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# Gradientizer

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2012

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Project by fabric | ch in collaboration with Amid.Cero9

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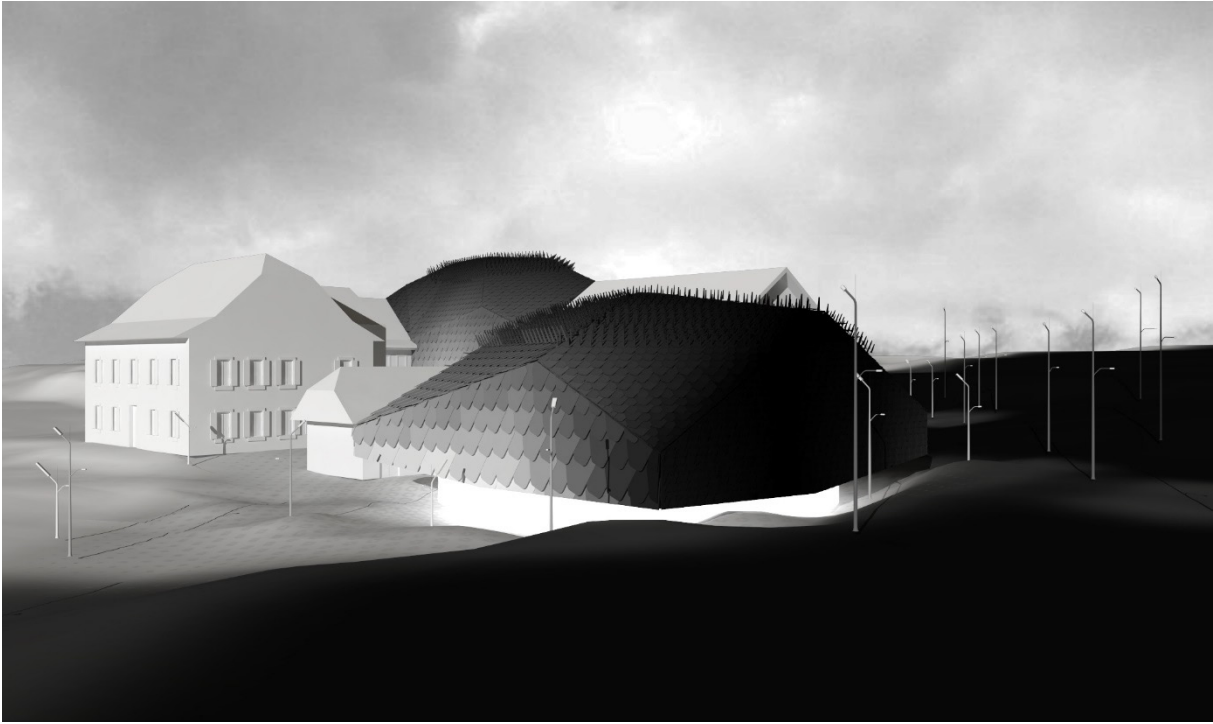
Architecture Competition: New Planetarium and Natural Sciences Center (CH)

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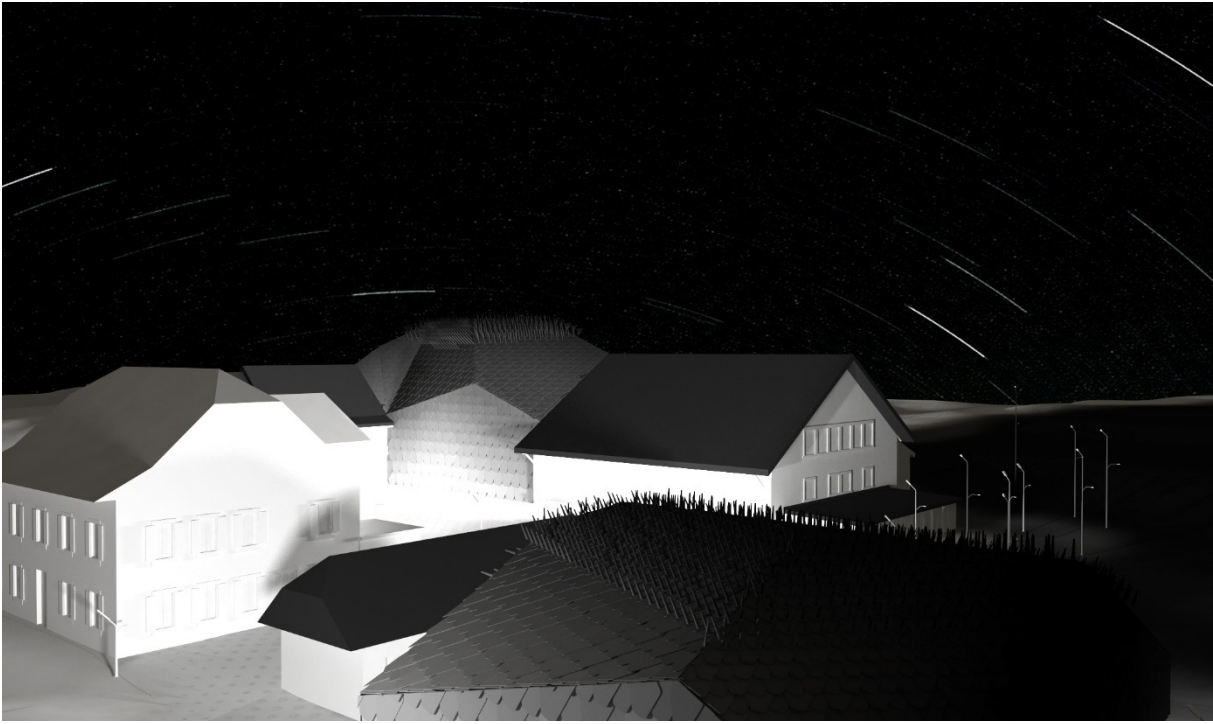
Location: Lausanne (CH)

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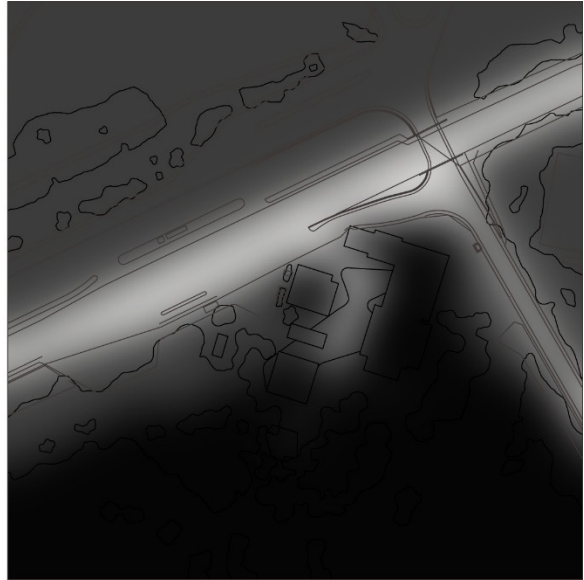
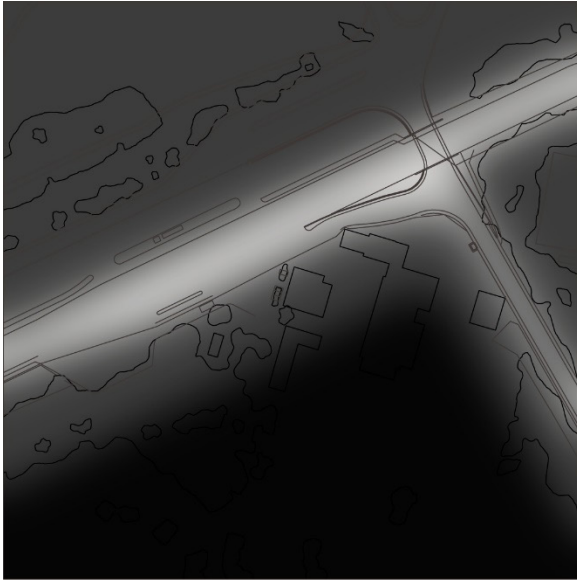
- Architecture organized around monitored gradients of light and albedo of surfaces
- Conditional distribution of functions on site and within buildings, according to their level of exposure to light
- Plan, section, elevation, and roof principles that filter lighting
- Monitored environment with feedback loops, interfaces, programs, open data storage
- "Nomadic" and variable use throughout time and seasons



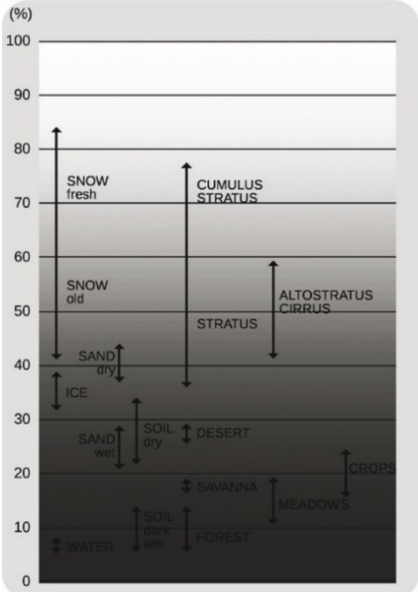
[Img. 1]



[Img. 2]



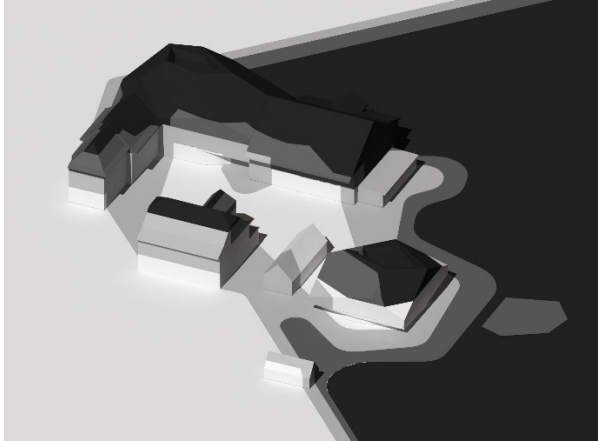
[Img. 3, 4]



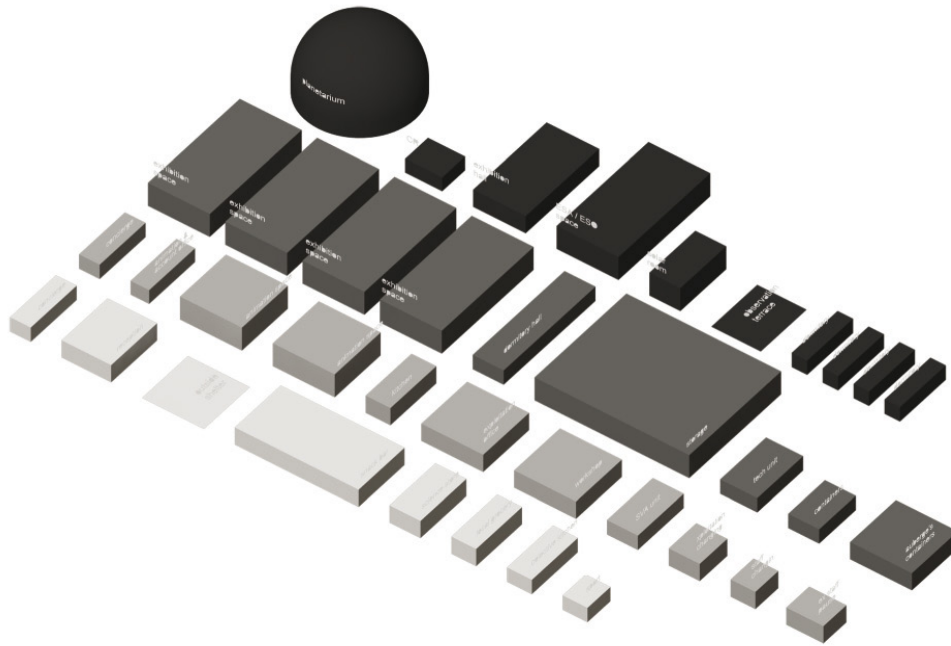
# GRADIENTIZER

Concours pour la construction d'un planétarium et d'un centre des sciences et de la nature

[Img. 5]



[Img. 6, 7]



[Img. 8]

Exposition à la lumière:  
 « totalement »  
 « la plupart du temps »  
 « en partie »  
 « pas du tout »

1.01 Accueil  
 1.02 Boutique des sciences  
 1.03 Epicerie du terroir  
 1.04 Espace cafétéria  
 1.05 Espace pique-nique  
 1.06 Cuisine  
 1.07 Sanitaire

2.01 Espaces d'exposition  
 2.01 **Espaces d'exposition**  
 2.02 Espaces d'animation  
 2.03 Exposition ESA/ESO  
 2.04 Planétarium  
 2.05 Régie technique  
 2.06 Hall d'expositions  
 2.07 Terrasse d'observation  
 2.08 Sanitaire  
 2.09 Vestiaire du personnel  
 2.10 Salle d'observation solaire

3.01 Bureaux exploitation  
 3.02 Local SVA  
 3.02 Vestiaires du personnel d'exploitation  
 3.03 Pause du personnel d'exploitation  
 3.04 Atelier  
 3.05 Dépôt

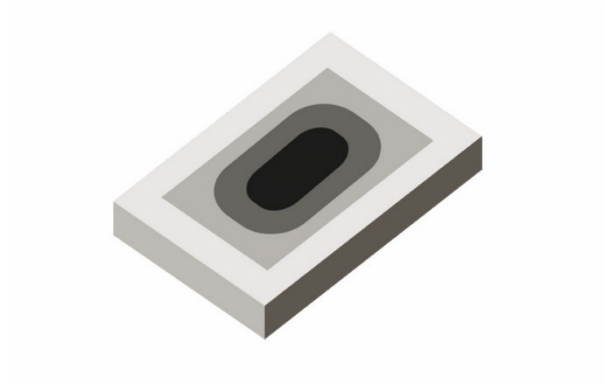
4.01 Dortoirs pour tourisme vert  
 4.02 Cuisine commune pour tourisme vert  
 4.03 Local matériel de sport  
 4.04 Locaux sanitaires, douches + wc

5.01 Appartement de fonction

6.01 Local containers  
 6.02 Locaux techniques

7.01 Couvert extérieur  
 7.02 Aire de parking pour autocars  
 7.03 Aire de parking pour voitures  
 7.04 Aire de parking pour deux-roues

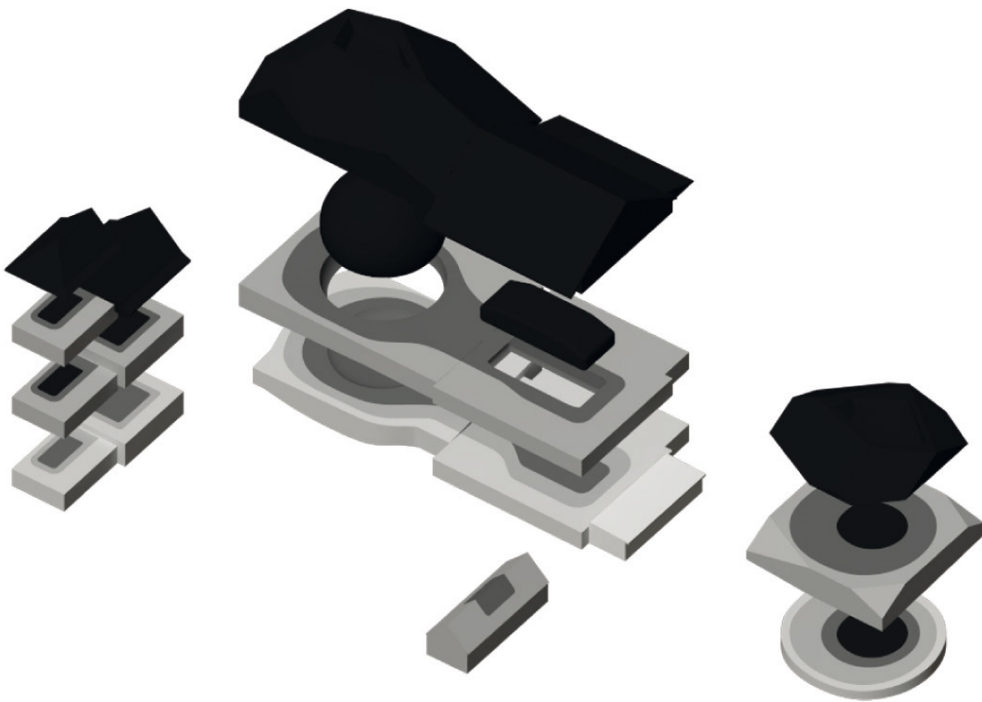
[Img. 9]



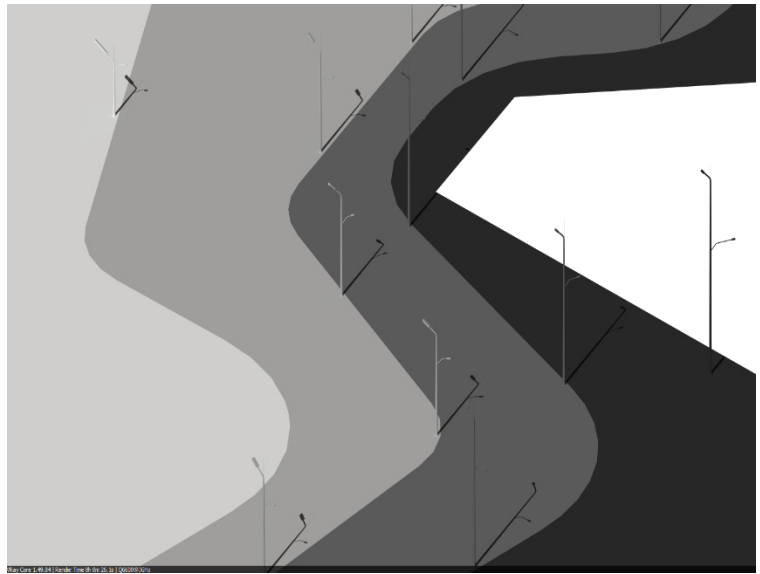
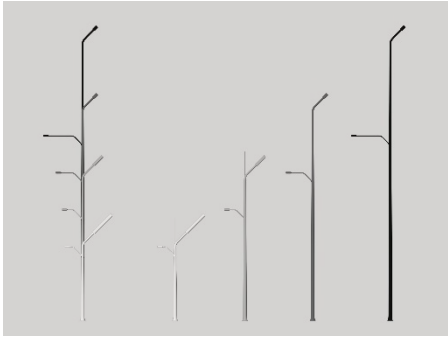
[Img. 10]



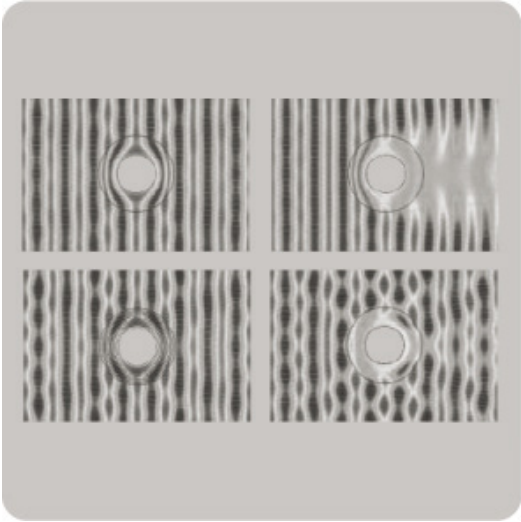
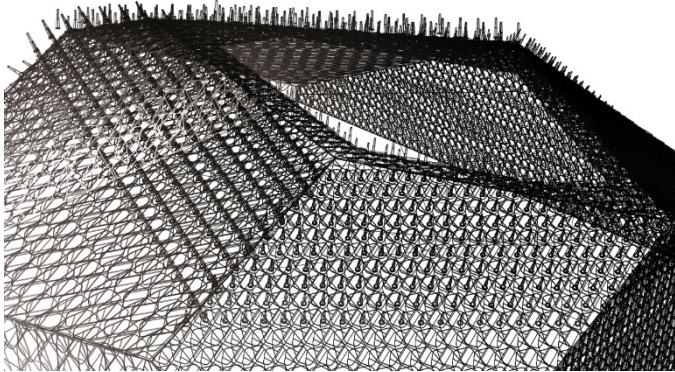
[Img. 11]



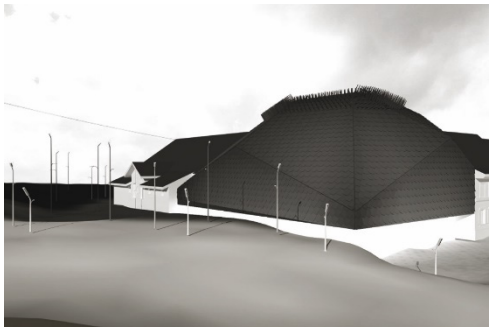
[Img. 12]



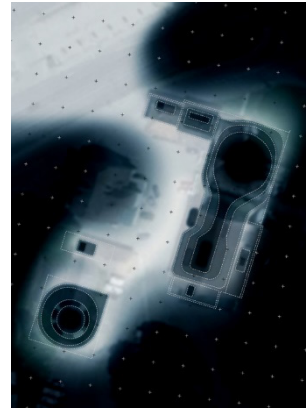
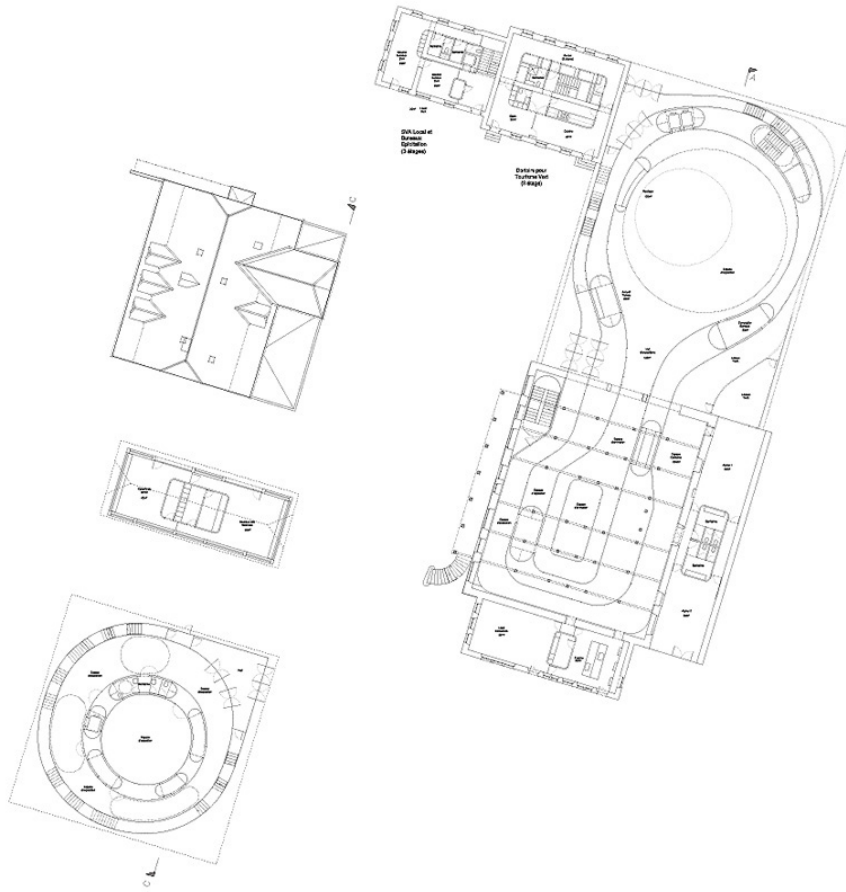
[Img. 143 14]



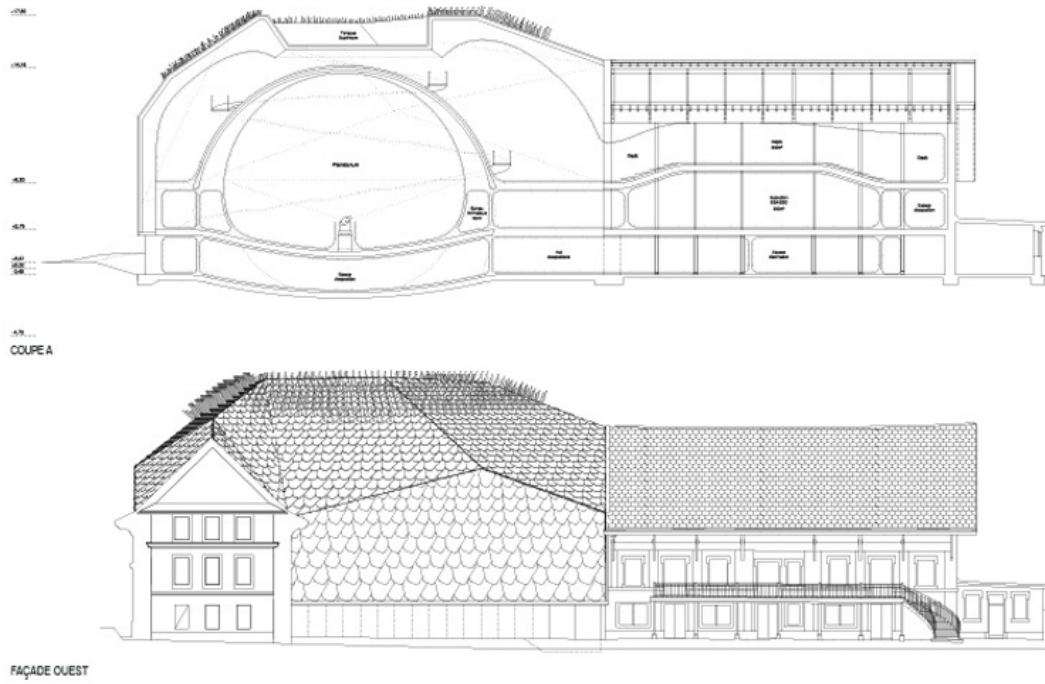
[Img. 15, 16]



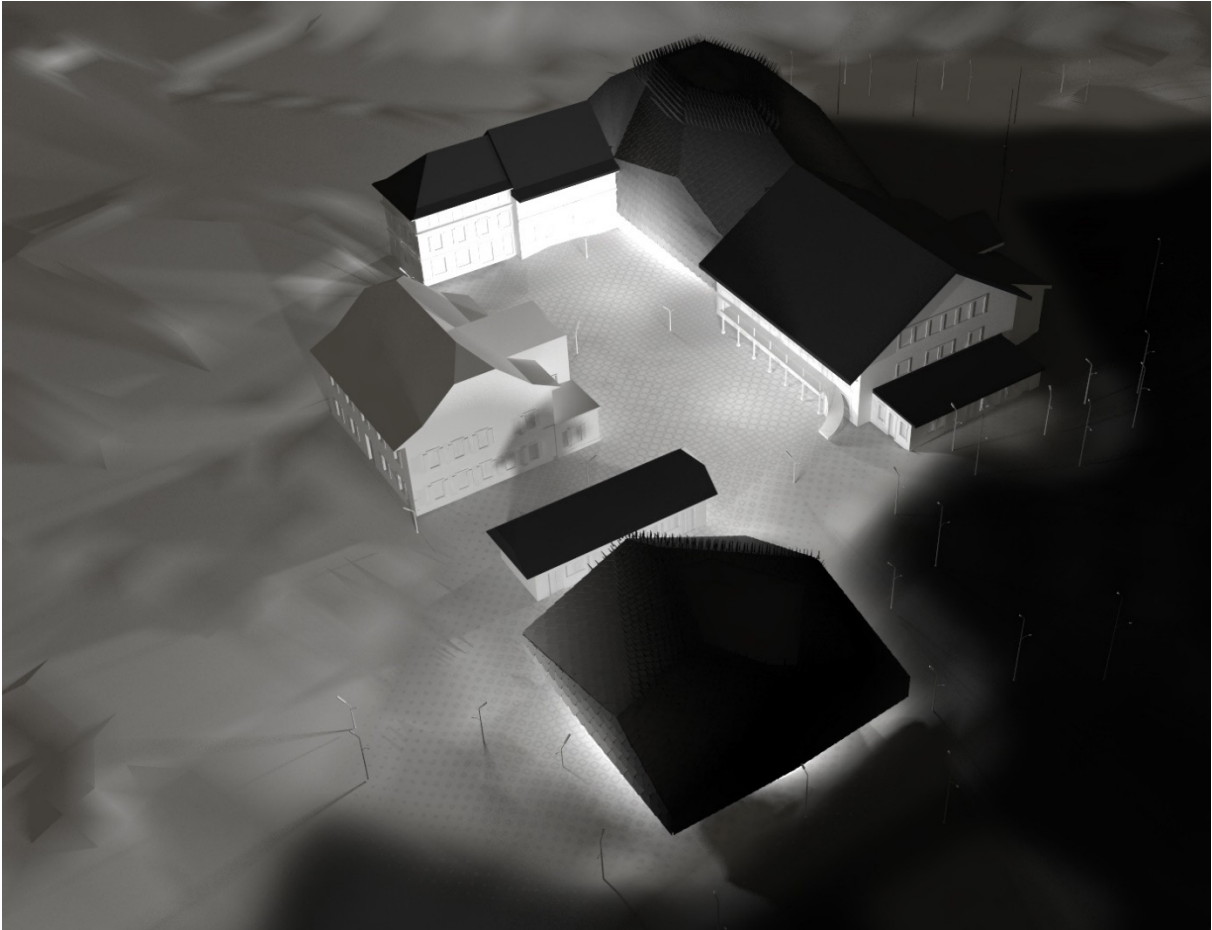
[Img. 17, 18]



[Img. 19, 20]



[Img. 21]



[Img. 22]



[Img. 23]

Image captions:

- [Img. 1] Two new buildings with large (and dark) farm-like roofs in an almost rural settlement define the New Planetarium and Natural Sciences Center. A planetarium, a museum, a solar room, observation platform and deck, scientific offices, and hotel, a café and an eco-shop constitute the main elements of the program.
- [Img. 3-4] Expression of the light gradient onsite at night (the road axes are artificially lit; the rest of the site is dark --woods and grassland-- with the adjunction of a courtyard in the new project [Img. 4])
- [Img. 5] Graphic of relations between surfaces' treatments/materials and their albedo.
- [Img. 6-7] Expression of the light gradient on site and on the buildings (average value between the exposure to natural or artificial luminosity and the albedo of the surfaces). White zone (fully exposed to light) along the roads' axes, in the courtyard and around the ground levels that evolve toward the black zone (not exposed to light) on the east of the site and in the upper levels (roofs), through light grey (mostly exposed) and dark grey (partly exposed). The gradient on site serves us both to locate functions and to choose materials or landscape treatments (according to their reflectance - albedo).
- [Img. 8-9] The program (surfaces, volumes, and functions) of the New Planetarium and Natural Science Center dispatched according to its potential exposure to light, with the same four levels (fully, mostly, partly, not at all), as expressed onsite.
- [Img. 10-11] Schematic rules in plan and section to increase and deform existing lighting conditions (both natural and artificial): "onion" rings that filter light from the outside towards the inside in plan, suppression of basements that are moved under bigger roofs to create progressively darkness from bottom to top levels.
- [Img. 12] The resulting axonometric view of the project and principles of spatial organization/uses according to the chosen set of rules.
- [Img. 13-14] The position, orientation, and design of the probes, made with four different heights and coated in white, light grey, dark grey and black, reveal a first vision of the site's light gradient and surface albedo to the naked eye. They also serve to locate different activities (observations in potential dark areas, public programs in the white ones).
- [Img. 15] The upper levels of the new roofs (around the observation decks) are treated as "darker than black" meta-materials (see below), instead they are scaled up about 10 billion times: a spiked surface within which incident lighting is being reflected many times and loses its strength before eventually getting out. It can be akin to what is happening in an anechoic chamber, but, in this case, light is used instead of sound.
- [Img. 16] "Darker than black" metamaterials are nanoscale materials (which can also be used as coating) that trap the reflection of light through very mat-dark, spiked surfaces. Therefore, the incident light is reflected many times (on a tiny scale) before eventually escaping again. Very little light is reflected.
- [Img. 17] Gradientizer master plan, with tiling on the floor level (courtyard) that "connects" the two main buildings. Observation decks on the roofs of both new buildings are oriented toward the south-east of the site. The overall distribution of functions follows the main gradient of light and albedo on the site.
- [Img. 18] East view of the planetarium with probes as landscape treatment (installed along the lines of gradients). No openings in the new buildings and blind openings in the old ones.
- [Img. 19-20] Planetarium, solar room, museum, hotel, and eco-shop: ground-floor plan and planetarium section, in which the principles of organization in plan and section are applied.
- [Img. 22] A dark roof, viewed from the dark zone, in front of a white zone at night.

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# Txt

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## Gradientizer

*Gradientizer is an architectural proposal for the New Planetarium and Natural Science Center buildings and program in Lausanne, Switzerland. It consists of the transformation of an old, almost rural, and isolated settlement and the adjunction of two new buildings.*

*The proposal was completed early this year and was developed in close collaboration with the Madrid-based architects AMID.cero9 (Cristina Diaz Moreno and Efrén García Grinda, both also teachers at the Architectural Association in London).*

*We didn't win the "trophy" unfortunately, but as we believe nonetheless that the project is of interest, we take the opportunity to document and present it shortly on | rblg.*

### **Gradientizer (excerpts from the competition text)**

An architecture which articulates light; which pervades into the existing luminous gradients and albedos of the site, which transforms them onsite, in plan and in section; and which creates "dark poles," the real "attractors" of the program: Planetarium, Solar room, Sky observation deck. A forgotten atmosphere, "almost unknown," but monitored nevertheless, built around the exposure of the program to light, in which visitors and scientists freely wander, layer by layer.

### **Monitored architecture of light gradients and albedos**

The observation of the sky, at daytime and nighttime, is always marked by an intimate relationship between the weather and light conditions. To make accessible the cosmos from Earth with the naked eye as through a powerful telescope, special conditions are needed: minimum cloud cover, low atmospheric density, a maximum distance from the sources of artificial light at night.

Would we realize today a world map of the suitable observation locations, in continuous time, it would likely reveal a landscape in a vanishing phase, a kind of forgotten preindustrial relic. A sensual landscape which evolves along days and seasons: clear sky, starry dark night, low pollution, near low-reflectance (albedo) lands.

It is this landscape, which has become almost unknown nowadays, that makes possible the observation of another landscape, fascinating and borderless: the cosmos. It is also around precisely this landscape that our project is built: a "gradient" architecture that seeks to analyze and transform the light patterns of the place, to inhabit

them, which looks to generate and shape this "unknown landscape" and to comment it.

(...)

However, the site of the New Planetarium has a light gradient of its own, with varying intensities: artificial illumination of roads at night, large farm-like roofs that generate darkness during the day.

The project seeks to leverage this existing state, to develop it, whether it be in the positioning and association of functions in an almost generative way (rule-based) or in the amplification of the roofs of the buildings: to "gradientize" the overall site through its architecture.

(...)

### **To "gradientize" the site**

Articulated around four main categories of exposure to light ("fully," "mostly," "partly" and "not at all" exposed), the program is distributed around the matching gradients of light on the site to achieve the initial distribution of functions. In section, this gradient is reinforced to create permanent "black areas" and to further distribute the program vertically.

Three main rules allow us to organize the whole program of the New Planetarium in this way and to outline its architecture. At night and in mass plan, the luminosity and reflectance gradient of the site evolves from lit perimeters, near traffic areas and roads, to dark areas towards forests and grassland (on the east part of the site, guaranteed to be kept in the future due to the reallocation of the whole area into a protected green park). The repartition of activities and functions on the site results mainly from this first rule (the program analysis based on its exposure to light). Thus, no artificial light is directed towards the east and south sides of the site at night. In plan, again, but inside the buildings this time and mainly during daytime, a concentric organization of volumes allow the filtering and lowering of the light from the outside towards the inside. In section, finally, during daytime especially, large, and deep roofs bearing agricultural characteristics also ensure the creation of shadows and darkness. No artificial lighting is installed in the dark grey or black areas.

This approach makes it possible to define principles of spatial organization by day and night. This is the intention of the project: an architecture which fits into a monitored gradient of light proper for the site; which exploits but transforms its vocabulary of forms and materials; which deforms, amplifies, and strengthens them, both in plan and section. These principles engender our architecture of spatial shifts, its main code. The result is the GRADIENTIZER.

(...)

### **Probes, sensors, monitoring, feedback loops and algorithms**

A set of light and atmospheric probes equip the site and the interiors of the buildings. They are positioned to reveal at first sight the average gradient on the site and to locate specific areas for the public (white, light grey, dark grey and black masts at different heights equipped with sensors that are positioned along the main lines of

each gradient). Some also serve as furniture or lighting (white areas). These sensors analyze continuously the state of illumination of the Gradientizer and reveal it through freely accessible interfaces (both onsite information displays, distributed over the Internet or through mobile apps) and feedback.

This constant analysis transcribes in "real time," over the course of time and seasons, the changing states of a large architectural device based on simple rules (the exposition of the program to --monitored-- light). Custom and architectural algorithms indicate appropriate times to achieve a particular observation, shift functions or activities in a conducive area.

(...)

### **Architecture as shifting landscape**

The whole Planetarium and Natural Science Center can be seen and experienced as light-based architecture - a landscape in constant evolution. It offers oscillations and unpredictable spatial and uses variations. It suggests some sort of nomadic and evolving use over time to adapt to the varying conditions.

A landscape that should be understood here in the sense of an environment with blurred limits, within which one can evolve with a certain freedom according to one's desires or needs. A landscape that "feels" its own variations and makes them visible, livable.

fabric | ch, February 2012

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# Contact

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fabric | ch (97-26)

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