

AN INVESTIGATION INTO LUMINOUS COMFORT IN THE SUMMER SEASON OF PALESTINIAN DWELLINGS: INHABITANTS' POINT OF VIEW

1 Introduction

Man spend more than 80% of his lifetime indoors [1]. Natural lighting represents an essential aspect of good building design. It is considered as a passive solar design strategy in building.

A successful daylighting as well as luminous comfort in building is generally composed of more than a simple opening in the façade (window). It often highly depends on climate, latitude, orientation, view of the sky, interior spatial organization, façade layout, space configuration, internal finishes, functions, etc. In addition to these factors, Rapaport stated that the quality of light would be also influenced by personal, cultural and historical aspect [2].

Careful management of daylighting has the potential to produce positive effects on health [3-4], well-being and productivity [5-6]. It can also bring tangible energy savings, as long as it minimises energy use for artificial lighting and prevents visual discomfort such as glare. A daylight strategy has to be designed in order to find a balance between conflicting needs of transmission and protection [7]. Moreover, it plays a crucial role in how occupants reveal and perceive their space [8].

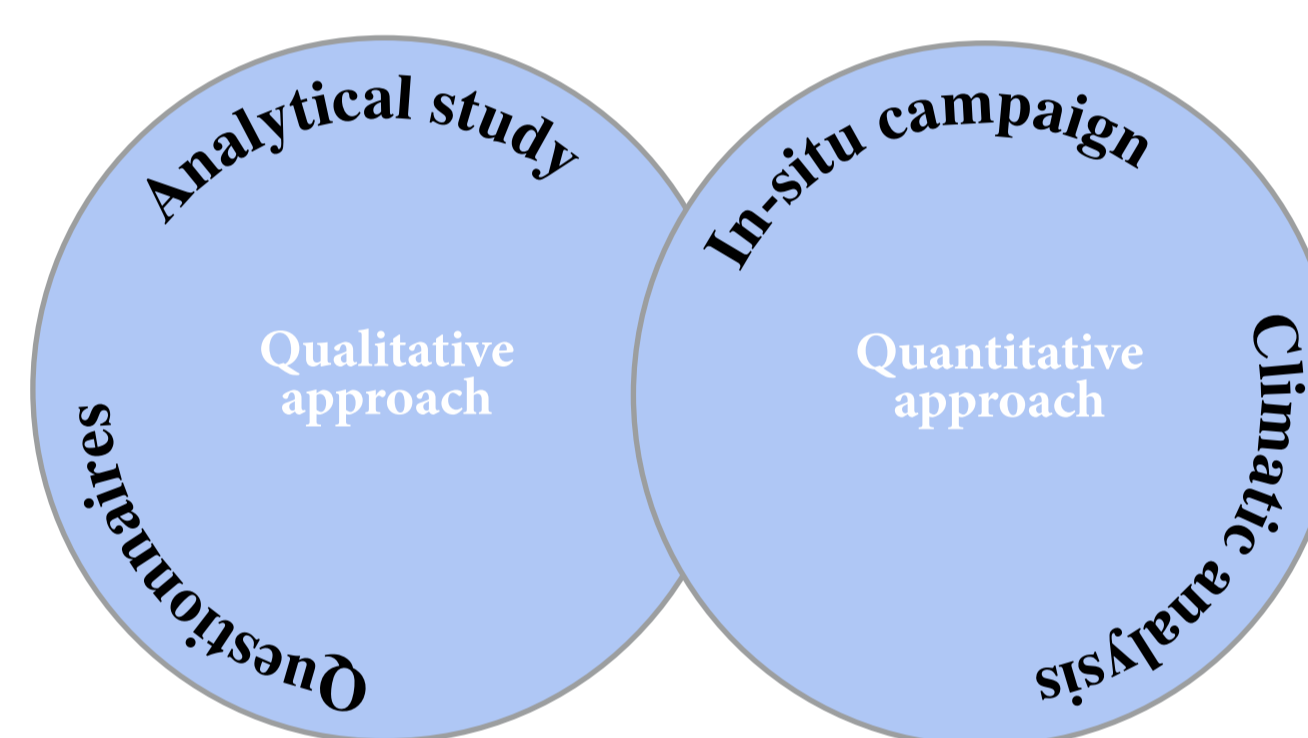
Today, in the Palestinian context, in contrast to vernacular courtyard dwellings, private and public current practices in architecture are based on Western standards, disregarding the environmental, climatic and socio-cultural Palestinian values [9].

This has led to extremely high energy consumption and to rapid environmental degradation. A large portion of this energy is designated for achieving human comfort through heating, cooling and lighting [10].

In this poster, environmental and socio-spatial assessment of both traditional and contemporary housing in terms of human comfort and more particularly luminous comfort is illustrated. It is highlight the appropriate building design characteristics and strategies in away to relate our housing designs to sustainable development.

2 Methodology

Two approaches were adopted:



- Evaluate the socio-cultural and environmental characteristics of contemporary housing.
- Determine the significant characteristics of future housing typologies in terms of sustainability.

Figure 2: Diagramme of adopted methodology.

3 Geographic & Climatic characters

Palestine is a Mediterranean country of 6100 km². Seven climatic zones were defined in this small area of territories (i.e.; five in West Bank and two in Gaza) [12]. Two representative cities (Jericho, Nablus) were selected for two of these climatic zones.

3.1 Geographic characters

Jericho (31.85N, 35.46E) located in the Jordan Valley while Nablus (32.21N, 35.26E) located in a mountainous area.

3.2 Climatic conditions

Jericho, in the first Zone, has hot dry summers and warm winters, while Nablus, in the fourth climatic zone, has warm sub-humid summers and cold winters.

Table 1 - Climatic data for the two investigated cities [11].

CITY	Monthly Temperature		RH%	Prevailing Winds		Precipitation
	Jan	Aug		Speed	Direction	
Zone 1 "Jericho"	8.2°C	38.8°C	54.6%	3.4km/h	E & N	125mm
Zone 4 "Nablus"	5.3°C	30°C	61%	5.5km/h	W & NW	715mm

3.3 Sun, shading periods &

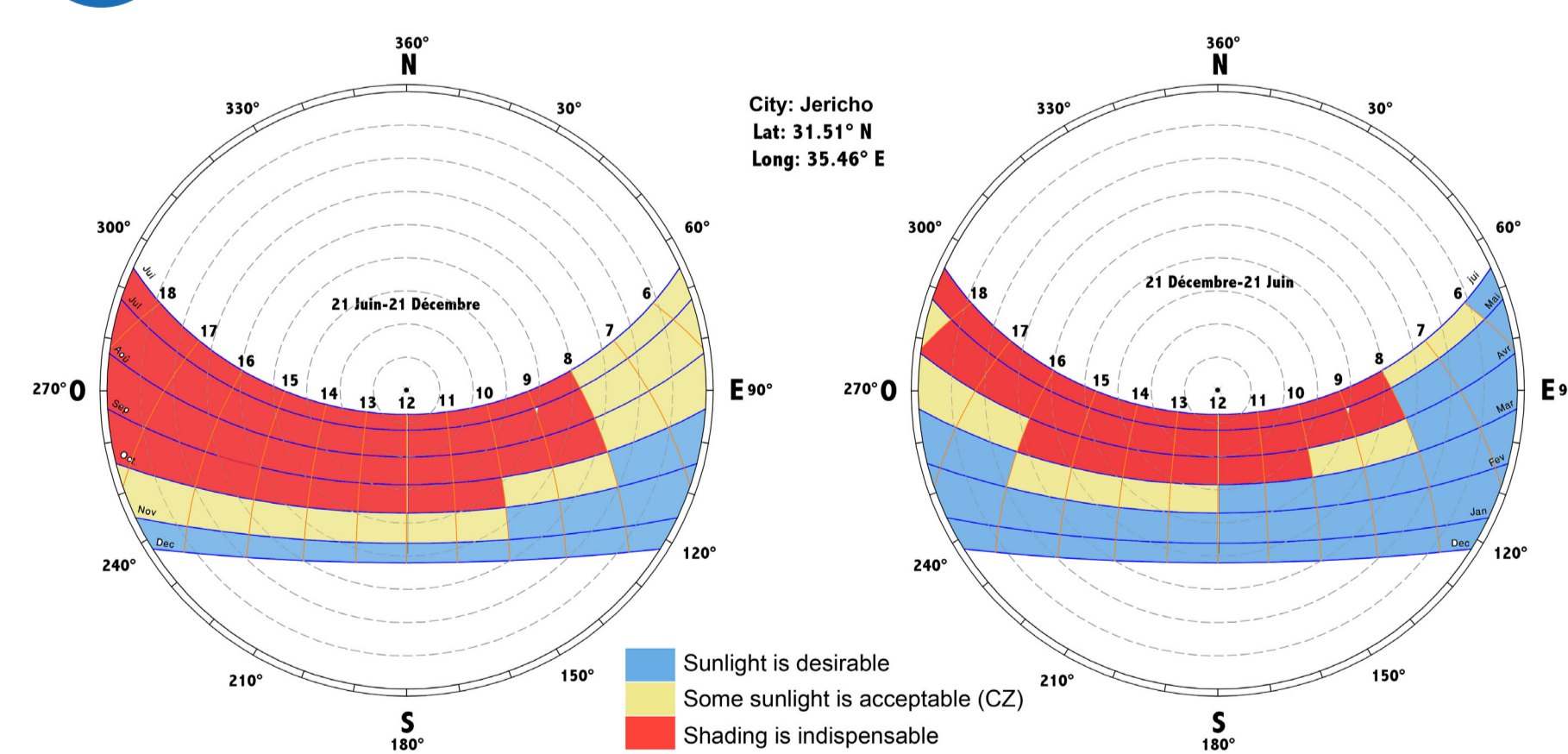


Figure 4- Sun and shading periods in Jericho

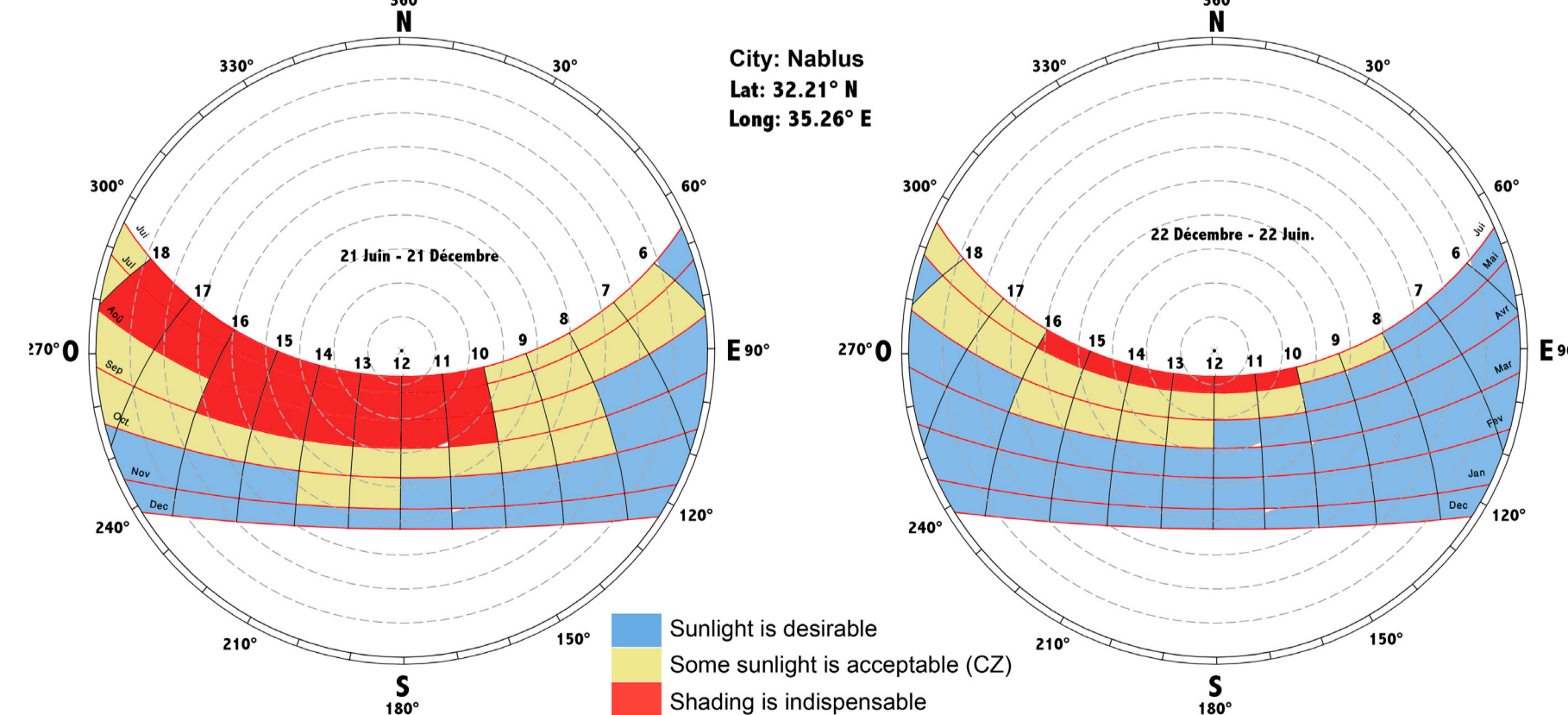


Figure 5: Sun and shading periods in Nablus

Table 2 - Examples of Mahoney's recommendations for buildings daylighting

Elements	Recommendations/ cities	
	Jericho	Nablus
1- Layout	Compact courtyard planning	Orientation north and south (long axis east-west)
2- Spacing	Compact layout	Compact layout
3- Openings	- Very small opening, 10-20%	- Medium openings, 20-40%
	- Position in north and south walls at body height on windward side, also in internal walls	- Position in north and south walls at body height on windward side

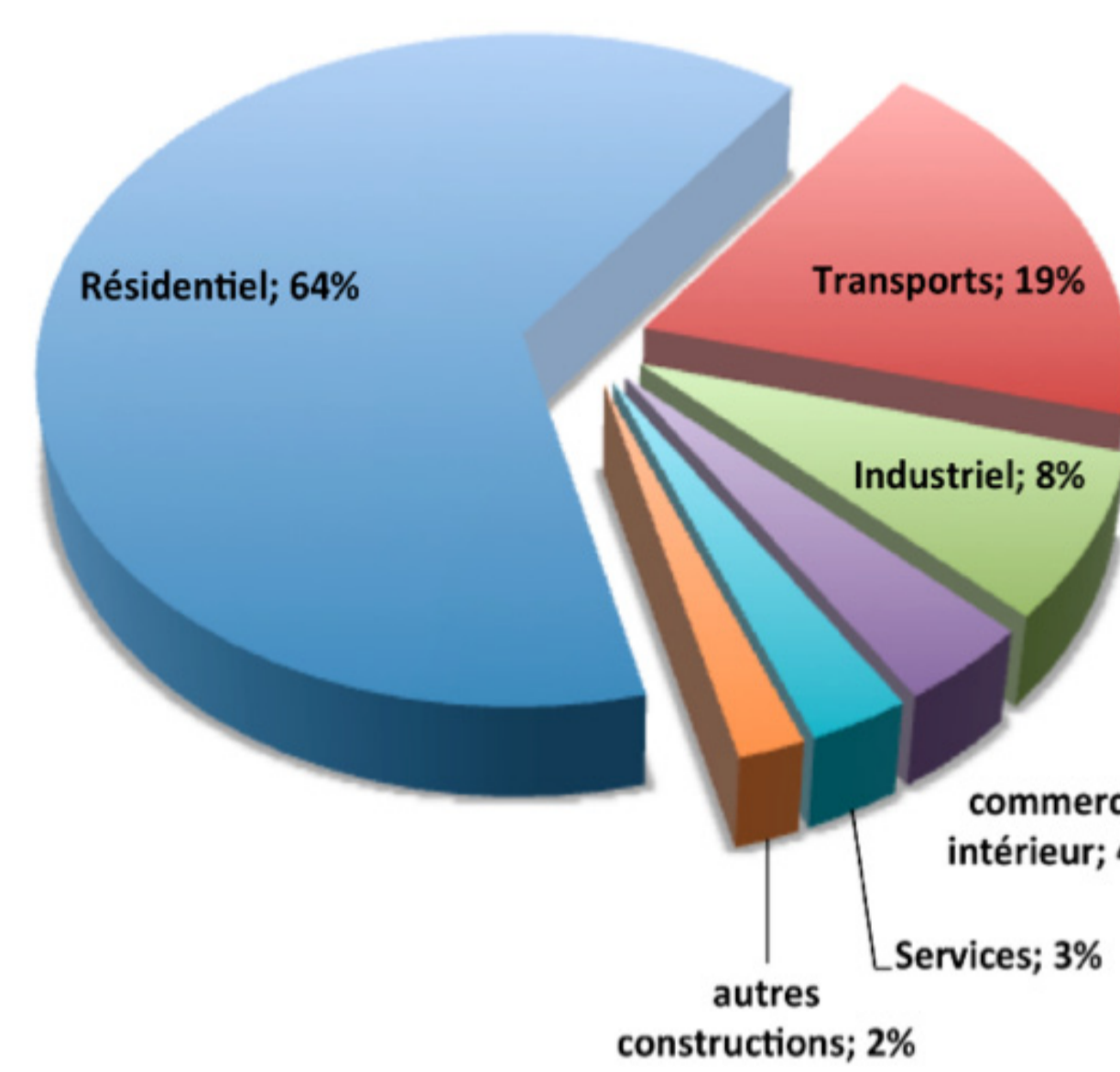


Figure 1: Energy consumption following to each sector in Palestine in 2005. [11]

4 Evaluation for luminous comfort in the Palestinian dwellings

4.1 Dwellings' layout

Traditionally, Palestinian dwellings were built based on introverted concept with a central open sky space i.e.; courtyard. It was the main source of light for the interior spaces. While the contemporary housing adopte an extraverted scheme in which the windows are the main entry for lighting.



Figure 6: Typology of traditional dwellings (left) and contemporary (right)

4.2 Orientation of living spaces

Traditionally, in Nablus, western and eastern external façades are the least opened due to the attachment of houses on these sides, which reduces the intensive solar radiation in summer time.

In contemporary housing, the findings show that most spaces, except for kitchen, are oriented to the West (53.5% in Jericho and 40.3% in Nablus) regardless of its function. Indeed, due to low sun angles, on this orientation, glare is harder to control. However, **more than 40%** of living rooms in contemporary apartment dwellings in Nablus are **isolated in the center** of apartment's plan without any connection with the exterior environment.

Table 3- Evaluation of daylighting in dwellings in Jericho

	Percentage of inhabitants' perception of daylighting (%)			Score
	High	Modest	Poor	
Kitchen	63.6	34.5	1.8	1.38
Living room	22.6	54.7	22.6	2
Master bedroom	35.2	59.3	5.6	1.45
Guest room	56.9	39.2	3.9	1.47
Dining room	28.9	62.2	8.9	1.8

Table 4- Evaluation of daylighting in dwellings in Nablus

	Percentage of inhabitants' perception of daylighting (%)			Score
	High	Modest	Poor	
Kitchen	51.2	45.9	2.9	1.52
Living room	26.5	52.9	20.6	1.94
Master bedroom	52.1	40.5	7.4	1.55
Guest room	62.4	30.2	7.4	1.45
Dining room	29.1	56.5	14.3	1.85

4.3 Openings

Traditionally, for environmental issues as well as visual privacy, whenever external windows exist, they are of small or medium size and often recessed or totally screened via *Moucharabiyeh*. Therefore, the occupied spaces were mainly lit and ventilated from the courtyard.

In order to mitigate glare effect in modern dwellings, inhabitants use fabric cloth or curtain on the exterior limit of their larg windows.

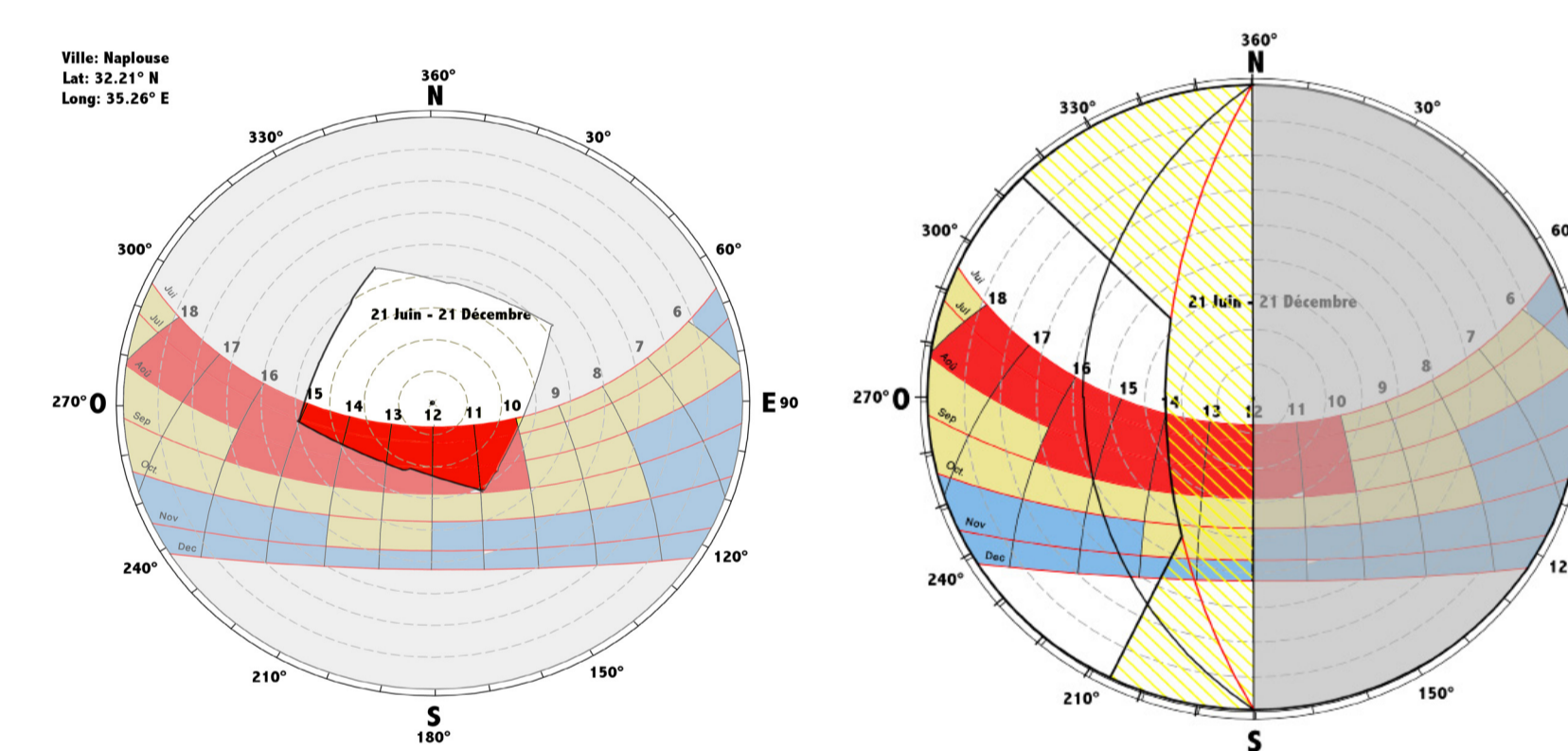


Figure 7: Natural lighting penetration: low efficiency for courtyard in winter (left), high penetration in modern housing in summer (right)



Figure 8: strategies to control natural lighting penetration: Traditional Moucharabiyeh (left), Modern fabric cloth (right)

5 Conclusion

The investigation for sun and shading periods and Mahoney tables showed some differences in the proposed building strategies and recommendations improving the luminous quality for each climatic zone. As a result, the optimization for natural lighting in the two cities needs for different strategies. The analysis of luminous comfort in the Palestinian dwellings shown an under performance in both typologies. The majority of respondents assessed the natural light as sufficient and satisfying during summer, while more than 60% of the collected measures are lower than the recommended values imposed by the international organization of illumination and limited by [200 to 500 lx] for residential usage. This is could be attributede to the fact that the availability of natural light is an influent factor on the occupants' environmental satisfaction, even if the illuminance levels do not respond to the visual tasks needs.

The climatic strategies have been using in traditional architecture for a long time. Openings and courtyard to maximum use of sun radiation in winter and to control shading mask.

Finally, we consider that the natural light is a valued and free wealth that should be efficiently exploited to ensure efficient indoor environments as well as energy saving.

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