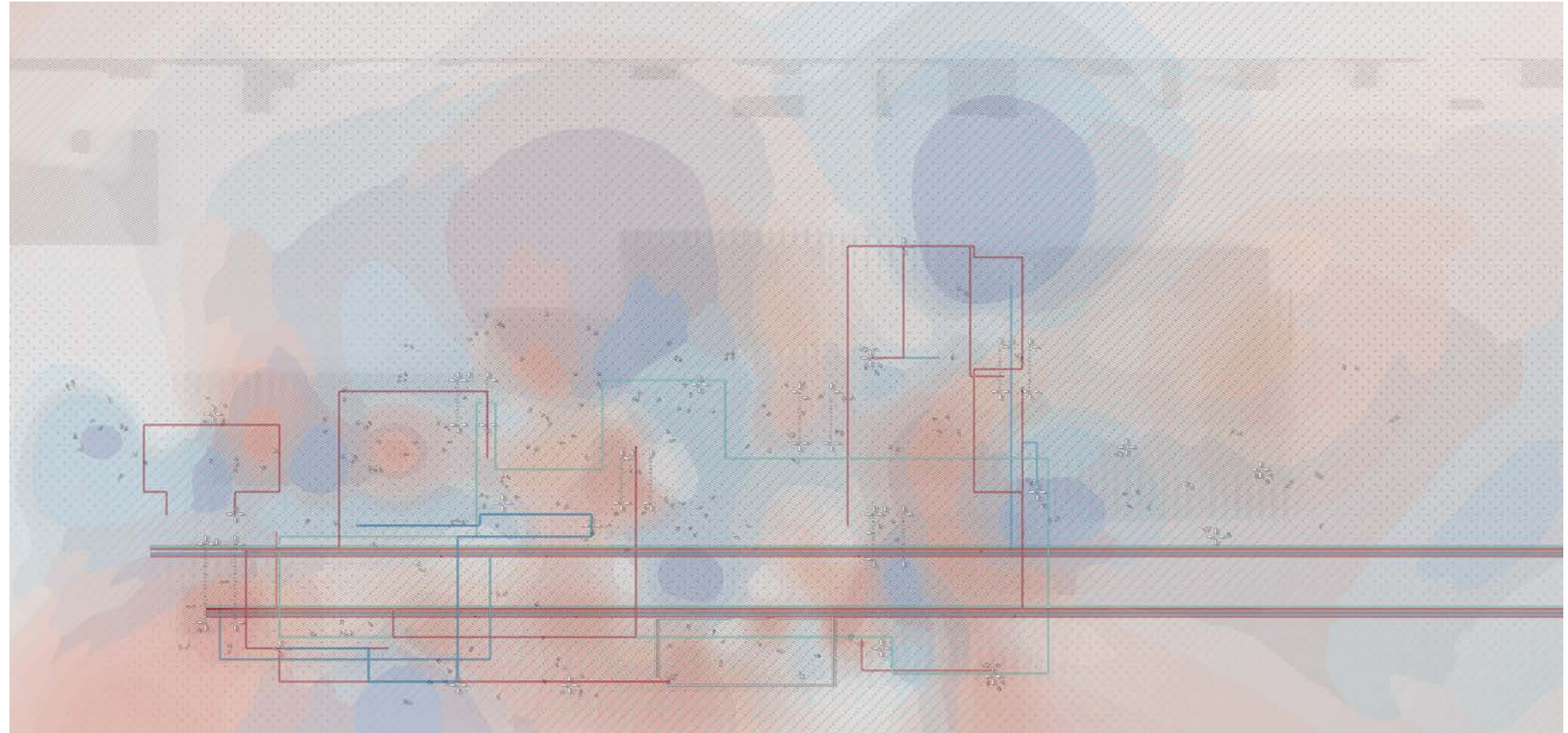
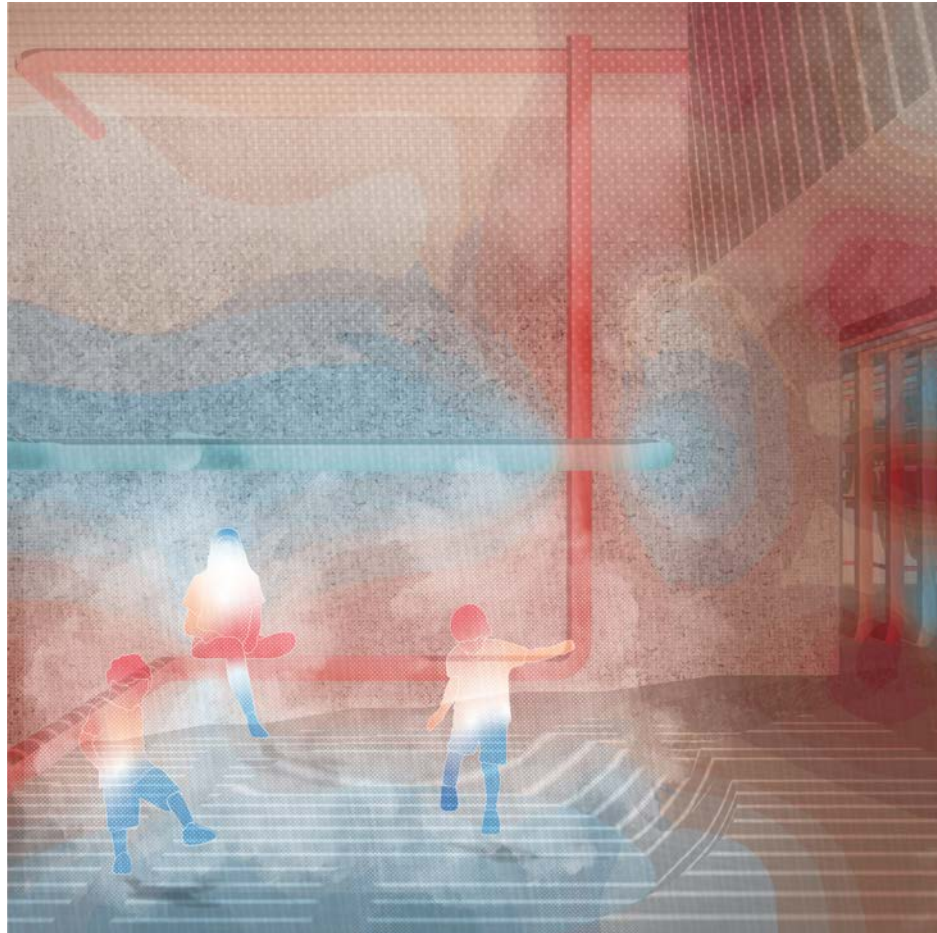
Puddles form in carved out areas of the landscape, offering the opportunity to experience the rare luxury of jumping into a puddle in the desert.

Curated by the spaces above and populated by pipework which brings water to and from the pools, there are a series of opportunities to engage with the climate, climbing up towards the cool soffits or resting on a warm pipe.

Ground floor plan : material



Ground floor plan : atmospheric

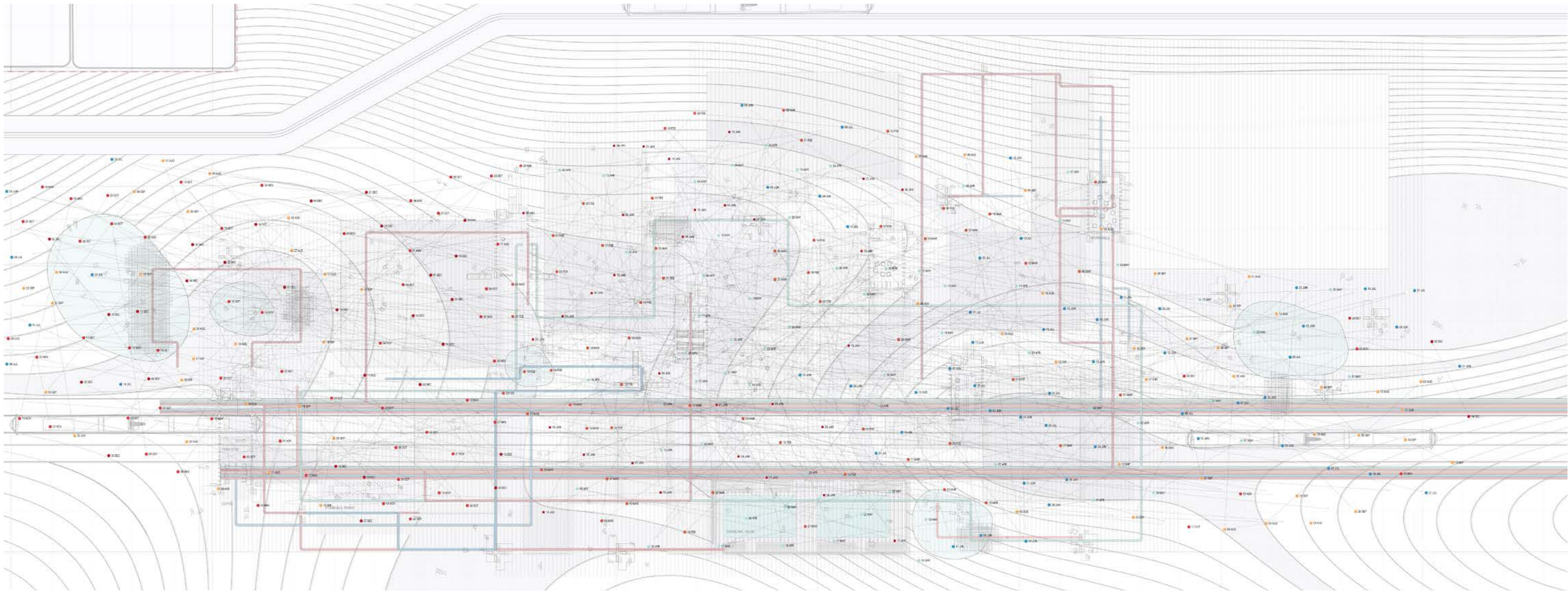


Architectural design, climatic design, CFD simulation, meteorological architecture

01 ATMOSPHERIC

Architectural design thesis | Antofagasta, Atacama, Chile | Meteorological building design

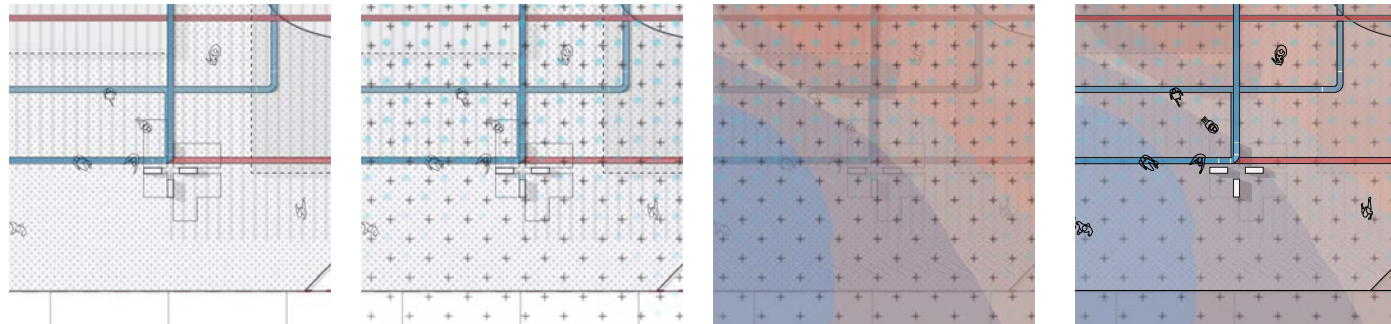
Ground floor plan showing atmospheric conditions relative to annual weather conditions in the city



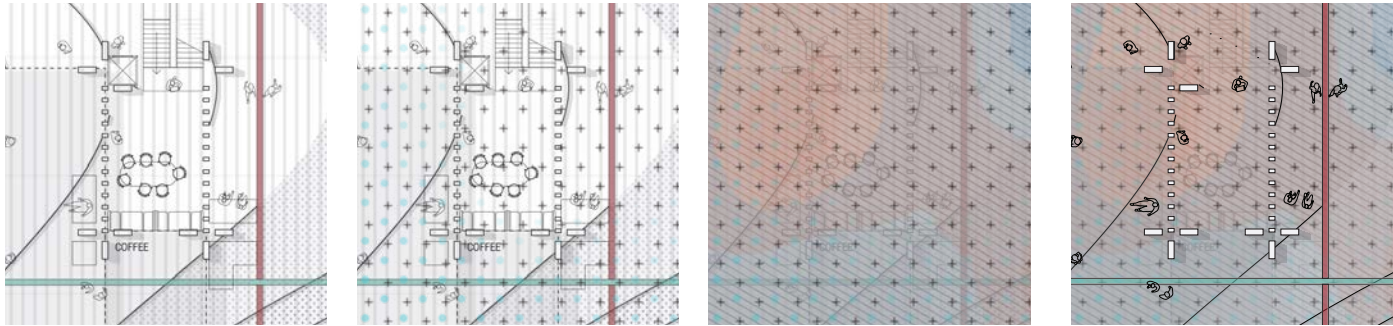
The conditions across the site vary according to the weather conditions which they are amplifying, the range achieved allows the weather of the city over the year to be experienced within the site across a single day. Activity inhabits places of comfort which change throughout the day, as a result of shelter, humidity, shade and temperature conditions; a curated meteorological landscape.

The most comfortable place to have coffee varies according to the weather conditions of the city:

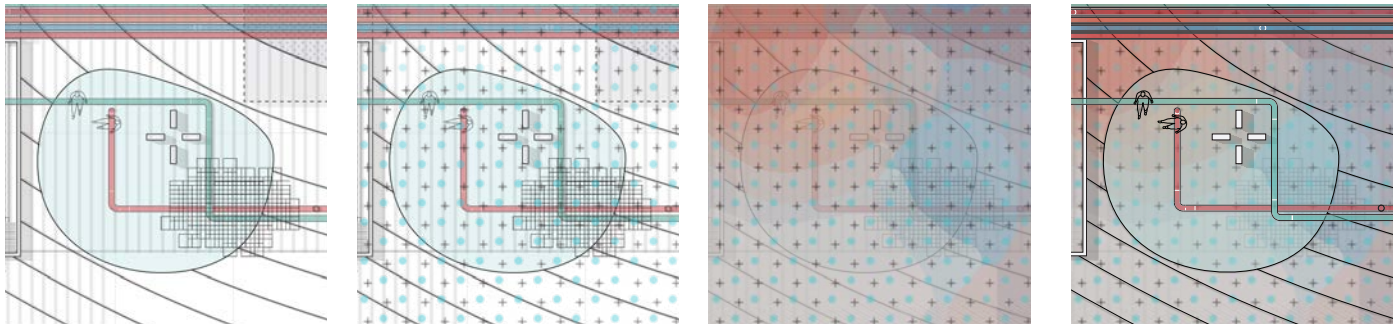
On a hot afternoon it is in the shade around the cool pipes bathed in cool humidity and exposed to wind.



On a cool, humid evening it is amongst the thermal mass of the columns adjacent to the hot pipes.



On a warm, dry day it is amongst the puddles.



Architectural design, climatic design, CFD simulation, meteorological architecture

02 DESIGN FOR THE WEATHER

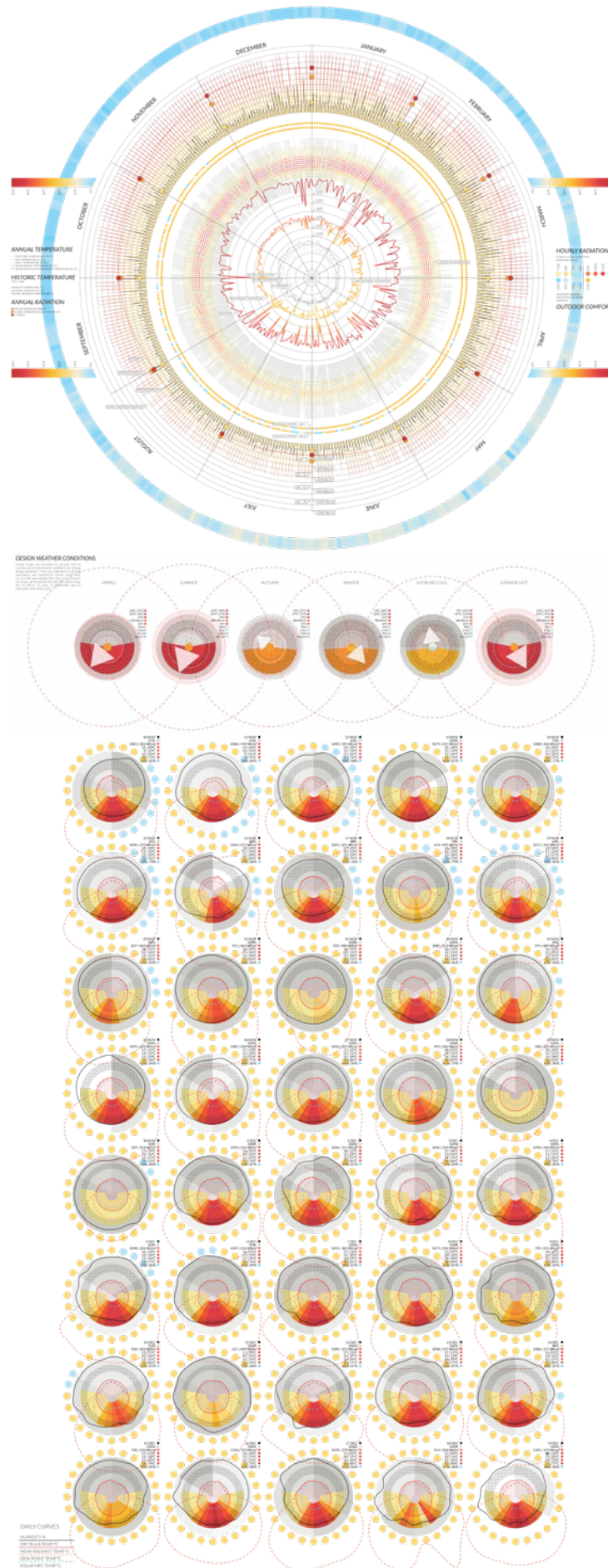
Research and visualisation | Architectural designs relationship with weather and climate

A short research project undertaken as part of the concept phase of the prototype design, exploring the visualisation of the weather and its position in architectural methodologies. It challenges the current assumptions architects and engineers make in the global application of comfort metrics and the simplification of an ephemeral condition to a finite number of scenarios. The project attempts to communicate the true variation of the weather and considers how this can inform design, challenging architects to consider how they can embrace this variation.

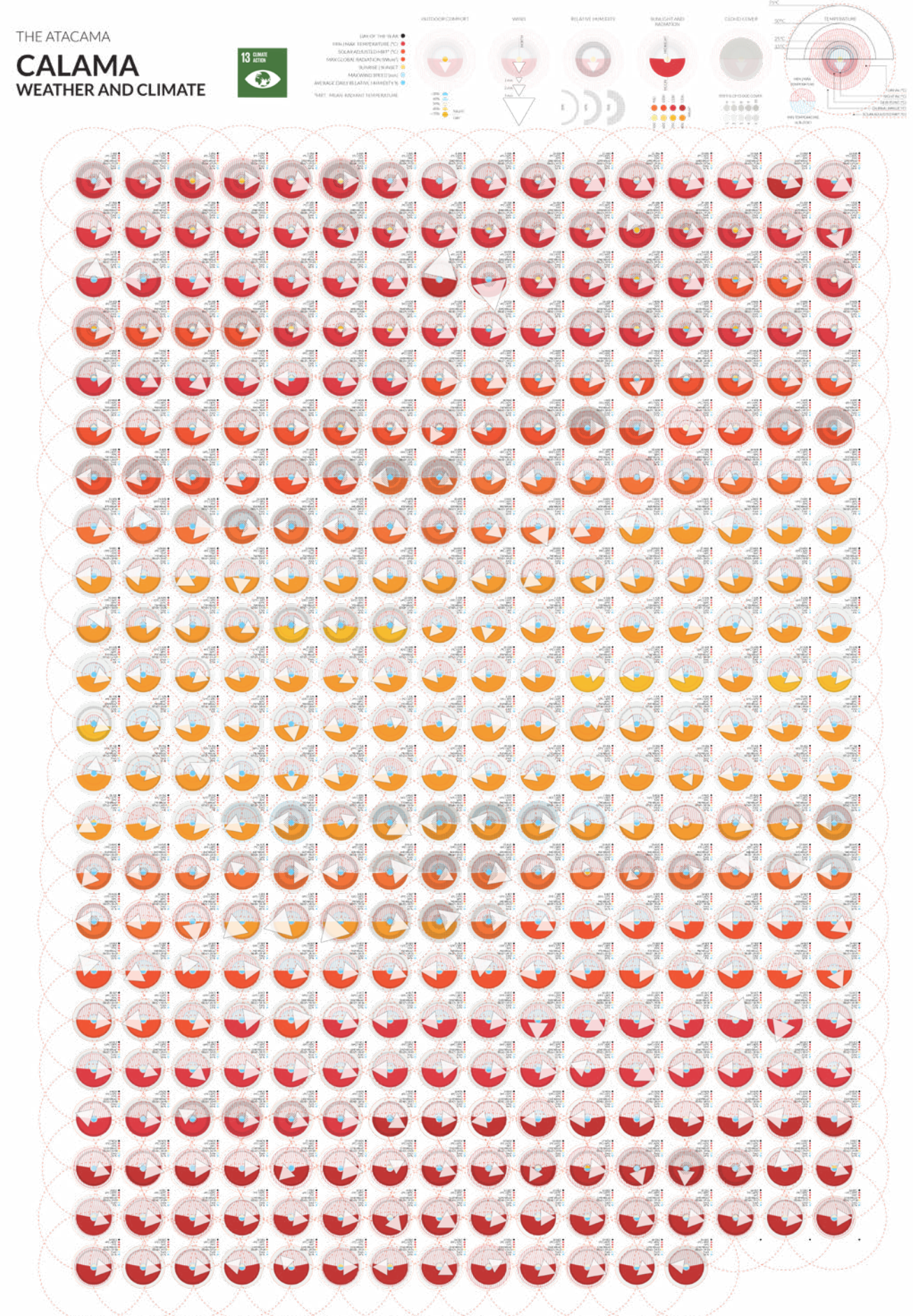
Weather data is too large and complex to be holistically represented using current methods, scripting and a series of simple repeated graphics are used to communicate the layers of data. The graphics enable an overall understanding of the climate whilst giving an insight into the variation and complexity. This project not only informed the design of my 1:1 prototype but was the basis for the development of my thesis project exploring the opportunities in the largely homogeneous climate of Antofagasta.

Since completing my studies I have also been awarded a research grant to continue this work and develop an open source tool which will offer designers a holistic perspective of weather and climate.

Annual visualisation of weather conditions in Antofagasta



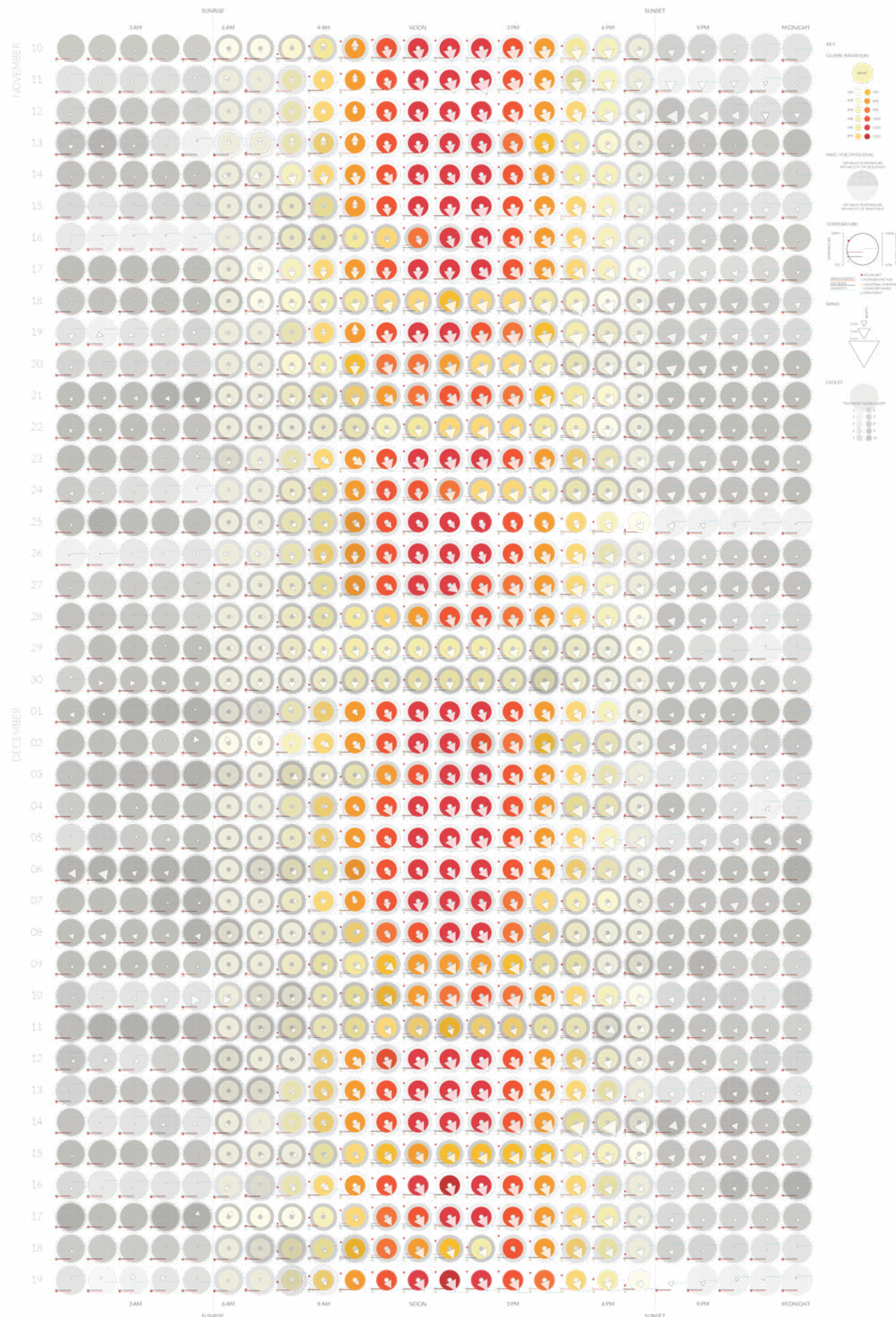
Annual visualisation of weather conditions in Calama



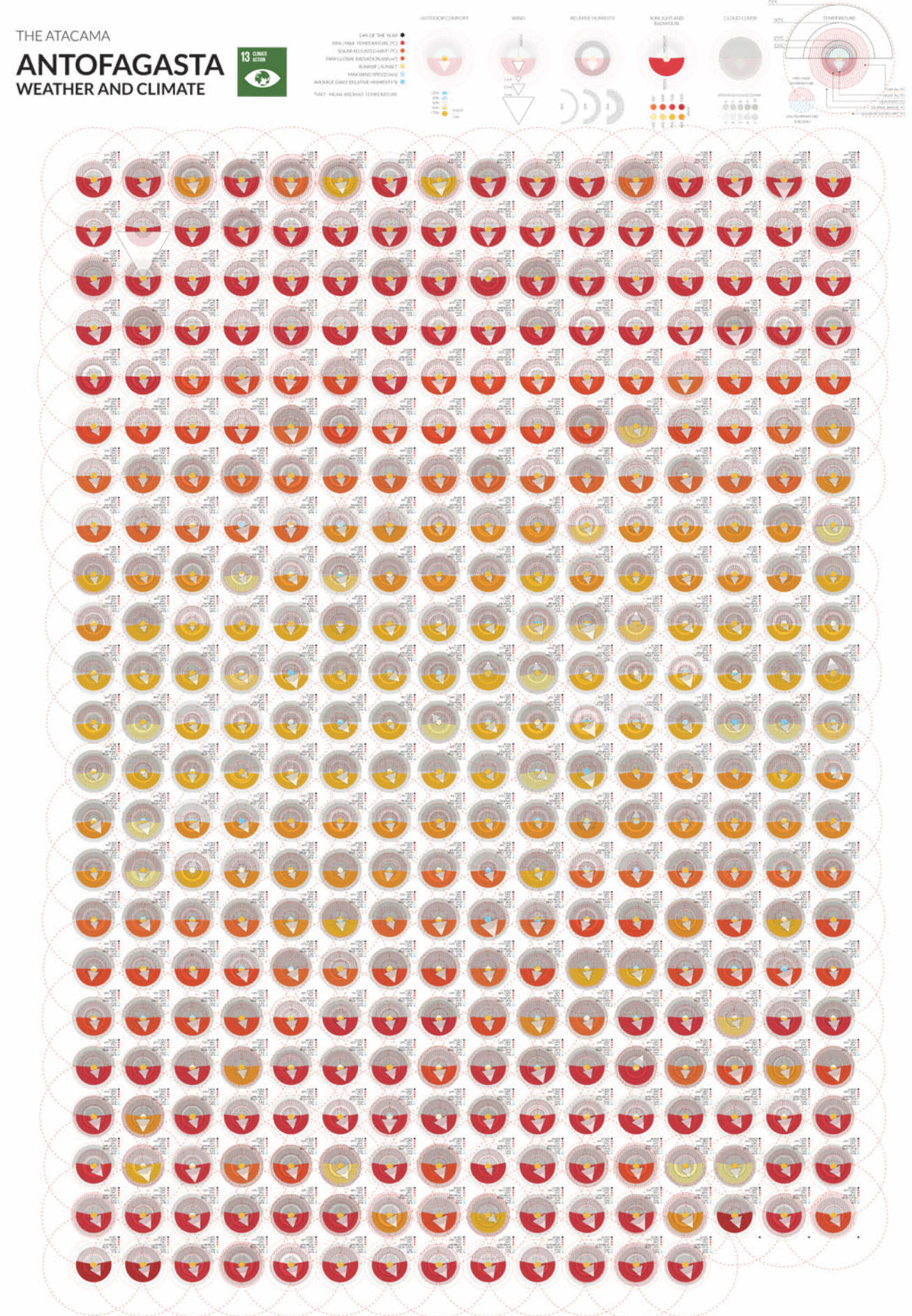
02 DESIGN FOR THE WEATHER

Research and visualisation | Architectural designs relationship with weather and climate

Daily visualisation of weather conditions in Antofagasta



Annual visualisation of weather conditions in Antofagasta



03 CONSTRUCTING ATMOSPHERES

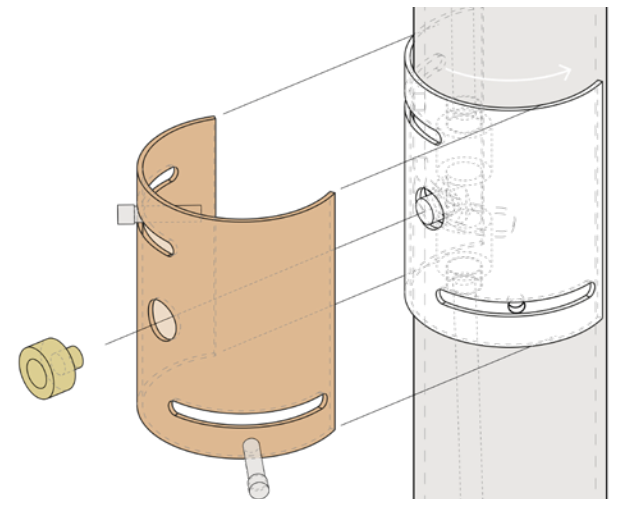
1:1 Prototype design | Antofagasta, Atacama, Chile | Design, fabrication and testing of mist cooling in public space

An exploration into the environment of the city as an atmosphere, the construction of atmospheres and the notion of comfort in humid environments. Investigating the discontinuities in the climate of Antofagasta the project explores the humidity and how we define comfort, challenging assumptions that drive existing comfort metrics.

Research into the daily weather patterns demonstrates the consistent conditions in the city. Working from the fundamental principles of perception and thermal sensation to design for the hyperspecific context the prototype uses fine mist to create an artificially humid environment and bring the luxury of weather phenomena to the occupants of the city. Exploring how the sensation of the regions Camanchaca fog can be introduced to the city. A fine mesh roof captures condensing droplets which fall as rain, a phenomena which the city usually experiences on only a couple of days each year.

The 1:1 prototype was designed and fabricated to enable transportation to the site in Chile, from Copenhagen, where it was installed at a series of sites as a point of engagement with the local communities. The experience generated a series of conversation surrounding comfort and the weather in the city which informed the development of the thesis design program. The experience also gave me an insight into the challenges of public installations, particularly in an international context.

Detailed design of the mist nozzles



Testing the prototype on site



Testing at Museo Ruinas de Huanchaca



Prototyping, design, fabrication, testing, engagement, climatic design, meteorological architecture

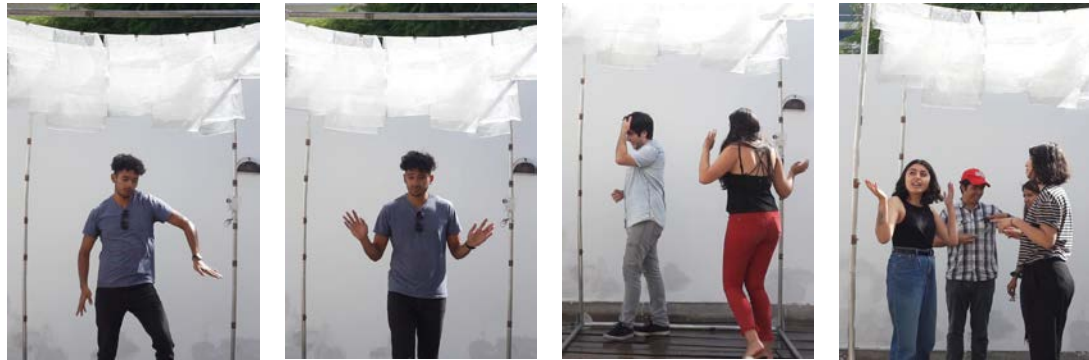
03 CONSTRUCTING ATMOSPHERES

1:1 Prototype design | Antofagasta, Atacama, Chile | Design, fabrication and testing of mist cooling in public space

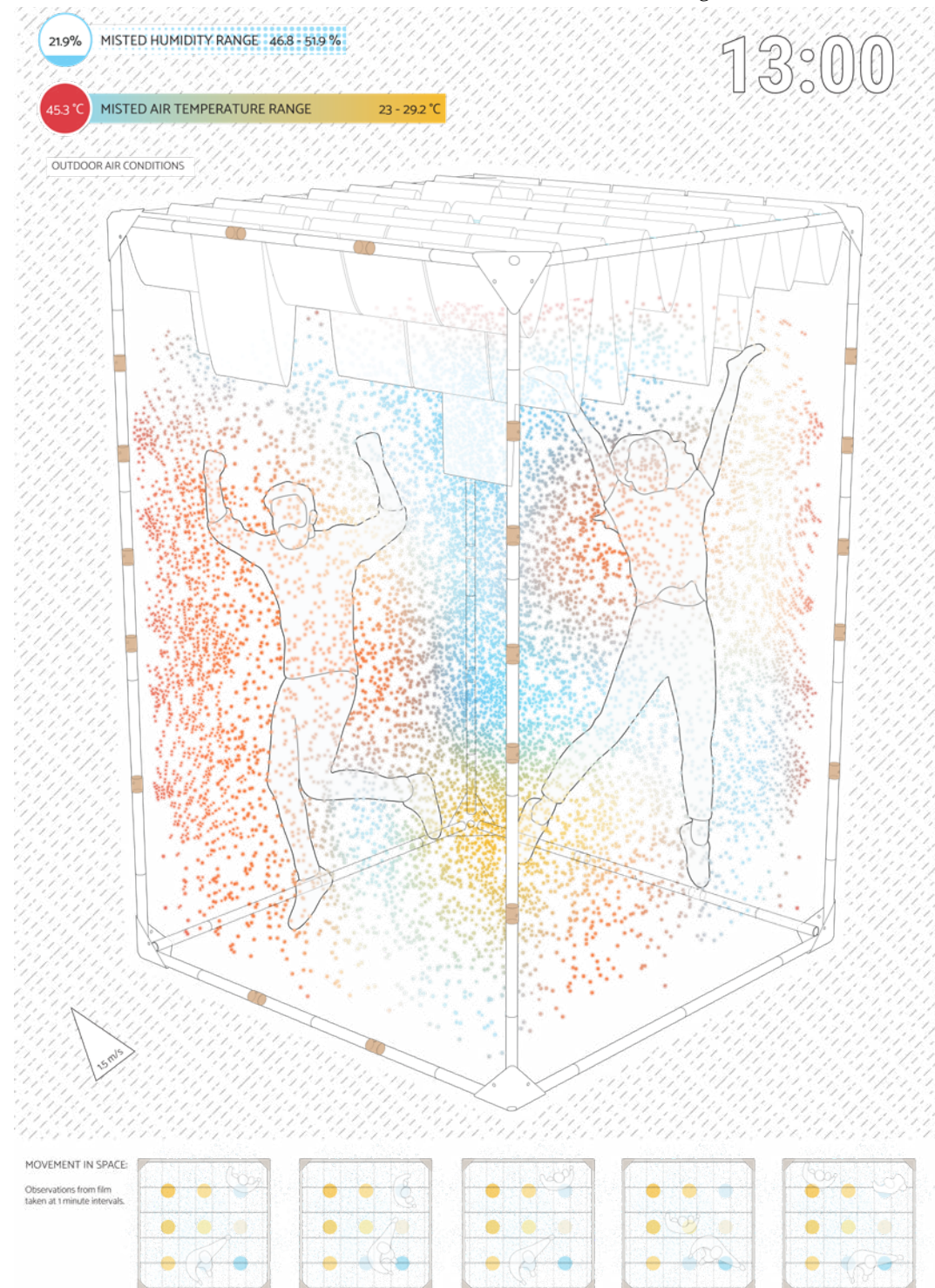
The conditions within the prototype were monitored and compared to the ambient conditions in the city and mapped against the spatial movement of the occupants. This project questions the role of the architect in the design of the atmosphere and the balance between nature and the artificial, considering the micro-climates which are a consequence of our interventions as an intentional act, suggesting architects should embrace the daily variation of the weather, an inherently social phenomena.

As part of the prototyping and research phase I produced a scientific paper positioning the design and findings within the academic context. The paper focuses on occupant perception and the phenomena of thermal alliesthesia, themes which I took forward into my thesis design project.

This paper has been successfully published in a special edition of the peer reviewed journal 'Energy and Buildings' which focuses on thermal comfort in extreme environments, particularly relevant topics in the context of climate change and increased urbanisation.



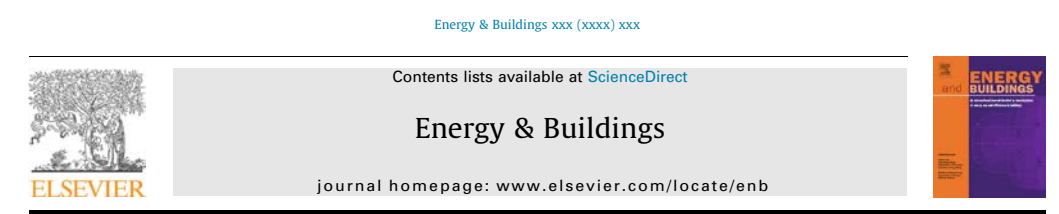
Visualising the curated microclimate



Local students engaging with the prototype.



Published scientific article in Energy and Buildings.



The spatial comfort and thermal delight of outdoor misting installations in hot and humid extreme environments

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 Mist cooling
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 Thermal comfort
 UTCI
 Thermal delight
 Alliesthesia

ABSTRACT

Within the boundaries of Climate Change, existing hot and humid climates will likely become more extreme, calling for research into solutions that enable the thermal liveability of these environments. There is literature advocating for exploring evaporative cooling in hot and humid climates, having observed that when fine mist is deposited on skin, thermal comfort can be achieved. However, there are only a handful of studies considering the efficacy of misting prototypes in these environments. Thus, an experimental study was conducted to explore the impact of simple mist cooling technologies on outdoor comfort. A full-scale misting prototype was built in the city of Antofagasta, located in the Atacama desert region of Chile, and experiencing high humidity and massive solar radiation. The generated environmental conditions were measured, and thermal comfort questionnaires used to supplement quantitative data interpretation with information on the levels of comfort achieved.

The experiment demonstrated the potential of mist cooling in this environment, which led to a significant reduction in air temperature, mean radiant temperature and thus on the universal thermal climate index, without significant increases in ambient humidity. Results showed over a 15 °C cooling effect in all three metrics at peak times, and occupants consistently reported a cooling effect after spending time within the mist.

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1. Introduction

Climate change is a global issue with local effects, concentrated in what are already extreme climates. With local temperatures trending upwards and no sign of pausing, there is an urgent need for climate-specific solutions to improve outdoor comfort [1,2]. It is expected that humid climates, which represent 64% of the Earth's land surface worldwide [3], will be vastly impacted by climate change. They will experience hot, humid conditions in the future. In addition, evidence shows that cities within these regions are globally the most affected by the urban heat island (UHI) effect [4–6].

In such climates, cooling the outdoors is becoming an essential area of investigation as it has the potential to increase outdoor access, and consequently wellbeing. Inviting people to make use of outdoor and semi-outdoor spaces by offering a pleasant micro-climate, increases communities' physiological comfort [7] as well as reduce the health risks on the vulnerable population, including elderlies and those with chronic illness. This is a relevant concern

in hot, humid cities in South America and Asia, where interventions are exclusively concentrated in wealthier districts: shade, and consequently, comfort, is becoming a sign of privilege [8,9]. Seeking to provide comfort, wellbeing and a correct climate for all within cities is aligned with the UN SDG 11: "Sustainable Cities and Communities" [10].

Outdoor comfort and thermal delight in hot and humid environments are the subjects of significant existing research [11–16]. These demonstrated that high humidity and temperatures cause heat stress, yet, recent research also indicates that residents of these hot and humid environments have acclimatised sufficiently to expand their comfort zone [7]. As climate change and the UHI problem progresses, evaporative cooling systems have been tested in outdoor or semi-enclosed spaces as a mitigation option, and the related literature advocates that even in highly humid climates, evaporative systems could provide relief from thermal stress [17].

One of the valuable options that relate to evaporative cooling is the use of mist [18]. A series of studies show it to be a useful tool in improving comfort levels in a range of hot climates. Research to date has included quantitative data measuring the difference in skin temperature [19] under mist spraying environments as well as using occupant surveys which have shown improvements in

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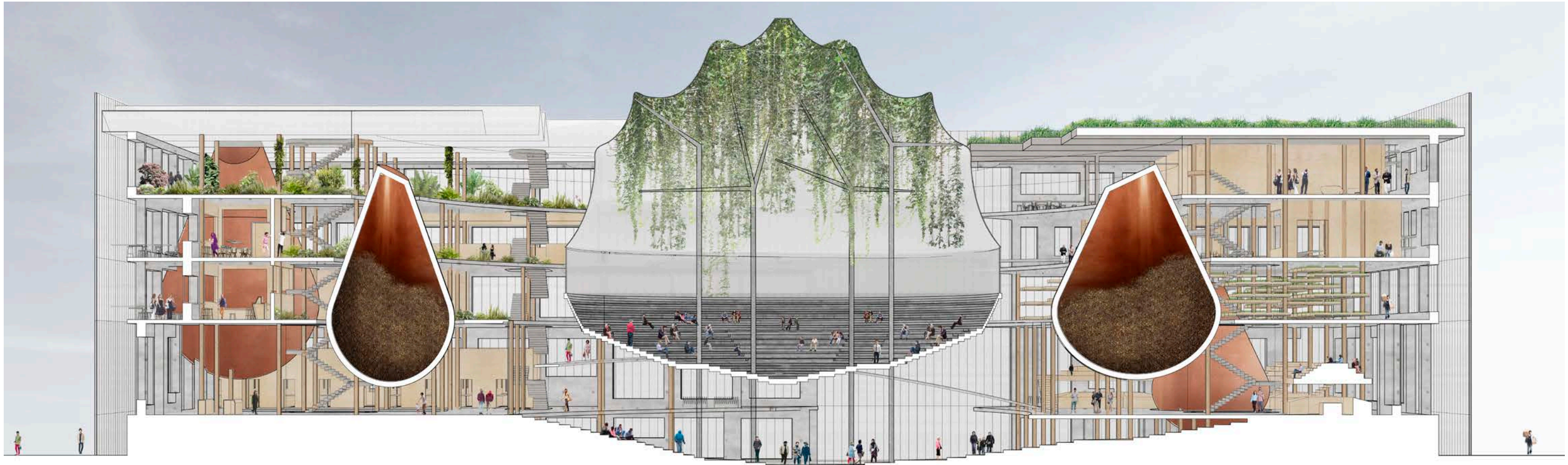
<https://doi.org/10.1016/j.enbuild.2020.110202>
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04 CULTIVATING DEMOCRACY

Architectural design | Anchorage, Alaska | A citizen's parliament for the Arctic

Long section showing the assembly space and anaerobic digesters



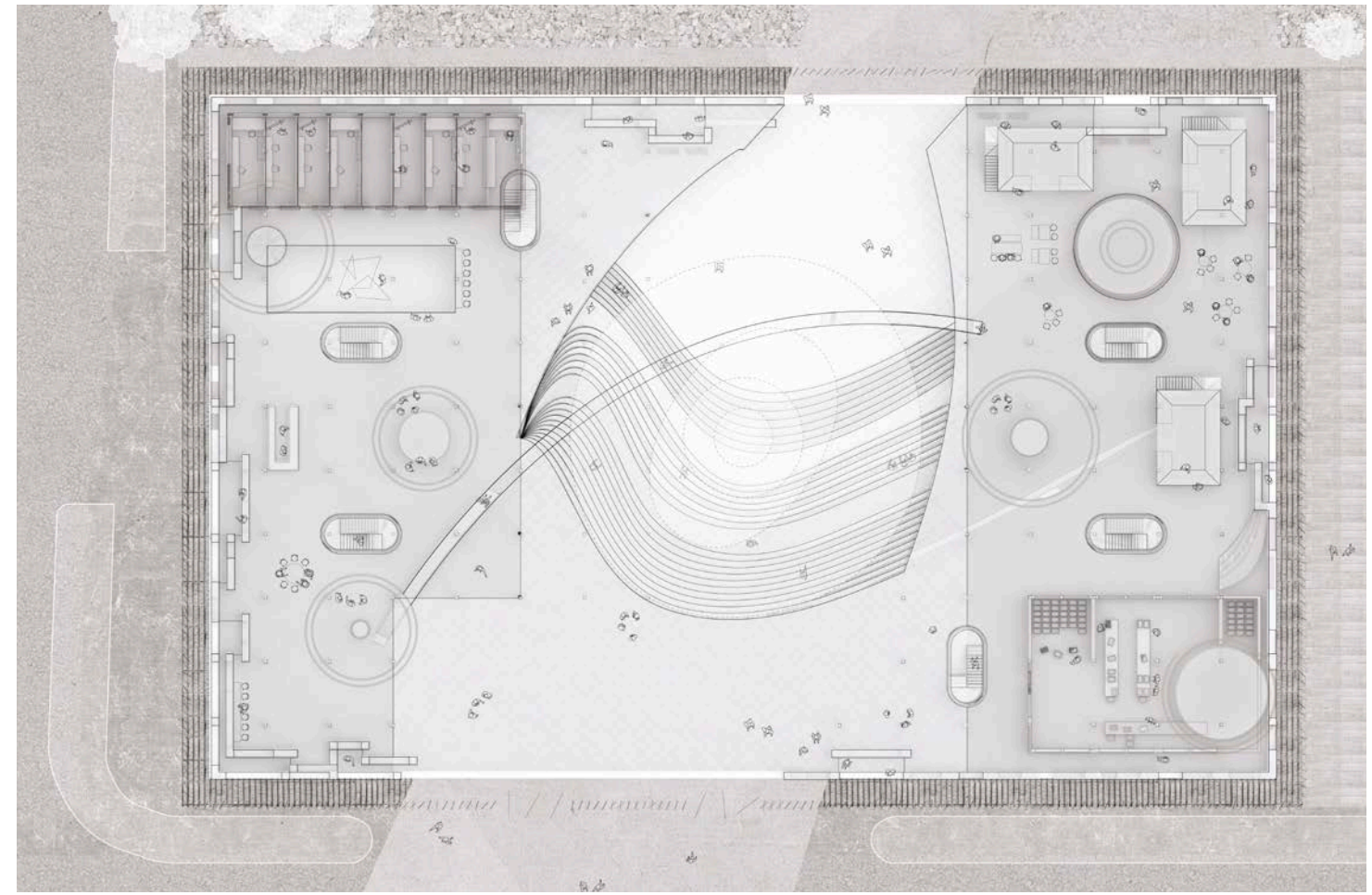
Cultivation spaces in the shelter of the envelope



The warm surface of the digester in winter



Ground floor plan of the public space



Architectural design, climatic design, concept development, hybridity

04 CULTIVATING DEMOCRACY

Architectural design | Anchorage, Alaska | A citizen's parliament for the Arctic

A Citizen's Assembly for the Arctic seeks to empower Arctic Citizens to engender change in areas that directly affect their lives, creating a supra national network that counters their under representation in existing democratic structures. To foster engagement across society the Anchorage assembly also addresses the issue of food insecurity in Alaska through cultivation, recycling, education and energy generation.

Anaerobic digesters are used to generate energy from food waste and also provide passive heating to the building. These 'energy eggs' enable the curation of microclimates which become places for gathering in the harsh winter and provide heating to the cultivation spaces, extending the growing seasons typical of the Arctic region.

The project explores the semi-conditioned and interstitial, assessing the potential for the habitation of these spaces in the Arctic allowing expansion according to season and occupation.

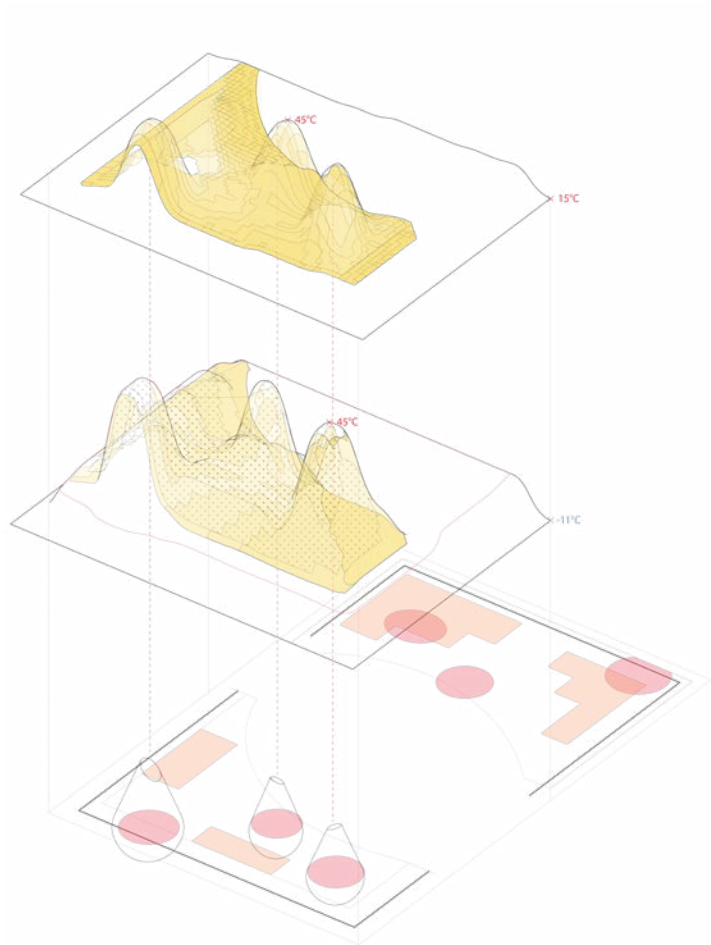
The digester punctuates the facade grid



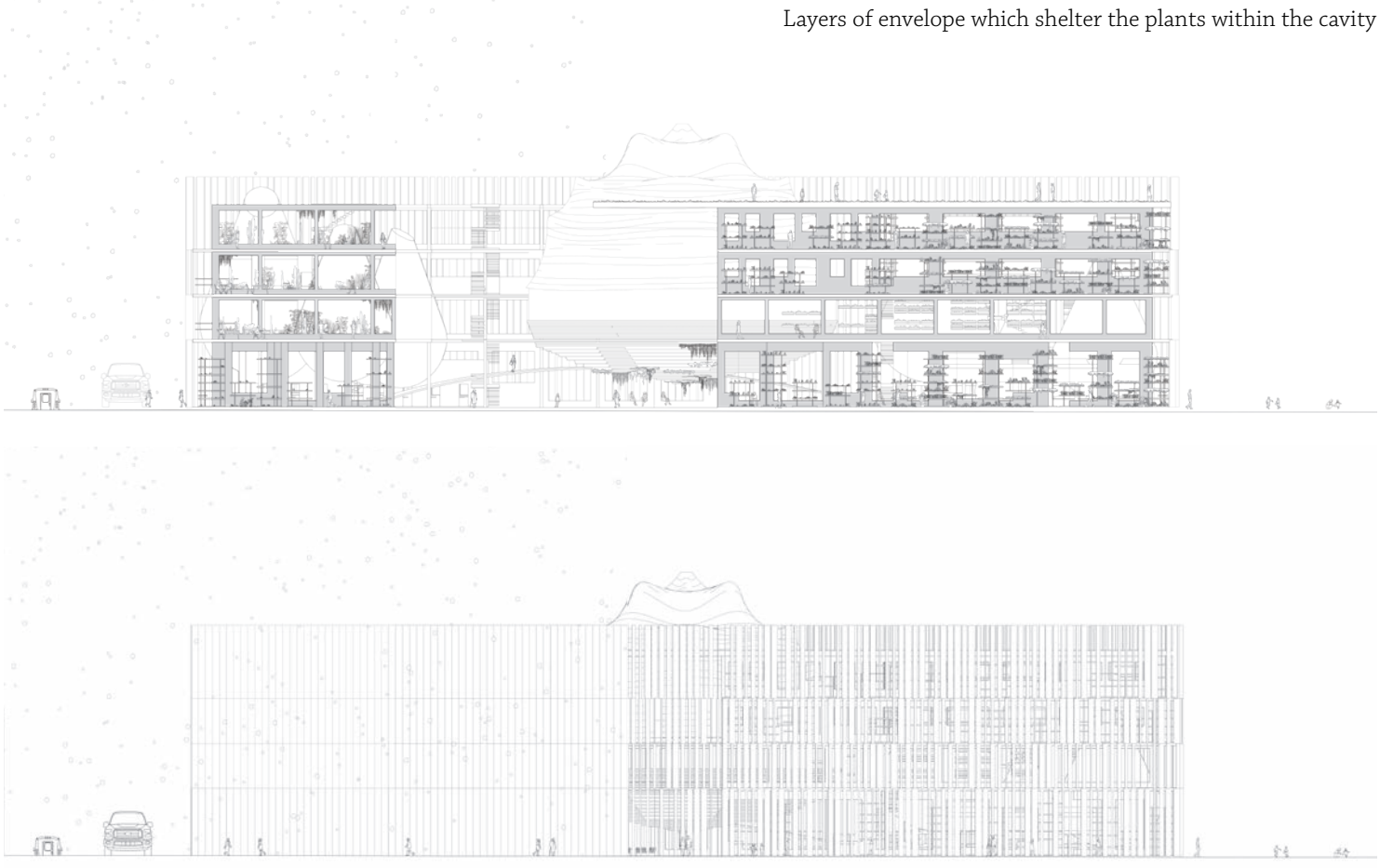
Steps beneath the assembly



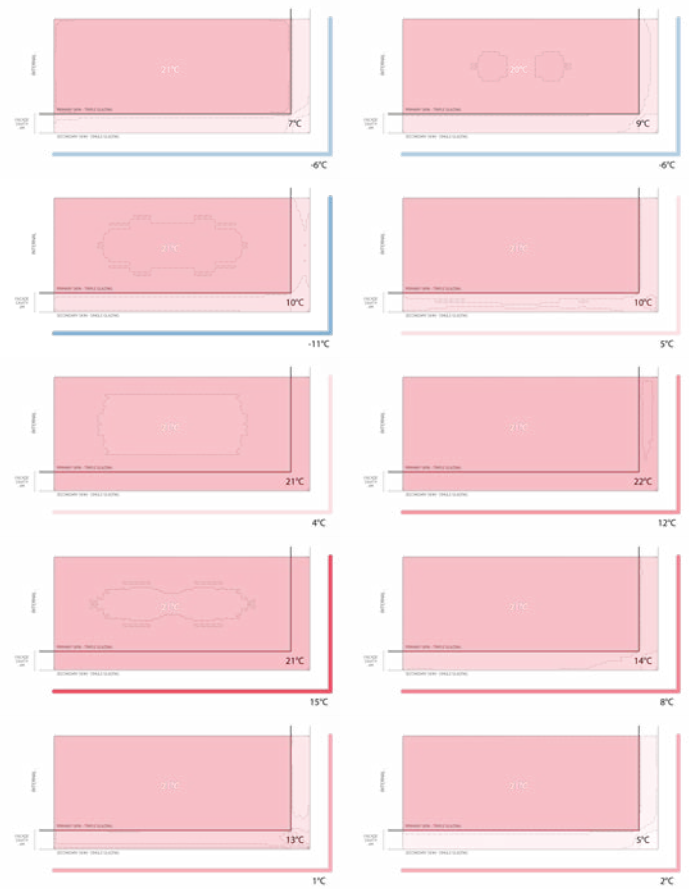
Climatic landscapes curated by the digesters



Layers of envelope which shelter the plants within the cavity



Analysis of double skin envelope conditions



Architectural design, climatic design, concept development, hybridity

Aimee Louise Desert

05 ALGAE IN THE ARCTIC

1:1 Prototype design | Alaska, United States | Design, fabrication and testing of algae façade panels

The design of a 1:1 prototype facade panel exploring the potential of microalgae, within the Arctic, to improve facade thermal performance. Taking naturally occurring microalgae from local water sources and measuring the heat generated as part of photosynthesis. The algae can then be used as a fertiliser, providing a bioloop on the dwelling scale.

