A PRECEDENT IN SUSTAINABLE ARCHITECTURE: BIOCLIMATIC DEVICES IN ALVAR AALTO'S SUMMER HOUSE

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INTRODUCTION

The problems discussed in forums such as that within the European Charter for Solar Energy in Architecture and Urban Planning are still up-to-date.[1] The role architecture plays in energy consumption calls for a conceptual reorientation that ensures a responsible design approach to the environment and the use of renewable resources based on local conditions.

In this sense, the Finnish architect Alvar Aalto (1898–1976) figures as a pioneering precedent of a sustainable architecture. The Nordic climate and the deeply nature-concerned culture within which he lived are factors that derived a conscious design method characterised by the exploration of environmental concepts. The contextual approach was developed since his early career and reached a peak in his own summer house erected in Finland in the year 1953. As Aalto himself comments, this building had the advantage of being the 'experimental game' of the architect, where he could freely work without worrying about the constraints of usual project requirements.[2]

The biography of Aalto shows that he used to help his father, who was a surveyor, by drawing plans from the Finnish territory.[3] Aalto himself grew up in Jyväskylä, a town located on the same lake studied here, and worked there in the first years of his professional career. He was familiar with the landscape and knew well in advance the general features of the house's surroundings.

The Summer House is a well-known building that has drawn attention in the academic context. Aalto published a seminal, brief text when the construction of the main block was finished, where experiments concerning topographical adaptation, material durability, and solar heating passive systems are mentioned.[4] After appearing in the complete work of the architect,[5] the Summer House was briefly mentioned in critical literature,[6] and in recent years has been the subject of numerous studies.[7] This panorama has contributed important information about the site and the house, which were, nevertheless, considered mainly by aesthetical and typological means. The bioclimatic themes seem to have not been systematically explored yet.

The present essay seeks to identify and explain some design strategies that can illustrate the bioclimatic structure of the building.[8] The textual argumentation is supported by photographs, diagrams, and a physical model. An introduction to the

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house is given by describing its geographical and programmatic situation. The study is then developed through the following topics: site and program; placement; spatial organization; and exterior-interior relations. As a conclusion, the house is evaluated as a precedent of an environmentally-concerned architecture.

KEYWORDS
sustainable architecture, bioclimatic architecture, Alvar Aalto, Summer House

SITE AND PROGRAM

The Summer House is located on the island of Muuratasalo in the lake Päijänne, which forms part of the fragmented, aquatic complex of the south-central region of Finland. The northern climate, taking as reference the nearby town of Jyväskykä, has great seasonal differences with dark winters and sunny summers. The temperature varies, in the average, from around –5°C to 15°C during the year. It rains a lot and there are irregular although moderate winds.[9]

The site is characterized by a peninsula covered by pine trees (Fig. 1 and 2).

The irregular topography is stressed by an outcrop that crosses the terrain, projects itself into the lake creating a natural harbour. One can consider that, in general, the geographical and spatial nature of the site is very stimulating.

The main block of the building is trapezoidal in volume and quadrangular in plan. It is configured as an open court and two articulated wings: the living room by the one side and the bedrooms by the other side (Fig. 3).

At the back, up to the site, a juxtaposed vestibular corridor connects a guest apartment. A free-volume storage cottage, angular positioned in relation to the overall orthogonal order, completes the 'head and tail' like complex.

FIGURE 1. Physical model showing the situation of the house.

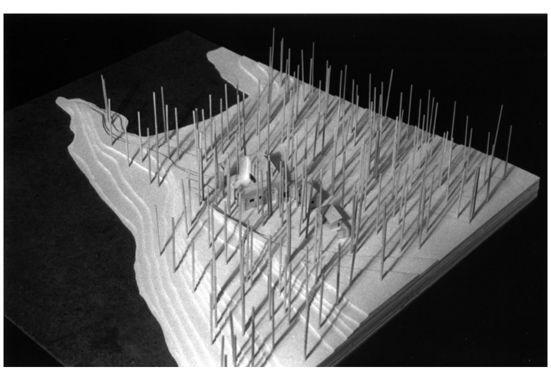
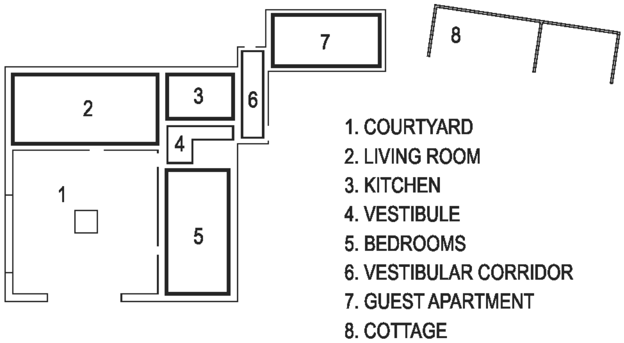
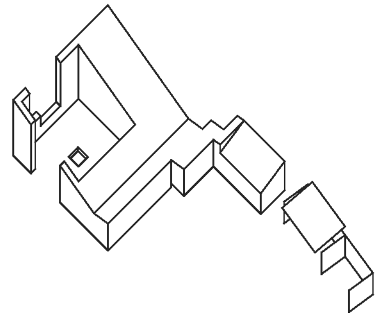


FIGURE 2. View of the site showing the outcrop projected into the lake. (Photo: Carlos Mijares Bracho)

FIGURE 3. Diagram showing zoning scheme and general volume scheme.





PLACEMENT

The outcrop plays an important role in the situation of the house (Fig. 4 and 5).

The main block gently transposes the topographical accident by anchoring the open courtyard to a rocky natural platform, from where the aquatic landscape and the sun are accessed. This anchoring strategy also provides an indirect geothermal passive system: the rock, exposed to the south, absorbs the sun's heat and imparts it to the house by night. The east-west longitudinal distribution of the house and the concave inflection of the composition also react to the southern sun. Aalto's awareness of the precise solar angles and routes is expressed in his writings, where he usually explains design strategies concerning climate and natural light.[10]

The position up to the site is explained not only by the outcrop, but also by means of protection against possible floods. Instead of placing the house nearby the lake, where there is a more regular topography, it is preferred to keep a more respectful distance from the water. This strategy makes great sense today, when the tendency of upper temperatures is changing the climate and making the water levels higher.

FIGURE 4. Diagram showing the topography and the solar route.

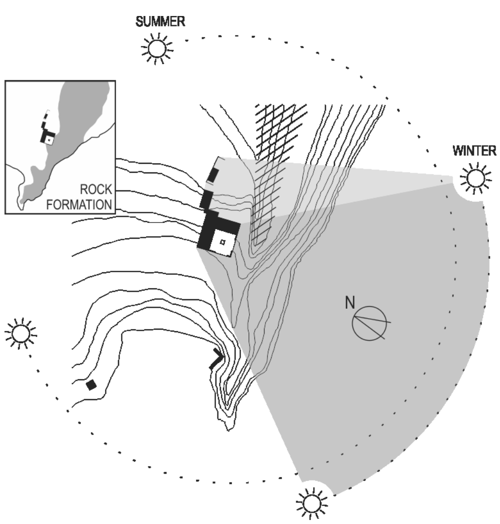


FIGURE 5. View of the house through the courtyard. (Photo: Carlos Mijares Bracho)

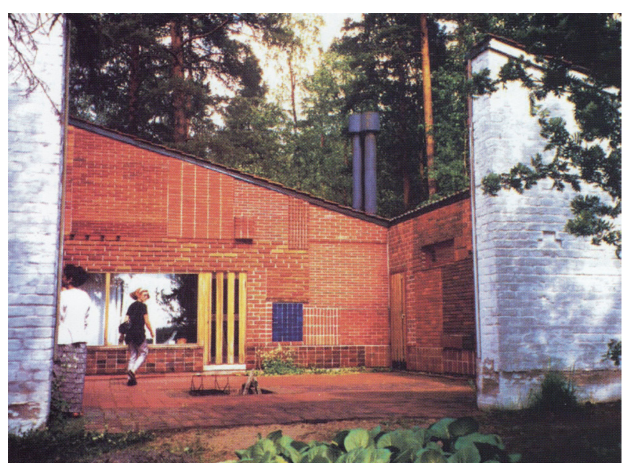
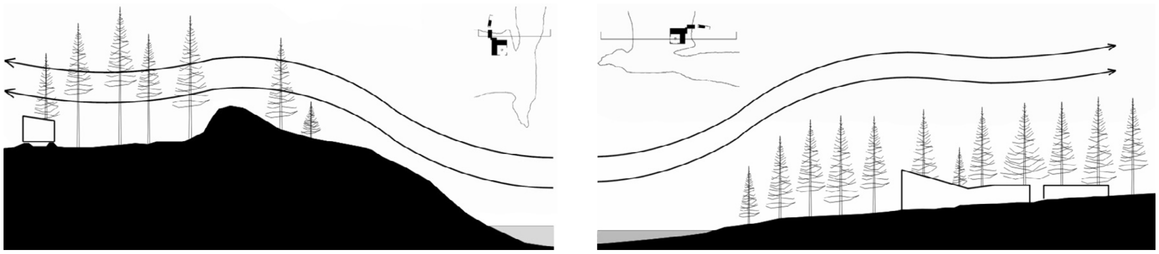


FIGURE 6. Diagrams showing wind protection.



The house's placement takes wind into account. The topography and vegetation provide protection from air flows (Fig. 6).

The house is immersed in the pine forest and hidden behind the outcrop. Besides, the volume of the composition is aerodynamic: it grows up and follows the topography from inland, while allowing the frontal winds coming from the lake to pass through the courtyard openings.

SPATIAL ORGANIZATION

Meanwhile, at the back side of the house, the linear aggregated units delimit, together with the outcrop and the main block, a portion of the forest (Fig. 7 and 8).

This confined natural space, besides representing a symbolical domestication of nature, provides climatic protection for the house's upper access. The main inland approaching route is then welcomed by an embraced vestibular space hidden from the wind. There is a gradual thermal and spatial transition from the forest to the house.[11] The movement to the entrance is also favored by the descending topography, the volume of the living wing, as well as by the natural light coming from the lakeside.

The protection attained by the confinement of the vegetation area is echoed on the interior of the building. The adjacent rooms—bedrooms wing and guest apartment—suffer a lower impact of the external cold air. Small windows with double glazing, as well as the thick periphery wall and the wooden sandwich panels, act as temperature controlling systems. The

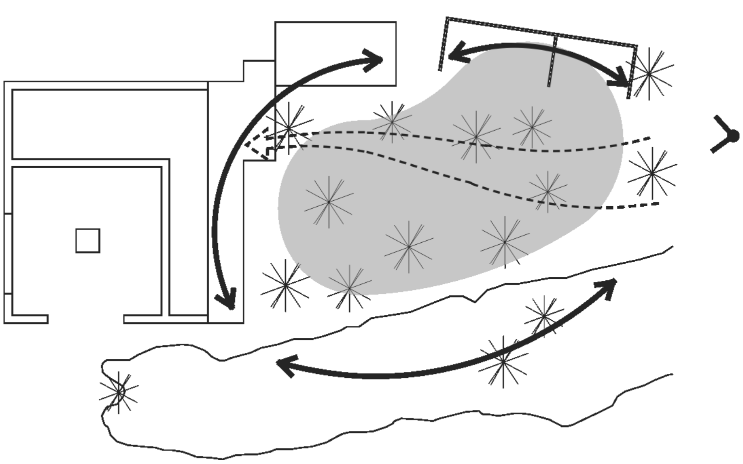


FIGURE 7. Diagram showing the "embracing" of a portion of the forest.

FIGURE 8. View to the house from the up side of the site. (Photo: Carlos Mijares Bracho)

low-motion and more private activities taken into the rooms are related to the insulated external area, by contrast to the open and sunny courtyard adjacent to the living room at the opposite side of the house.

Besides the sun and the wind, the placement and the spatial organization of the Summer House are also closely related to the topography. The building adapts to the sloping site by breaking the floor into different levels (Fig. 9).

The main block fits on the ground by leveling the courtyard with the rock formation and by locating a storage floor under the living room. Those strategies result in a soft and proportional manipulation of the earth. They also provide an easy access from the boat storage to the harbour, as well as a climatic and visual connection to the landscape through the open court. Here the pavement is made of raw bricks, which were recycled from the disposal of the construction of the nearby Säynätasalo Town Hall.[12] They are put directly on the natural ground, so as to allow the water to infiltrate into the soil and the plants to grow between.

The aggregated wooden units at the back of the house—the vestibular corridor, the guest apartment, and the cottage—have a stratified floor scheme that takes into account existing rocks for structural support. This natural foundation system insulates the buildings from the

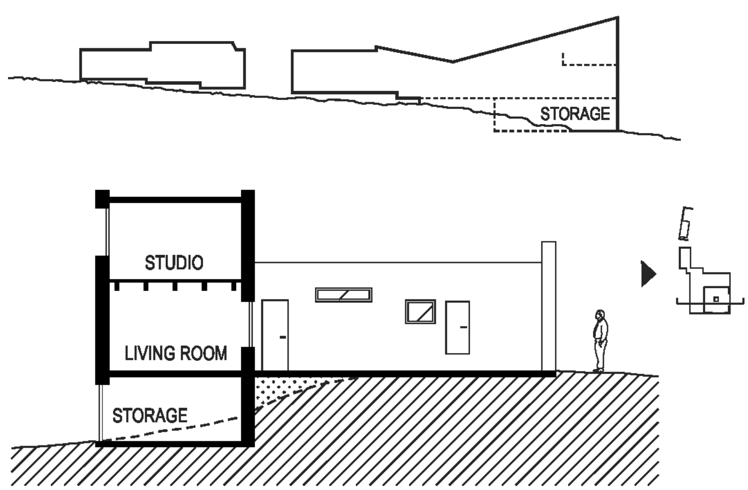
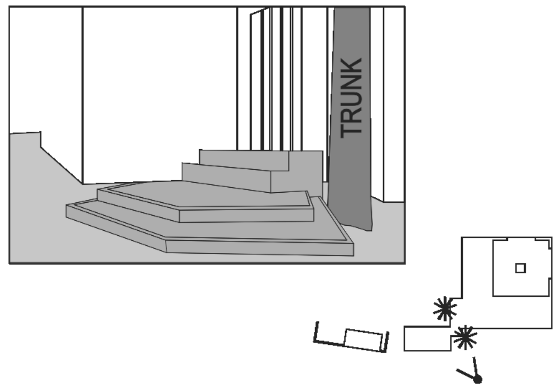


FIGURE 9. Diagram showing adaptation to the topography.

humidity of the earth. It is extremely economic in terms of energy and resource consumption, besides demonstrating the refined *in situ* work done during the project.

FIGURE 10. Diagram showing pine trees nearby the house.



A great deal of attention is drawn to the vegetation of the island. The direct projection of the functional spaces of the house on the ground and the consideration of the tree-free areas are means of preserving the forest. Although in both secondary entrances—to the forested back "court" and to the north face—pine trees that almost touch the building indicate their precise mapping (Fig. 10).

The trunks point out the door entrances. The diagram also shows how the natural soil is modelled and incorporated to the stairs and how the walls accommodate to the slope. One can suppose that the trees cut down for the enterprise were probably used in the constructive system of the house.

Let us now focus on the courtyard within the main block. The central-located fireplace warms the space and creates a cozy atmosphere by night.[13] The semi-open configuration implies, as in the forested back "court," a gradual transition from the outside to the interior of the house. The big openings allow the southern radiation to reach the thick walls, whose top side is protected from the rainwater by roof tiles and copper sheets. The lateral surfaces, composed by panels made of different kinds of brickwork and tiles, serve as an experiment to proof the resistance of materials against the weather.[14] The brick fabric itself has a good thermal inertia, requires little maintenance and becomes more beautiful with time. While the raw brick tends to absorb the heating inside the court, the white painted exterior emphasizes the building at the landscape.

Down the site in the harbour there are two other wooden structures, a pier and a sauna. The pier is discretely placed nearby the outcrop projected into the lake, so it is protected from the wind and the rain. The sauna is a log-constructed trapezoidal box supported, as in the wooden units of the house, by local rocks. It is by definition a hermetic thermal capsule where the extreme conditions of hot vapour inside and cold climate outside must be balanced. The sauna, with its vernacular construction system, expresses an important design reference for Aalto: the architectural Finnish heritage. It is not casual that the courtyard and the volume organization of the house are closely related to the traditional Finnish rural settlement.[15] Rooms providing a gradual exterior–interior transition and a communal space warmed by a fire are common devices that align the Summer House to the vernacular Nordic cottage.

EXTERIOR–INTERIOR RELATIONS

The integrated space of the living room wing houses the architect's studio in the mezzanine (Fig. 11).

The trapezoidal shape of the room allows air to circulate up and leave the building. The distribution of light by the high small windows by one side, and the big low window opened to the court and the sun by the other side, corresponds to the use of the space at the ground floor level: while the working space fosters concentration, the resting place provides sun

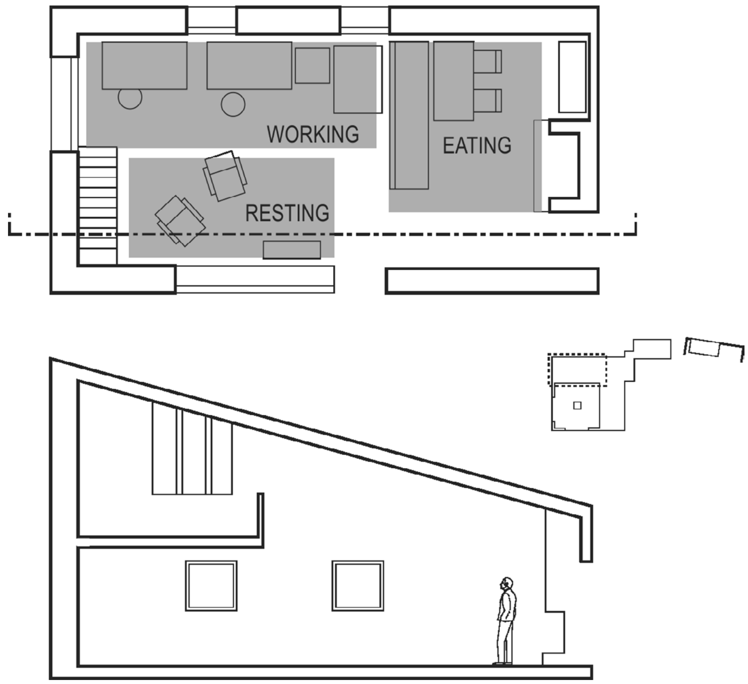


FIGURE 11. Diagram showing the spatial scheme at the living room wing.

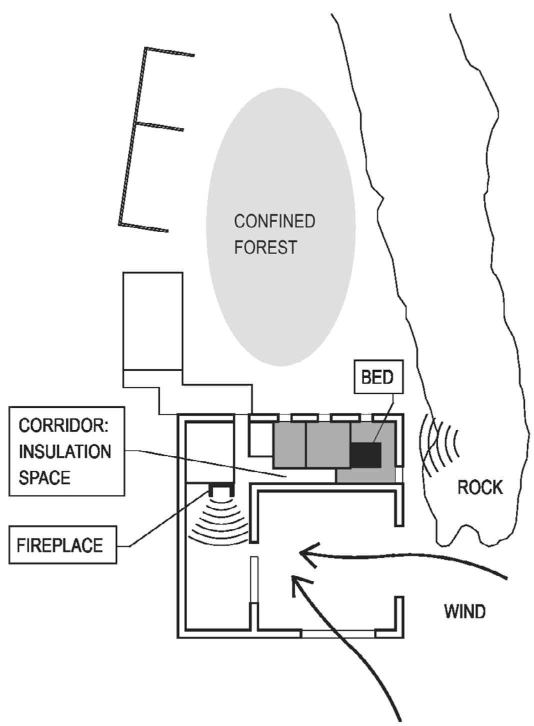
bathing and contemplation of the courtyard and the landscape. This luminance scheme contrasts with the compressed and dark space of the dining sector, where the lateral blind walls and the fireplace make the atmosphere warmer, climatically as well as aesthetically.

Another factor that contributes to the warmth of the living room is the material employed. Not only the furniture, but also the studio structure, the doors, the window frames and the floor are made of wood, while the remaining white lateral surfaces function by means of light reflectance. The Scandinavian climate and the availability of wood in the land are factors that explain the large use of the material. Aalto himself recognises the biological and human qualities of wood in interior architecture by stressing its low thermal conductivity and its plastic properties.[16]

The bedrooms wing is also concerned with bioclimatic matters (Fig. 12).

It is placed between the two confined open spaces. The bedrooms are juxtaposed to the protected section of the forest at the back side of the house, while a corridor also functions as an element of insulation from the courtyard, where the sun and wind enter. In a longitudinal direction, the bathroom, vestibule, and kitchen, that receive some heat from the living

FIGURE 12. Diagram showing climate protection at the bedrooms wing.

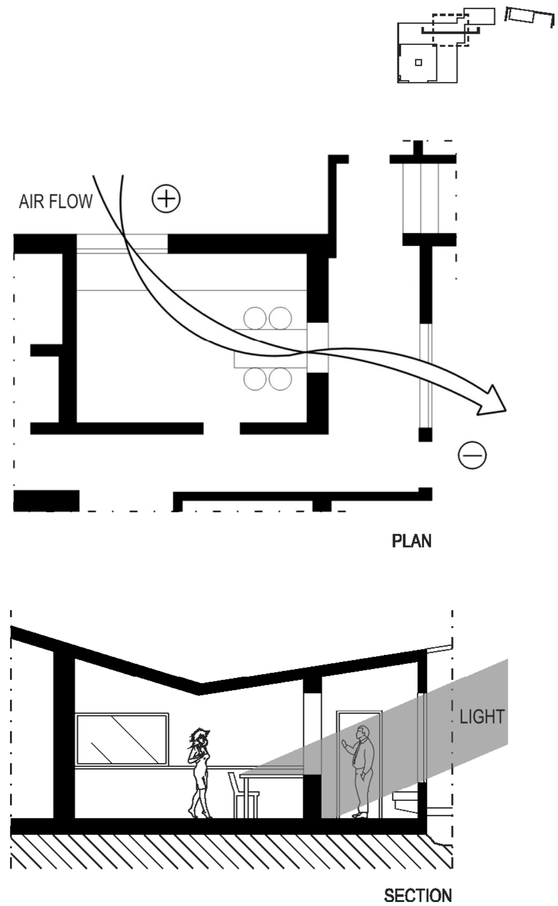


room's fireplace act as insulation units. To the opposite side, the rock formation emanates the heat absorbed from the sun during the day. The master bedroom, placed in a more hierarchical and private position within the plan, has a window opened towards the lake. The bed is strategically put by the inner wall, so that the cold from the outside walls cannot be directly transmitted.

Finally, we cover the vestibular corridor that connects the back confined forest to the house. It is another filter in the exterior–interior transition system, as well as an articulation space to the north entrance and the guest apartment. Taken in relation to the kitchen, it shows other environmental–sociological combined properties (Fig. 13).

A window in the inner wall makes possible a cross ventilation and the natural illumination of the table. It also provides a visual and communicative link between those preparing meals and the guests, who can greet each other before directly meeting.

FIGURE 13. Diagram showing climate concerned matters at the kitchen and the vestibular corridor.



CONCLUSION

Architect Alvar Aalto was concerned with local conditions and existing resources of the site. The precise consideration of the environmental and bioclimatic factors—sun, temperature, light, topography, wind, vegetation and hydrogeology—reflects directly on the adaptation and design of the building.

The use of environmentally compatible forms of energy is made by means of lighting, heating, and ventilation. As early as 1953, tests with energy-storage systems using the lake water heat and the solar radiation were intended.[17] The use of wood and recycled brick, as well as the experimentation realized on the durability of different kinds of tiles and brickwork, show a concern for the energy content and life cycle of materials.

Concepts like the accounting of the geographic and climatic conditions, the symbiosis between the built environment and nature, and the ecologically-balanced use of land are expressed in the house. Other factors taken into account are the architectural heritage, the human movement, as well as the functional, social, and visual aspects concerning the use of the space. It can be concluded that the Summer House attends to the main general principles of an environmentally concerned design.

This study has some limitations. The evaluation of the climatic and morphological conditions of the site has been constrained by the lack of specific data about the microclimate. In order to detail the design strategies and techniques employed, more precise site research and data recording must be done. Quantitative measurement and the detailing of the constructive system will provide a deeper understanding of the building. In order to better relate bioclimatic and spatial tasks, simulation and empirical studies should be further developed.

Still, the Summer House figures as a representative precedent that illustrates a bioclimatic and sustainable approach to architectural design.

NOTES

1. The *European Charter for Solar Energy in Architecture and Urban Planning* was written and signed by leading architects in 1996. Web site: http://www.eurosolar.de/en/index.php?Itemid=10&id=12&option=com_content&task=view. Retrieved: February 16, 2012.
2. Aalto, A. (1953). *Casa experimental en Muuratsalo.* In: Schildt, G. (ed). (1997). *De palabra y por escrito,* Madrid: El Croquis, 2000, p. 322.
3. For this specific relation with his father's work, see: Aalto, A. (?). *La mesa blanca.* In: Schildt, G. (ed). (1997). *Op cit.* p. 16–17. For general biographic information see the trilogy: Schildt, G. (1984, 1986, 1989). *Alvar Aalto.* New York: Rizzoli.
4. Aalto, A. (1953). *Op cit.* p. 322–323.
5. Aalto, A., and K. Fleig. (1963). *Alvar Aalto. Volume I: 1922–1962.* Basel: Birkhäuser, 1995, p. 200–203.
6. See, among others: Porphyrios, D. (1982). *Sources of Modern Eclecticism: Studies in Alvar Aalto.* London: Academy; and Quantrill, M. (1983). *Alvar Aalto: a Critical Study.* New York: Schocken Books.
7. See, among others: Guimarães, M. (2007). Alvar Aalto y la conciencia del agua en el paisaje. *Bitácora Arquitectura,* n.16, p. 34–37; Komomen, M. (2001). *Experiments with Materials at the Architect's own Expense.* In: Sippo, H. (ed). *Alvar Aalto: the Brick.* Helsinki: Alvar Aalto Foundation; Armesto, A. (1998). *La casa de Aalto en el paraíso.* In: Brosa, V. (ed). *Alvar Aalto.* Barcelona: Serbal, p. 167–180; and Quintero, J. (1996). *Habitar de tiempo: imágenes para la lectura de una casa.* Retrieved: February 16, 2012. Web site: http://www.arqchile.cl/habitar_de_tiempo.htm
8. The main bioclimatic concerned references here considered are: Goulding, J. et al (ed) (1992). *Energy Conscious Design: a Primer for Architects.* London: Batsford; and Serra, R. (1999). *Arquitectura y climas.* Barcelona: Gustavo Gili.
9. See: Meteorological Finnish Institute. Web site: www.fmi.fi
10. See: Aalto, A. (1940). *La humanización de la arquitectura.* in Schildt, G. (ed) (1997). *Op cit,* p. 147.
11. Regarding the interior-exterior transition, see: Aalto A. (1926). *De los escalones de entrada al cuarto de estar.* In: Schildt, G. (ed) (1997). *Op cit,* p. 69–74.
12. The Säynätsalo Town Hall (1949–1952) was also design by Alvar Aalto. About the use of the disposal bricks at Muuratsalo, see: Schildt, G. (1996). *Alvar Aalto. Obra completa: arquitectura, arte y diseño.* Barcelona: Gustavo Gili, p. 198.
13. Aalto, A. (1953). *Op cit.* p. 323.
14. *Ibidem.*
15. Aalto, A. (1941). *La arquitectura de Carelia.* In: Schildt (ed) (1997). *Op cit,* p. 165–167.
16. Aalto, A. (1956). *La madera como material de construcción.* In: Schildt, G. (ed) (1997). *Op cit,* p.141.
17. See: Schildt, G. (1996). *Op cit,* p.198; and Aalto, A. (1953). *Op cit,* p. 323.

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