The Architect's Convictions & the Client's Perspectives:
A case study on non-technical barriers

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ABSTRACT: In passive and low energy architecture, climate and other influences from the physical environment are dealt with in a more or less straightforward manner. There is a relatively well-known repertoire of technical solutions, which provide efficient and comfortable buildings. Contrastingly, cultural influences appear in a surprising diversity. As a result, a proper technical solution may be not sufficient for the acceptance of the design. This paper discusses non-technical barriers to the dissemination of passive and low energy architecture on the basis of a multiple-case study in the city of Curitiba, Brazil and surrounding regions. The polarity between the architect's convictions for passive and low energy architecture and the client idiosyncrasies are presented. Those may range from an interest for environmentally sound solutions to a prejudice against the unknown, which may be extreme in the case of commercial intolerance against buildings, which are not conventional.Causes of acceptance and refusal are systematized. Finally, a general conclusion on what can be learnt from the Curitiba case study is presented, as a contribution to the success of passive and low energy architecture.
Keywords: non-technical barriers, dissemination, temperate climate, occupants perspective

INTRODUCTION

Rather than presenting a technical contribution to the subject, this paper deals with non-technical barriers to the dissemination of passive and low-energy architecture. We are by no means claiming to have discovered that it is difficult to disseminate passive and low-energy buildings.

Our intent is to present particular stories. Scientifically regarded and treated as a multiple case study, they are expected to broaden the comprehension of non-technical barriers.

The cases are taking place in Curitiba (Fig.1), a city, which is perhaps known for its environmentally sound urban policies. Curiously, same may not be said from the city's architecture. But rather than making a general judgement, we chose to speak about Curitiba just following the advice that Leo Tolstoy once gave to a young writer: *describe your village and you will be universal*.

Here, a report is provided on the activity of the authors: an architect, who has been following for more than two decades passive and low energy principles, and a consultant engineer, who has been cooperating with him in the last decade. A systematic observation of the human factors in architecture leads to the identification of several dissemination barriers which arise from the cultural context. And this context leads to a discussion on the occupants´ perspective.

Figure 1: Cuitiba, Brazil. Source: Google maps

Acceptance of design has to do with the familiarity of the population with it [1]. Therefore, innovation in architecture is not a trivial task.

Experiences in the Brazilian [2,3] and Chilean [4] contexts were conducted by one of the authors, who has been investigating the issue non-technical barriers to some specific aspects of passive and low-energy architecture: green roofs and wooden constructions.

The following stories show different ways in which this perspective may be in frontal conflict with the architect's passive and low energy convictions.

THE NEED TO DISGUISE PLEA PRINCIPLES

The Barão de Cotegipe residence (Fig.2) is a multi-familiar building with 14 floors, containing 14 units of 300 m². Each unit occupies two half floors, and is placed at either the east or west façade of the building. The project belonged to group of investors intending to live in the building. Therefore: they were clients and users at the same time.

The architect's conviction was: the design has to consider that building density in the region shows a strong growing tendency. Changes in wind regime, solar radiation and noise production are to be expected.

Figure 2: The Barão de Cotegipe residence.

In fact, such an evolution rapidly took place within the next 10 years, and the design choices by the architect proved adequate considering the long term.

However, during the design phase, the users' reaction was to ask the architect to put those considerations apart and to prioritize market issues.

The architect kept on developing his own design, but with the attitude of not revealing his environmental awareness to the users. He architect considered their wish to have dormitories at the Northern, side façade, due to an attractive view in that direction. However, he finally managed to change the dormitories to the East and West, respectively front and rear façades. As a result, the design was accepted and the residence was built.

Nowadays, after the neighbouring lots gave rise to tight buildings, both the view and solar gains at the East and West façades were preserved.

In this experience, the clients´ perspective was found to be surprisingly short sighted.

AUDACITY: A FIVE-FLOOR TROMBE WALL

The Casa building (Fig. 3) was intended as headquarters of an expanding building company in Curitiba in the 1980s. It has 5 floors and a total area of 700 m². Here, again, the client was at the same time the building user.

The architect's conviction: in winter, discomfort is more serious a problem than in summer. Therefore, solar gains combined with some thermal mass would provide the occupants a warmer environment, allowing for heating load reductions.

This was not a difficult design task as the building lot faces north. In addition, some cooling strategies were proposed. However, the client desired an emphasis on modernist design, expressing economic power. As a compromise, there was a combination of direct gain and Trombe walls. A large glazing covering the north-oriented façade was proposed. Massive walls were provided behind the glazing, covering not the full floor height, but allowing external view.

The architect warned his clients that a protection against excessive solar gains should be needed. In order to cut costs, such protection was not provided. No wonder, as the client showed not to care for passive principles.

Figure 3: The Casa headquarters in Curitiba

Figure 4: The Casa headquarters in Curitiba

Ten years later, during a visit to the building, both authors listened to a complaint by one of the company's top managers.

Thus, the former user´s perspective: the building uses to be *too hot in winter, causing them often to catch a cold when going outside*. The occupants proved not aware of the need to operate windows.

Recently, the building became the headquarters of a well-known environmental foundation. The new user decided to place a huge screen of perforated plastic tissue in front of the glass façade, thus filtering the solar radiation and daylight over the complete area (Fig. 4).

The new user´s perspective is unknown, as it was probably the marketing intention what motivated the design.

MARKET FORCES AGAINST INNOVATION

Caiobá beach is 120 km distant from Curitiba and one of the preferred resorts of the city's population. Prainha is a more isolated location with an splendid landscape at the entrance of Guaratuba bay. The Prainha project was a set of 45 summer houses of 250 m².

The architect's conviction was: it is necessary to provide the occupants abundant fresh air without impairing the building safety while the family is out.

However, how to achieve ventilation without keeping windows open?

First, wind catchers were considered. Then, the team started looking for some aerodynamic technique. It would be possible to conduct the prevailing winds along the attic, promoting the extraction of indoor air by means of the Venturi principle (Fig. 5).

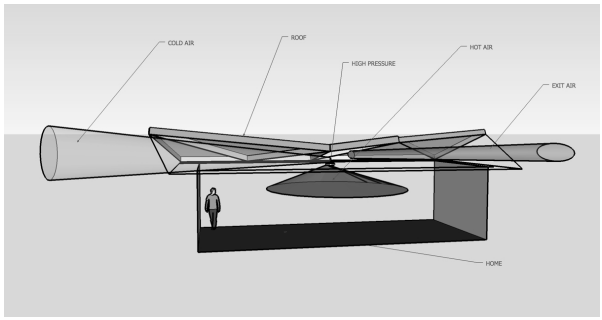

Figure 5: The Venturi principle.

In order to promote a depression in the central portion of the house plan, while keeping some traditional character, a variation of a gable roof was developed. The result was harmonious and included a nautic metaphor.

The roof proved effective after flow visualization experiments with a reduced model, which were published [5]. Air intake grids along the lower floor

made it not necessary to windows open during the day, what could encourage unwanted visits to the house while the family is out on the beach.

After analysing the design, two chief engineers and a sales director presented a report to the building company's CEO stating that the proposed ventilation principles would not work. The design team was fired.

It should be explained that architect also had a summer cottage in Prainha beach, and happened to be a community leader at the time of the design discussions. This position gave him a privileged understanding of the problem, as he could notice the client's intention to challenge the current height limit of three floors. The company was putting pressure for a four-story building, but what the architect proposed was a three-floor solution.

The truth is: the company wanted flat slabs, with the secret intention that in the near future (after the building was license was issued) people could call them to add a further floor on it.

In addition, the company understood that the natural ventilation design added no value in the perception of the potential buyers.

The real users´ perspective remains unknown.

DISCOMFORT, AN UNEXPECTED EXPECTATION

A further experience in Caiobá beach was a refurbishment proposal presented to a large seafood restaurant. Most of the tables were placed under a canvas roof, where the thermal sensation used to be very hot.

The architect's conviction: more thermal comfort leads to higher customer satisfaction.

Therefore, before being asked to do it, he took the initiative to send a refurbishment proposal to the restaurant's owner.

One of the design alternatives consisted on an evaporative strategy to reduce heat. Another one combined a radiant barrier and a Venturi-based exhaustion (Fig. 6). After some considerations, the owner rejected the proposal. His argument: the restaurant is crowded and needs no improvement.

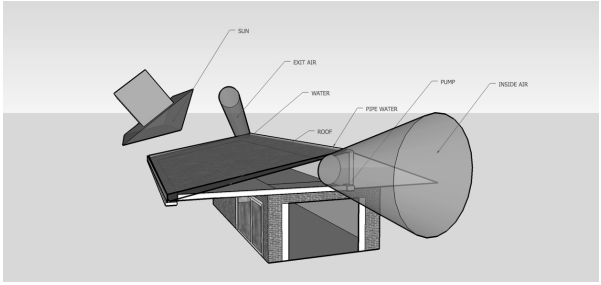

Figure 6: Radiant Barrier and Venturi-based exhaustion

The users´ perspective: comfort is a concept, which is not to be accomplished in the vacations. Outside the working environment, one accepts discomfort, as no better conditions are expected.

The client's perspective: why to pay more if he had already got enough to satisfy the users´ stomachs?

TECHNOLOGICAL CONSERVATIVISM

Next situation was found at a Chemical Company supplying the cosmetic industry.

The company occupies several barn-shaped buildings. The handling of volatile components raised the concern of the municipal health agency.

After an inspection, the agency was convinced of the air quality, but asked the company to provide the buildings with countermeasures to the daily and annual temperature oscillation.

The architect's conviction: earth coupling of the ventilation system provide be the simplest solution.

The consultant helped him sizing a duct system, whose place was chosen after considering the construction costs. The proper placement of the underground ducts seemed to be the main concern of the company's decision maker, a chemical engineer and former university professor.

After a long negotiation, the team was told that the company had chosen a conventional air-conditioning system.

The client's perspective: there was no similar experience in the region.

THE ARCHITECT'S WIFE AS A CLIENT

The Reis residence (Fig. 7), with an area of 500 m², was intended to combine an innovative design and the traditional passive principles, as well as recycled and reused materials.

The architect's conviction: the house should be efficient without the appearance of a glazed box.

The main volume has at the ground floor a single living room. Its plan is an irregular polygon. The walls and floors are of concrete. The ceiling is of reflecting, corrugated aluminium foil, which causes a unique lighting atmosphere.

The combination of solar gains and thermal mass causes the indoor environment to be noticeably more comfortable in winter than most conventional houses – that uses to be the opinion of the visitors.

There is a concrete niche 1,2 m deeper than the floor level, providing sitting places for a small committee. If it is the guest´s desire, the niche can be filled with water at the level of their breasts.

The architect's wife, an enthusiast of his husband's principles, intended to have a generous main guest room, in order to show to several guests how wonderful passive solar architecture can be.

Figure 7: Reis residence near Curitiba, main (East) entrance.

The reception of guests to the house involves many amazing details. The front door is placed 1,5m above floor level. Each incoming guest is revealed by a motorized door, which slides down to let people in. The purpose of this door is to create a thermal buffer zone. The surprised guest stays a few seconds under a soft flood light while a smoke stroke rises from the ground. Next, he has to reach floor level by crossing a descending concrete bridge, leading him to the other end of the room. This is the architect's way of celebrating his guests.

Not everything is easy, as the unusual shape of the windows places some difficulties in the accomplishment of a double, evacuated glazing. But, most important, it has the power to convince people to believe in passive and solar energy.

The user´s perspective: passive and solar energy is great, and people should not only feel this, but commemorate it and join the architect´s party.

FINAL REMARKS

In the analyzed case studies, there are convergence points. The users lack information. Curitiba is considered the single capital in Brazil within the temperate climatic zone. In winter, daily average temperature by 5°C is frequent. However, this reality does not exceed three months. People do not suffer enough in order to take definitive countermeasures.

Passive and low energy architecture and principles are not sufficiently disseminated in Brazil.

Real-state companies try to attract buyers by what they want: normal houses.

The authors intend to participate in PLEA again in the future and report on their positive results counteracting that reality.

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