On the Use of Slots and Shafts

Informal Cooling Strategies as Indicators for New Cooling Concepts - Microclimate Ethnography in the Ard el Lewa Informal Quarter of Cairo (Egypt)

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Although the significance of vernacular cooling strategies is well accepted among scholars of architecture (Taut 1937, Fitch / Branch 1960, Fathy 1986), the differences between passively cooling a small village house, and cooling a large-scale city building have to be considered carefully. But what about the large-scale high-rise informal buildings in a big city like Cairo, Egypt (Fig.02)? Have these buildings something to teach us in terms of cooling large-scale mass housing developments (Fig. 01)? In this article I'm going to argue that the very young phenomena of informal building is the missing link between vernacular and academic construction. The gap between tradition and modernity can be bridged by investigating informal cooling strategies. During fieldwork conducted in an informal quarter in Cairo (Egypt, 2010) I had the opportunity to live with and to investigate such informal cooling strategies.

Fig. 01 Construction site, Ard el Lewa (Cairo, 2010)

Fig. 02 Informal high-rise buildings in the Ard el Lewa quarter (Cairo, 2010)

Rethinking Low-Tech Strategies in Architecture

At present, in many parts of the world, a fundamental transformation of traditional building methods is occurring. In Indonesia, for example, there is a trend away from filigree construction (wood and bamboo) towards solid construction (fired bricks and concrete). In Egypt, the trend is in the opposite direction, but has similar results: traditional thick-walled solid construction methods (mud bricks) are being abandoned in favour of more filigree structures (fired bricks and concrete). The climatic implications of these developments are indeed dramatic: the microclimate-regulating capacities of traditional building structures are increasingly replaced by new technologies, including air conditioning. The response to climatic conditions becomes a technical or scientific problem for architects and engineers without any cultural and social implications, divorced from the everyday practices of a building's inhabitants. Natural energy resources such as wind and solar are replaced by fossil fuels and electric energy.

Today, there is a need to rethink those architectural concepts which help to reduce (1) the mere technological impact on building methods, and which strengthen (2) the structure itself as a multidimensional means to maintain and enhance the climatic comfort of the users. Structures not only bear (Fig. 3) Instead of searching for low tech solutions, architects should first carefully re-evaluate the *everyday practices* that make an architectural solution appropriate for its users. In his book *Small is Beautiful*, (Schumacher, 1973) the economist Ernst Friedrich Schumacher explained the term ‚low-tech' very precisely: Low-tech means to involve people into the production, the operation and the use of things. The so-called *intermediate or appropriate technologies* gained their full importance, mainly in the global south, as a labour-intensive alternative to the capital and energy-intensive technologies of the industrialized countries. In other words, architects need to integrate both *technology and everyday practices* into their considerations.

Climate responsive design research is a good example of how appropriate technologies are reliant on both technological and ethnographic insights. The "affinities" (Marcus, 2010) between climate research and ethnographic fieldwork have been apparent for decades, since architects first used the thermodynamic knowledge of building physics in order to better understand vernacular building phenomena. (Roesler, 2013) (One might speak of a "climate ethnography" (Crate, 2011) conducted by architects.) In his book *Natural Energy and Vernacular Architecture* (1986), Hassan Fathy describes two ways of influencing air movement both inside and outside the traditional Arab house: "The architectural design can ensure such natural air movement through two principles. In the first, differences in wind velocity produce a pressure differential which results in air flowing from the higher to the lower air pressure region. In the second, air is warmed, causing convection, with the warm air rising and being replaced by cooler air." (Fathy, 1986)

Fig. 03 Building with the two basic types of clearance: a shaft within the building and some slots along two facades

Natural Ventilation in Ard el Lewa

According to estimates, 65% of Cairo's inhabitants are living in informal and semi-informal settlements today. Apparently, the vast majority of these buildings are not regulated by any kind of air conditioning devices, added before or after completion of the buildings. The climate of Cairo is a hot desert climate with summer temperatures of around 35° C. Considering the climatic conditions of Cairo, there is a obvious need to attenuate these conditions architecturally with appropriate building methods and typologies and using traditional cooling strategies, as this fieldwork revealed. Very old mechanisms for controlling a building's temperature and enhancing the comfort of inhabitants are still in use today. I spent one month in the informal quarter *Ard el Lewa*, which lies in the west of the city of Cairo, at the edge of the formal quarter *Mohandessin*. Since the 1970s, *Ard el Lewa* has been continually expanding, as have many other informal quarters in the city.

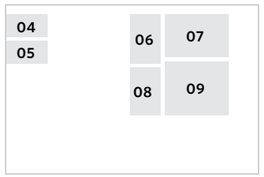

Fig. 04 The houses are built together, generating high-density building aggregates. Google Earth Air view of Ard el Lewa (Cairo, 2010)

Fig. 05 Narrow streets, as in the old town of Cairo. Google Earth Air view of Ard el Lewa (Cairo, 2010)

Fig. 06 In the background: overhanging beams as distance reground: shafts are already envisaged

Fig. 07 Some slots along the facades. Sooner or later this building section will be extended without any clearance

Fig. 08 View into a shaft of a newly constructed building

Fig. 09 View into a shaft of an old informal building from the 1970s

The informal building typology in Cairo generates high-density building aggregates that are extended horizontally, without any clearance, by repeatedly building new sections (Fig. 4). In Cairo, this typology not only reflects the former urban fabric as it is still visible in the Old town, but also the former pattern of land ownership of the agricultural land on which the informal settlements are mostly built (Fig. 5). Quarters like *Boulaq el Dakrour* are some of the most dense places in the world. The Google Earth map of *Ard el Lewa* reveals the specific structure of the informal quarters that have so much in common with old Arabic cities (Fig. 6). In principle windowless on three sides, the numerous recesses, notches and slots along the facades and in the interiors of the informal buildings provide natural ventilation and illuminate the (otherwise) stuffy and dark rooms (Fig. 7, 8). If the slot dimensions are of the appropriate size a ventilation system is established and the apartment interiors are cooled by natural means (Fig. 9). The slots along the facades are indicators of how the urban fabric might develop in the future. Against the topos of "spontanous architecture", there is in fact both foresight and logic in informal building practices.

The layout of many informal apartments does not ensure a controlled wind flow, a circulation of which would bring both fresh air inside and heated air outside. The slots and shafts of the informal buildings lack the efficiency of the traditional egyptian *malqaf*, the wind catcher tower of the old residential buildings. Unlike the thick-walled houses of the old town, today's informal column-plate structures have little storage capacity. The traditional interplay of natural ventilation and heat storage cannot be activated by these modern (filigree) structures.

These limited observations and remarks should be enough to indicate how many problems have to be solved by architects in order to make structural typologies such as those discussed truly thermodynamically efficient. Nevertheless, in terms of climatic response the informal high-rise buildings in Ard el Lewa have to be seen in continuity with the Arab-Egyptian *courtyard houses*. Regarding natural ventilation, my fieldwork revealed surprising conceptual continuities between the vernacular house types of the region and the contemporary informal buildings. The informal building structures therefore provide clues about how the modernisation of traditional air conditioning practices should be further developed by architects today. Informal cooling strategies are an indicator for new (low tech) architectural cooling concepts – in developing countries and beyond. Contemporary low-tech architectural strategies have to be informed by vernacular and informal building traditions in order to achieve their full effectivity, not only technically but also socially, and culturally. In Cairo, there is a whole culture of making use of natural energy within buildings, a culture which is very much related to social status. Today, people using natural energy are either poor or rich. It's time to make natural ventilation accessible again to everybody, worldwide.

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