Thermal comfort in urban space renewal

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ABSTRACT: Modern and contemporary public and semi public urban spaces (squares, courts, streets, commercial and transit centres) seem to have very poor thermal comfort performance when compared to that of traditional urban spaces. Few squares (traditional, new and newly renewed) have been studied in Milan and hinterland through field investigations and evaluations. The results point out the essential role of urban "niches" or "pockets", where appropriate mix of materials vegetation and operable shading devices provide comfort and improve vitality in urban spaces.

Keywords: comfort, urban spaces

1. INTRODUCTION

Recent urban spaces renewal in Italian cities have often bad environmental performances as pointed out by the protest movements against newly renewed squares and streets.

Urban renewal and new development are very often only an occasion to self celebrate the "star" architect and the Local Administration which often do not take into due consideration environmental comfort of people who are the final users of urban spaces.

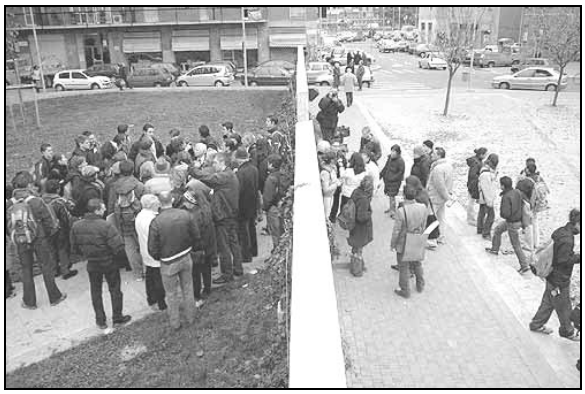

Figure 1: Meeting of a local group claiming against a very bad renewed urban square in Milan (a "defensive wall cutting spaces and communities)

Newly renewed squares we analysed in Milan often switched from liveable articulated urban places to scenic "non places" loosing a great part of local identity and environmental performances.

2. PRELIMINARY ENVIRONMENTAL PERFORMANCE EVALUATION.

An investigation on 8 squares in Milan area has been done by students following a preliminary performance approach based on a five items checklist evaluated on six questions (yes/not answers, referred to a 10 score scale) adapted from Cooper Markus [1] :

The first item concerns *circulation* in relation with:

- mesh and balance of circulation pattern (low vehicular, high pedestrian flow);
- system of pedestrian structures (walkways, subspaces…) to encourage walking and sitting;
- urban elements to reduce vehicular velocity;
- parking close to square;
- public transport stops in the square.
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The second item concerns *activities* (walking, chatting, listening music, shopping …) supported by public equipments, and structures which enhance space attractiveness such as:

- bars and restaurants;
- furnishings to accommodate people activities;
- shops;
- children playground;
- area for music, theatre etc.. with movable structures (chairs, ..);
- events scheduled and notices structures.

The third item concerns *microclimate* to check if the square has a good balance between sunny and shaded area to allow uses appropriate to all seasons. In particular survey has been done on:

- shading devices to provide summer protection (canopies, trellises, vegetation);
- correct seasonal use of deciduous and non deciduous vegetation;
- water to mitigate microclimate;
- correct use of materials in relation to thermal and visual performances;
- glare from adjacent buildings and/or paving;
- wind protection in winter and wind enhancement in summer.

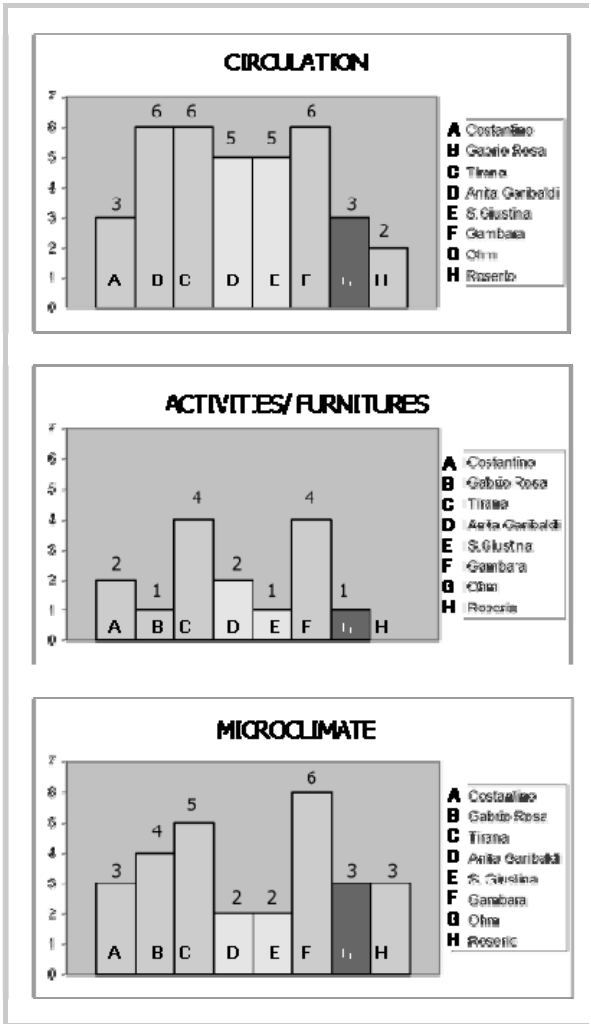

Figure 2a: Results comparison of the preliminary performances analysis in eight squares in Milan

The forth item concerns the presence of *niches* (or subspaces/ pockets) In particular survey has been done on:

- existence of subspaces to provide a variety of experiential settings for users;
- features such as grade change, vegetation, seating arrangements;
- subspaces separated from one another without creating sense of isolation.
- variety of activities inside the subarea
- availability of adequate urban structures
- use of the subarea allowed by microclimatic conditions

The last item concerns the *sedibility* that is an adequate quantity and quality of seats in the square. In particular survey has been done on:

- availability of sunny and shaded seating locations;
- benches arrangements and movable chairs and tables to accommodate groups;
- seatings arrangement to guarantee privacy;
- variety of seating orientation to allow different views;
- secondary seating (steps, seating walls, mound of grass, retaining walls) incorporated into plaza design in quantity similar to that of primary one.
- seating materials appropriate to thermal comfort.

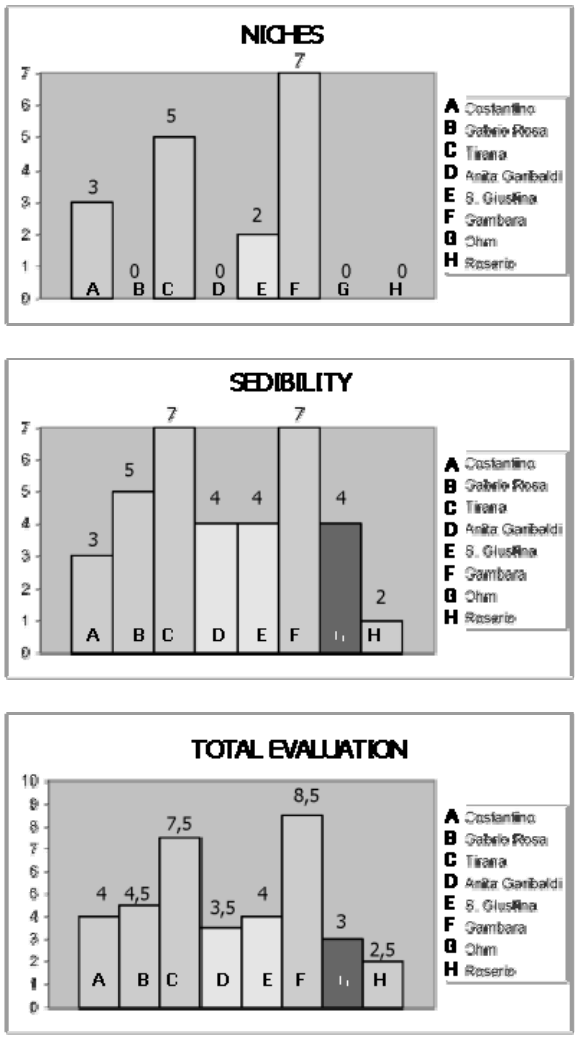

Figure 2b: Results comparison of the preliminary performances analysis in eight squares in Milan

The overall evaluation of the survey in a ten scale rating (0 to 10) gives interesting information: the best overall rate (squares C Tirana end F Gambara) is based mainly on the contribution of microclimatically responsive niches and sedibility arrangements (Figg 2a, 2b).

The lesson from the survey is the importance to move from a purely visual design approach to multisensorial one which gives a more complex design answer to the basic vitality needs of everyday life.

3. "AUTHOCRATIC" VERSUS PARTICIPATING DESIGN

The same survey has been done in two squares of Cinisello Balsamo a middle size town in the northern border of Milan. The first one – piazza Gramsci – is

the "historic" town square which was redesigned in the seventies (Fig 3) as a "local" square and then recently redesigned by the Dominique Perrault winner of an international architectural competition.
The second one – piazza Costa (Fig 4) –is a recent development which has been redesigned through a participating design process which involving a large number of local dwellers.
The final rating of the survey is very low for Gramsci square designed by the "star" architect (overall rating 2,5) while is very high for piazza Costa (overall rating 8) (fig 5).

Figure 3: Gramsci square view before renewal

A part from general architectural evaluation, the checklist comparison shows a low vitality of Gramsci square in terms of microclimate and niches.

At the contrary overall rating of piazza Costa environmental performance is high due mainly to the contribution of microclimate control and niches.

Figure 4: Costa square view after the renewal

The survey evaluation, confirmed also by simple post occupancy survey, is very close to "common sense" of local people.

People judge can be consciousness when disagreement is expressed in a formal way aggregating pressure group to ask for change in recently renewed urban spaces (as in some cases in Milan, fig.1) or unconscious through behaviour modifications: the place is not used anymore much for settled activities but just as a walkway to cross.

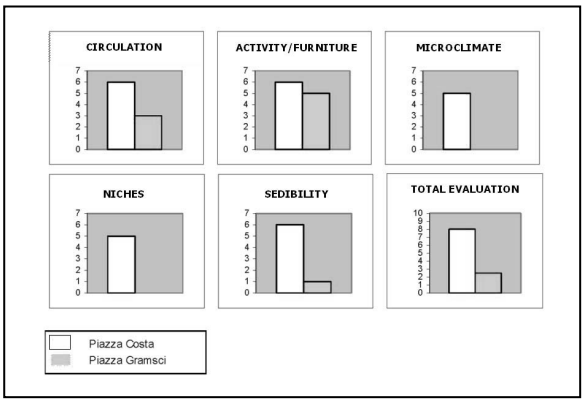

Figure 5: Results comparison of the preliminary performances analysis in Gramsci and Costa squares

4. THE DESIGN FOR VITALITY

One of the central issue of contemporary urban culture is how to design urban spaces to answer people enduring needs for livable spaces which are multisensorial spaces within which physical forms, borders and materials are thought also to enhance ventilation, sun and shade, sound and perfumes… in a word what Lynch calls "consonance" of spaces that is its overall multisensorial performance [3].

Since few year a renewed interest for multisensorial spaces design stimulated the elaboration of simplified tools and methods to define environmental requirements in urban design focused also in thermal comfort needs.

Microclimate mitigation techniques came out of specialized research fields and enter into design practice as a tool give solutions for a better comfort or, at lest, to reduce thermal stress.

The first design step is to learn from users behavior, which means a detailed observation of the most used urban niches in different period of days and seasons which give a bioclimatic "chronogram" of space uses.

The second step is to do a short microclimatic survey through measures of the main variables (air and radiant temperatures, solar radiation, relative humidity, wind velocity) to evaluate the physiological answer to environmental stimuli [4].

The last step is a perception survey, which is done through a questionnaire to users in the place where they are and in the same short time the microclimatic measures are done. Subjective perception and objective measures data are then related. Comfort subjective perception commonly does not completely agree with thermal comfort indexes - like the PMV (Predicted Mean Vote), the PET (Physiological Equivalent Temperature), or similar- as pointed out by many researches recently developed including RUROS [5], [6].

This means that adaptive comfort is very active in outdoor spaces where psychological factor (mainly the expectation to freely move from sunny to shaded

areas…) play an important role mainly for not voluntary activities (strolling, standing, seating …)

Conventional indexes give anyway a rough indication of the thermal effect of design choices.

An example is a student study to evaluate alternative proposals to improve microclimatic and thermal performances of the Gramsci square above described. Taking in consideration displacement activities in the square, like walking and strolling along the border, microclimate conditions due to exposure to solar and thermal radiation are extreme and therefore thermal uncomfort mainly in the afternoon is close to thermal stress (PET 36.7°C, PMV 3) (Tab 1) In these conditions public space is used only for necessary activities, i.e. crossing the square to get in a bus stop.

Student environmentally sound retrofit proposals range from mobile tents (in the tradition of XIXth century urban furniture) to tent wetting to pavement wetting.

Mean radiant temperature (MRT) and air temperature have been measured, while the contribution of shading canopies have been calculated through the simplified method to roughly evaluate radiant conditions in urban spaces [4].

Only with shading devices, comfort conditions are still in the warm area (PET 32.4, PMV 2.1) but still according with short time activities.

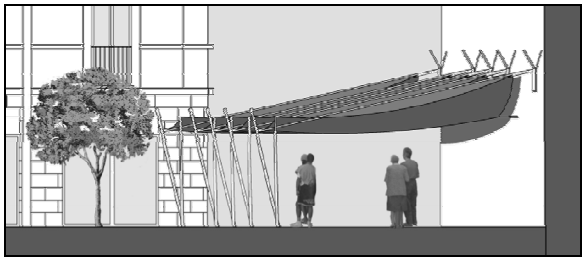

Figure 6: Movable Canopies to shade the south exposed border in Gramsci square

Table 1: Measured data of air temperature and MRT and related PMV and PET

Period time	Air temperature (°C)	Measured data		
		MRT	PET	PMV
midday	29	38,55	34.7	2.7
afternoon	30	40,71	36.4	3

Table 2: Foreseen data (MRT, PMV and PET) with shading device

Period time	Foreseen data with a shading device		
	MRT	PET	PMV
midday	30	30.5	2
afternoon	31	32.4	2,1

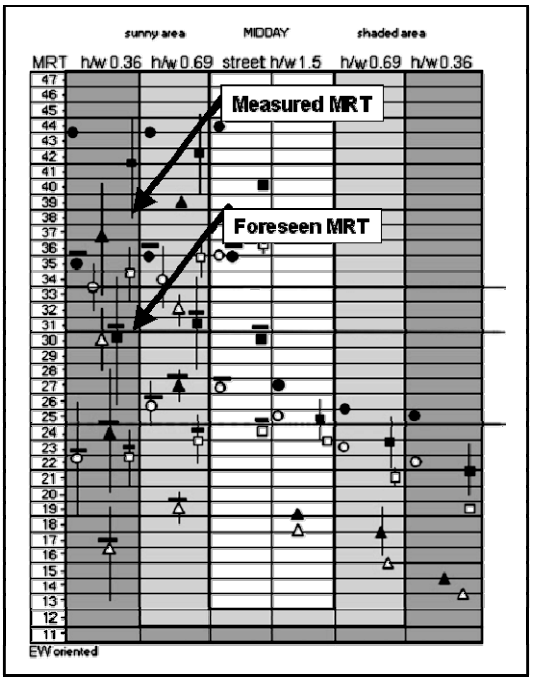

Figure 7: Evaluation of MRT in piazza Gramsci in the morning with the shading device

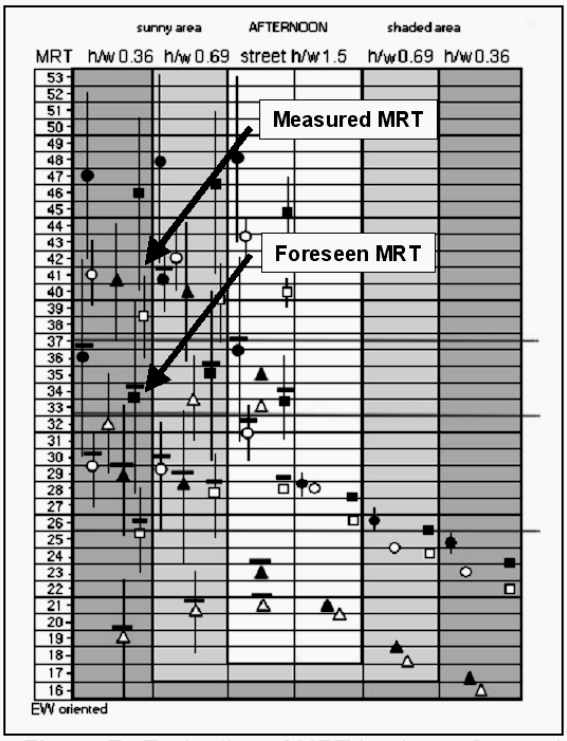

Figure 8: Evaluation of MRT in piazza Gramsci in the afternoon with the shading device

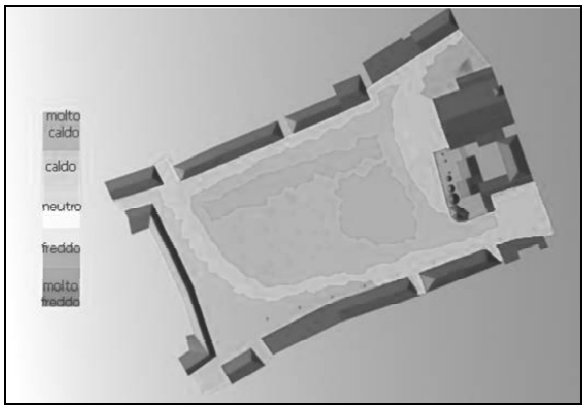

Figure 9: Comfort map of piazza Gramsci that shows the hottest areas during the afternoon

5. CONCLUSION

The lessons learned in this Milan study are:
- the important role of "urban niches" and traditional environmental control devices which can really help to promote vitality in urban spaces through microclimatic mitigation vegetation and better thermal comfort.
- the positive role of simplified methods to give at an early urban design phase a rough evaluation of MRT which is the most critical variable in thermal comfort evaluation[2].

MRT evaluation can be done trough the RUROS graphic tools (Figg 7, 8), which is also useful to roughly map comfort condition in urban spaces (Fig 9).

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