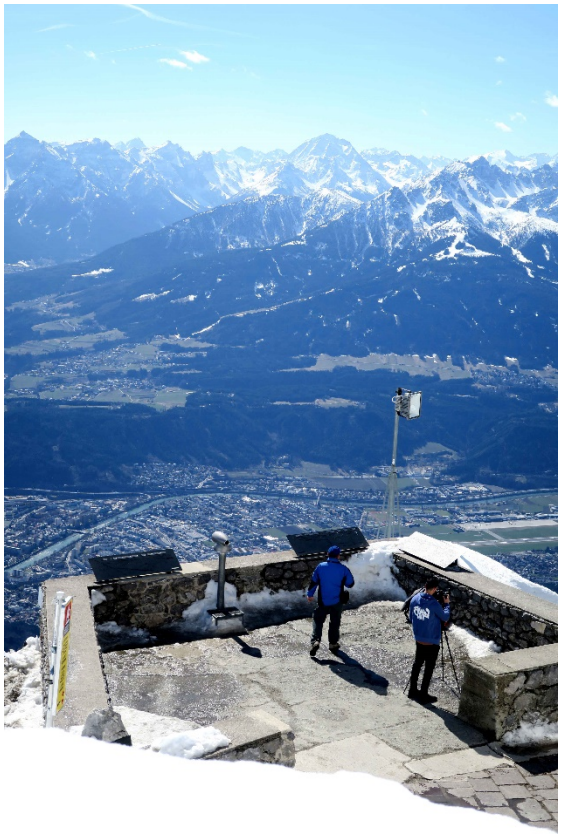

KAR: Alpine Climate Chamber

architectural installation

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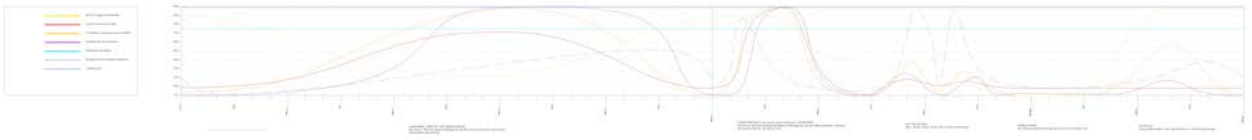
Universitätsstraße / Karl-Rahner-Platz,
in public urban space between Jesuitenkirche and Faculty of Theology

The site specific alpine climate installation KAR (engl.: steep alpine bowl) refers to Hafelekarspitze (2300m), an alpine peak on the mountain ridge of Nordkette, north of Innsbruck. The Hafelekarspitze marks the highest point in Innsbruck's municipal area. It is accessible easily within less than half an hour from the city centre, by taking the Nordkette cable car almost right to the peak. The architecturally famous top station of Hafelekar (2269 above sea level, built in 1928 by Arch. Franz Baumann) features a small terrace with breathtaking views into the main alpine ridge, and the city below. The installation KAR refers to this small panoramic terrace, and transfers it into University of Innsbruck´s International Mountain Conference.
As Innsbruck´s topographic high point, right at the edge between city fabric and alpine wilderness, the Hafelekar forms a site of greatest possible contrast between cultural and natural realm. At the same time, it provides an important point of orientation and identification for the city.

Due to its situation on the Nordkette ridge, i.e. above a 1700m high, steep south-facing slope right above the city, above the Inn valley as west-east wind corridor, and directly facing the Brenner valley as one of the most powerful foehn channels of the alps, the Kar features an **extremely dynamic microclimate**.

The climate installation KAR for the Austrian Architecture Days 2019 and for the International Mountain Conference 2019 gives its visitors the opportunity to **experience** this dynamic space in the city centre.
During the Conference days, the KAR is open from 10 a.m. to 8 p.m. for conference members as well as the public – stay inside it for a few minutes and gather your own experiences, sensations and connotations.

Dynamic Choreography and Sensations



constant change: designed choreography (graphic full format see last page below)

The dynamic conditions of the KAR comprise solar radiation, heat absorption through cold masses (glaciers /solid ice walls), air movement, air moisture / mist, light intensity and light temperature, and acoustic dampening. These parameters are **constantly changing**, providing the visitors with an intensified experience of time, memory, i.e. **being alive**.
In a kind of Ganzfeld space, any visible spatial contour is dissolved in order to create a „whiteout“. The KAR intensifies certain sensations by extinguishing others. The visual whiteout makes visitors concentrate on the thermal perception of their skin, on their balance and orientation, on acoustics. In an endless loop of constant change, the choreography features a succession of situations which most alpinists will know: being high up in remote alpine terrain despite bad sight - surrounded by mist, but very close to the upper margin of the cloud layer. In a slow and gentle process, the sun becomes vaguely visible and you perceive strong solar heat radiation. Light temperature becomes warmer. But the clouds rise again, and that remote source of light and heat slowly vanishes, leaving an afterimage on your retina. Then the sequence accelerates and you seem to be very near to an opening in the cloud cover. You get touched by air movements, embraced by lots of light, the sun disk appears and almost breaks through. Exposed parts of your skin sense the heat radiation. Again, clouds become thicker, the light diminuishes and its colour temperature gradually drops, as does the infrared radiation perceived by your skin – the surrounding surfaces of ice absorb the heat of your body. Then an almost, but not entirely static phase follows: thick and grey cloud cover, bad sight, no contours and orientation, light decreases in intensity and temperature, colours of the human skin and clothes seem to loose brightness and saturation. Fortunately, after a while the cloud margins seem to start moving again: lots of diffused daylight come through, still no sun – although you still cannot orientate as a mountaineer in this bright and calm whiteout, being embraced by light again you feel a significantly rising spirit.
This choreography of constant change creates an intense temporal, spatial and bodily experience.

Technology and Natural Phenomena
The implementation of state-of-the-art technology in design processes (e.g. computer simulations) as well as in operating buildings, and an emphasis on natural phenomena are not contradictory. We see this pairing as a chance to create highly performative and delightful architecture that is durable and simple to operate.

Transience
The KAR is utterly ephemeral. It will not last as it is until the end of the IMC. The small glaciers inside the KAR will melt down and vanish during the days of the IMC, as all the glaciers of the Alps will do within that century we live in.

Structure, Fabrication and Assembly
The KAR has been designed along the clear logic of an interior space that condenses human perception. Its modular, deployable lightweight construction and skin is designed to hold with minimal means a volume of moist air, drained with light and thermal radiation. Four „glacier“ ice blocks have been cast in a freezer room in numerous layers, to act as heat absorbers as well as

sensuous and aesthetic objects. With almost one ton of weight each, they have been transported on and are held up by highly torsion-resistant steel supports that prevent the ice bodies from cracking.
The fabrication of all parts and their assembly on site is a collaborative work of the authors together with a group of highly dedicated architecture students, who have gained significant knowledge and hands-on experience on materials, structural design, detailed construction and the actual buildup process.

ACTIVE HOUSE – research and teaching on climate responsive building design

The institute of experimental architecture.hochbau at University of Innsbruck has established a cooperation with the internationally recognised KlimaEngineers of Transsolar (Stuttgart, Munich, New York) since 2014, and developed ways of teaching architectural design and building construction in an integral process with focus on indoor and outdoor comfort and energy optimization.
This field of research is part of *„Meeting Nature Halfway“* - the institute´s focus on architecture as interface between technology and environment.
The architectural research project KAR examines and points out on some of the key issues that arose within ACTIVE HOUSE.

Comfort and Variance

In buildings as in many other areas (e.g. automobile design), we observe ever increasing demands and regulations on user comfort. Norms and standards cast this demand into narrow bands of acceptable parameters for architectural spaces: room ambient temperatures, light intensities, etc. These narrow bands have to be maintained with increasing technological and energetic effort. As they are applied to all buildings of one certain typology on a national or even supra-national level, they will rarely consider specific local climates, topographies, cultural conditions etc.

„Do we need specific ways of climate conscious building for alpine regions?“
Alpine regions often feature site specific climatic conditions on a much smaller scale than flat country. E.g., Innsbruck as well as many other places in Austria, Switzerland etc. provides more winter sun hours and thus higher solar potential for passive heating than regions north of the alps or in the eastern parts of Austria.

„Is there a carbon reduction potential in re-differentiating local or regional ways of building, instead of applying increasingly standardized building designs, industrial elements and supra-regional norms?“
The building sector causes at least one third of our carbon emissions. We will have to cut down on these emissions drastically. For a carbon neutral operation of buildings, we will have to harvest environmental energy more than we have done in the past. Many of these renewable energies underlie constant fluctuation – daily and seasonally.
These fluctuations are part of what we consider as valuable experiences, as long as we stay in natural spaces.

Buildings could harvest much more of carbon free renewable energy than they usually do, if we would allow them to. But we have to design them in a specific way though, considering local micro-climatic conditions. On a technologically much less developed level, we can study forms of local and vernacular „energy design“ in many alpine regions.

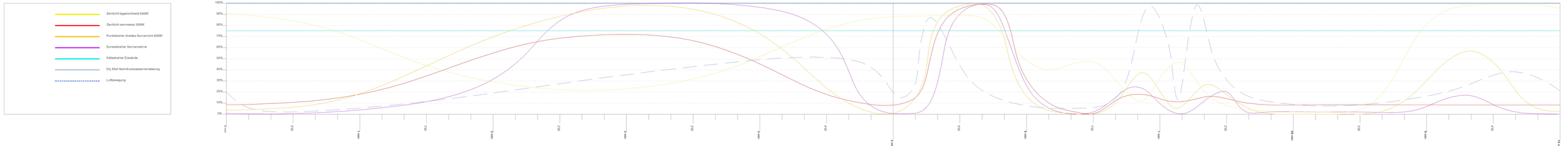
If we accept more variance in indoor conditions (whilst keeping a high technological performance for building skins), can we build in a different way with less negative impact on the environment? And will this lead to less, or to more quality?
In neurobiology, the systemic thinking of what keeps humans healthy and agile has changed fundamentally. The human perception continuously strives to recalibrate along the borders of its range – not close to mean value.
„Could we give up on some of our expectations on comfort, without actually loosing qualities – possibly even gaining some?“
We humans are bodily creatures. We have evolved and lived outside buildings from time immemorial. Our sensory organs, our metabolism, our memory and our perception of time are stimulated through change and contrast.
Highly static environments can therefore deprive us of valuable experiences and be counterproductive for our physical and mental health.
„If we imagine a space for living which is rather cool and fresh when we wake up and soon leave for work or school, and is warm and comfortable from the afternoon onwards by absorbing solar radiation without any active system involved – is this a constraint? Or does it enhance / intensify a notion of being „connected to one´s universe“?“
Research on the relation between indoor climatic conditions and occupants' perception of thermal comfort has shown, that occupants of buildings that allow them a certain extent of influence and control, are significantly more often satisfied with their thermal environment. And they tend to accept a wider range of indoor temperatures.
„Should we thus consider designing more interactive architectural elements that help harvesting environmental energy, and can be manipulated by occupants in a preferably direct way?
Should we try to build in ways that make these energetic connections and relations evident? Could this initiate an experience of resonance, self-efficacy, responsibility, maturity?“
In many building codes, alterable elements e.g. a low-emissivity curtain as one of several layers of an adaptable and energy harvesting building skin, are not properly considered in thermal and energy calculations of the envelope.
Alike for living elements – e.g. facade greening. These plants could offer seasonal, self regulating natural cooling in summer and are permeable for light and heat radiation in winter. They require involvement of occupants, which can again be seen as an opportunity to connect to one´s environment.

Climate change in alpine regions – a cause to question sealed building concepts
Do we have to rethink sustainable building concepts in an age of global warming?
Alpine regions are already exposed to longer summers with higher temperatures, and according to climate models this change will intensify. Sustainable cooling for these long hot periods will become as important as low carbon heating for winter. Mechanical cooling for all buildings is not a solution, unless we accept another rise in energy consumption and even higher temperatures in the outdoor spaces between these buildings. Low carbon air-conditioning systems loading heat into soil mass or groundwater can be a valid option, though not for every place and building typology.
Most alpine regions feature a helpful day-night temperature variation, which means that we should connect every space inside our buildings to thermal mass that discharges through night time flushing. This path to make buildings future-proof needs high amounts of air, preferably propelled by natural draft and uplift through large openings. This means that we have to design building skins and even internal divisions which are temporarily highly permeable. And we have to care for outside spaces which do not overheat, particularly in cities.

Is there a whole world of spatial concepts and architectural elements that waits to be designed for an age of global warming?
If we include outside spaces in our spatial and energetic concepts, and densely connect them to interiors ones when this is useful and comfortable, an integrating architecture could lead to new spatial qualities whilst featuring lower carbon footprints.

Alternative strategies for utilizing environmental energy in building often comprise spatial layers, buffer zones, zones of non-standard thermal condition. *Are these spaces of constrained use, or do they actually add to a richer spatial / architectural experience if we integrate them into a spatial program?*

Climate responsive building design should not only focus on energy exchange with the environment, but also vibrancy and sensuality.
This approach will lead to buildings and cities combining the two goals:
High Comfort - Low Impact on the Environment.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LANGSAMES, "SANFTES" WETTERGESCHEHEN
Kar nahe am Rand der steren Wolkengrenze, die Sonne kommt fast durch, dann wird die Wolkendecke wieder dichter
KURZES EREIGNIS / Kar nahe an einem Wolkenbruch / AUFREISSEN
es reißt kurz fast auf (vorangehende stärkere Luftbewegung), intensive Wärmestrahlung, intensives Sonnenlicht, sehr hell, viel warmes Licht
KALTER LUFTZUG
Böen, Wolken werden dichter, abnehmende Lichtintensität
DUNKLE PHASE
sehr dichte graue Wolkendecke, ganz wenig und nur kaltes Licht
WHITE OUT
ruhige Wetterlsituation, maximales Zenitlicht, nur sanfte Veränderungen