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Occupant Satisfaction in Post-Refurbishment of Historic Buildings

Baroque case studies in Valletta, Malta

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ABSTRACT: This paper evaluates occupants' subjective response to controlled architectural interventions in listed historic buildings, as part of a comprehensive plan to restore, rehabilitate and re-use the edifice. The overall strategy was to monitor a series of historic buildings, which typically represent the same period, namely 16th century architecture, depicting the Baroque period in Malta's World Heritage Capital, Valletta. Such buildings often had discrete traditional physical features, such as ventilation stacks through their thick massive walls and an open courtyard, generating the typical introvert planning. These assisted the acclimatisation of their indoor spaces. Interventions were limited to exposing their thermal mass and re-activating the original features. The buildings were partially assessed for their thermal performance through a post-occupancy survey (POS), based on subjective evidence. Questionnaires and structured interviews were conducted with office staff, two years after entering the commissioned refurbished buildings. Results indicated that the revival of modest passive design solutions was effective in attaining comfort levels today, thus reducing the dependence on energy guzzling modern environmental control systems. This suggests that such feature-revealing interventions can be easily adapted to other similar historic buildings offered for refurbishment, thus achieving energy efficiency all round, also reducing their overall carbon footprint.
Keywords: comfort, post-occupancy survey, thermal mass, passive cooling, energy, cultural heritage, carbon footprint.

INTRODUCTION

As part of a revitalisation programme of cultural heritage all over Europe, historic city centres are being resuscitated through the architectural refurbishment and re-use of listed buildings. Given their heritage sensitive character, such buildings cannot accommodate and hide the standard air conditioning or ventilation systems with complex ducting layouts and respective services, since out of their own historic nature the fabric typically needs to be exposed throughout. This presents a stronger design challenge to expose and exploit the natural bioclimatic features of the original buildings, as these were often blatantly or unwittingly ignored through earlier refurbishments in the 1960's and 1970's. Moreover, at the time the emerging energy-conscious design trends and thermal comfort standards had not yet been fine-tuned as today, on the threshold of the 21st century.

BACKGROUND

At the onset it was necessary to understand the need to elaborate on the ultimate objectives of a questionnaire survey. These need to be carried out on the basis of proper design and planning based on a good degree of clarity of goals. What is often considered a simple questionnaire or an informal interview could easily turn out to be a hollow fruitless 'chore'. Oppenheim [1] underlines the case that setting up a questionnaire and interview survey is no simple task.

> *" Fact-gathering can be quite an exciting and tempting activity to which a questionnaire opens a quick and seemingly easy avenue; the weaknesses in the design are frequently not recognised until the results have to be interpreted – if at all then!"*

Although questionnaires and interviews may not seem challenging enough, if not properly designed, output results, probably inadvertently collected in a misguided manner, could lead to pompous conclusions.

Through a pilot study of a similar single case study building [2], here referred to as building one, and earlier studies with subjects in school buildings by the author [3], the lessons learnt were that questionnaires and interviews need to ultimately address the primary goal of the study, in this case thermal comfort and its constituents. It was realised that certain questions may have been internally conflicting, others generating self-implied answers. Such refinements were addressed in this broader four case study post-occupancy survey.

LITERATURE REVIEW

Earlier established work by Leaman, Bordass et al [4] in their BUS (Building Use Studies) in 1985, sets forth a standard comprehensive twelve-page questionnaire prepared for a generous sample of over fifty office buildings with a population sample of 125 per building. Considering the limited size of offices in Malta, particularly in the wake of upcoming trends in refurbishment and re-use of historic buildings in Valletta, Malta, in this context, Leaman's BUS questionnaire was considered too complex for a staff contingent of eighteen, occupying an equally small building footprint of around 150sq.m., spread on three floors, a third of which is occupied by a central courtyard. (Such offices are classified as 'small' by EU standards).

It is also worth noting that the footprint area of a listed historic building limits the size of the office and its potential expansion. Business directors often claim that the low potential for expansion does not limit business growth; to the contrary this may be a positive asset for proper management of the limited human and physical resources [5]. Therefore the history of the building and its size can actually curtail unwarranted multi-faceted energy wastage. Endorsed maintenance and good house-keeping also enhances cultural appraisal of the country's heritage.

Further work by Bordass, Bunn et al [6] as part of their PROBE [7], a building survey undertaken in 1999, forty nine variables were categorised in twelve groups of independent parameters for a 'sample' of sixteen representative buildings. Leaman and Bordass [8] state that

> *"many surveys end up with too much data and not enough time to consolidate and analyse the results. A smaller core data set avoids this 'data bloat' problem, and also releases time for managing the wider data set".*

This is what made benchmarking achievable as surveyed under BUS with a large buildings sample of over 50. However in the context of the survey behind this paper this was not achievable due to a sample of four case studies with less than 20 users each. Although the sample choice was a rigorous double short-listing process from an exhausted list of 32 refurbished historic buildings, none presented any sample of over a 50 staff contingent. Other parameters such as the building's history and its architectural integrity were considered more important.

The same work [7] highlights the case that a smaller core data representative sample can give a very good general overview (without benchmarking) while, on the other hand, a broader survey over scores of buildings with a more intricate questionnaire survey will result in benchmarking. Very often an overview in a relatively new field of study (as in Malta) becomes more important than the detailed deductions. Therefore the work reported in this paper modestly purports to do just that. It contends to give general trends rather than specific findings.

AIM OF THE STUDY

The aim of this paper was to assess human response to refurbished built form. It sets out to explore occupants' assessment of thermal comfort and their knowledge of the potential of traditional built form to control the indoor environment. Subjective feedback was collected through a questionnaire survey and a structured interview.

It is therefore of paramount importance to generate a user-sensitive approach not only in new build design but particularly in the acclaimed '3R', – to restore, refurbish and re-use – three-in-one architectural commission of a historic listed building [9]. Referring to dated listed buildings Parsons [10] goes on to state that in the design of a refurbishment and other changes for a re-use to a building…

> *"…it is useful to exploit the built environment as an asset, to determine which are the prevailing environmental conditions, but if a subjective assessment can give a percentage of dissatisfaction, then that is a bonus not to be missed."*

Existing built form presents the opportunity to monitor and predict new scenarios that are unavailable on a virgin green site or a total rebuild job. This field study is primarily concerned with the human dimension of thermal performance of buildings. The subjective survey was designed as a binding instrument to other tools used as part of a greater study forming the basis of a four-year research project [11]. It was projected to assess subjects' views about the design intent of the architects behind the original versus their present day use of the historic edifice.

METHODOLOGY

Choice of Case Studies The case study buildings were selected not so much on their occupants, but predominantly chosen on the basis of their historic nature, their inherent physical features and their architectural integrity, being as authentic as possible to their original design. The type of uses and consequently the respective occupants these bring with them were only given secondary importance. However underlying trends were never disregarded: If not fully refurbished, all case studies were upgraded to modern comfort, health and safety standards – even if to a marginal degree. Such an

upgrading included only new sanitary facilities, services, finishes and furnishings, whereas, being listed buildings, full refurbishments were only limited to re-opening blocked partition wall doorways and removal of timber panelling and false ceilings. These influenced natural ventilation and thermal mass respectively in the building's thermal performance.

THE CASE STUDIES

All four case study buildings were built in the same era, typically 17th century houses, originally designed as *Palazzi* or modest city dwellings for titled families in Valletta, built circa 1600- 1670. The architectural style was predominantly Baroque, with touches of neo-Classical proportions. The typical planning format consists essentially of an imposing hallway, followed by an open staircase, leading onto a central courtyard, of approximately one fifth to one fourth the footprint area. The planning is introvert, with no back yards or front terraces, spread out on three floors with an overall height of circa seventeen metres. The ground floor, and even the first floor (called the *piano nobile*) typically has a higher floor to ceiling height. The front room was originally the lounge area, regularly entertaining guests, as part of the pomposity of the day in the Baroque period.

Such buildings are built in local stone, a.k.a. *globigerina limestone*, which manifested the mason's craftsmanship through ornate external and interior architraves, cornices and angels in prominent places. The Baroque style exploited the massive deep soft stone walls for such sculptural embellishment. The heavyweight structure also contributed to resilient environmental characteristics, resisting temperature extremes through thermal mass and ventilation across high spaces. Today most of these buildings have been converted into small scale offices of around 20 staff contingent, some even family run, or used as a family business and habitat *en suite*, rendering them to be truly a *casa-bottega* (house-workshop), as the order of the day. These buildings only had localised seasonal heating or cooling (heaters or fans), manually controlled by occupants independently in each office space. Figures 1, 2, 3, 4 illustrate the respective floor layouts for such buildings.

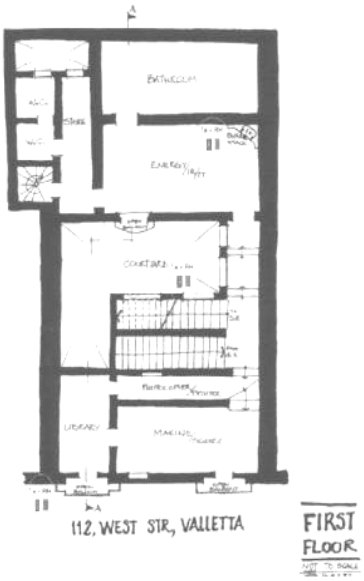

Figure 1: Blg.1: 112, West Street, Valletta

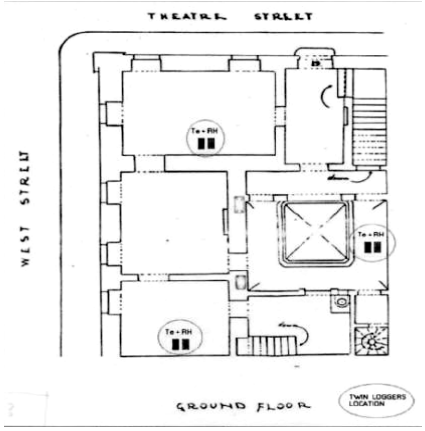

Figure 2: Blg.2: 89, Old Theatre Street, Valletta

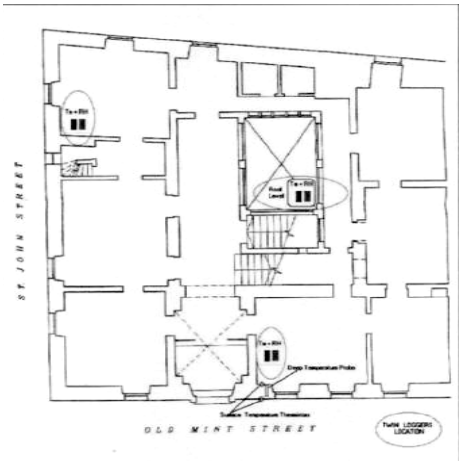

Figure 3: Blg.3: 36, Old Mint Street, Valletta

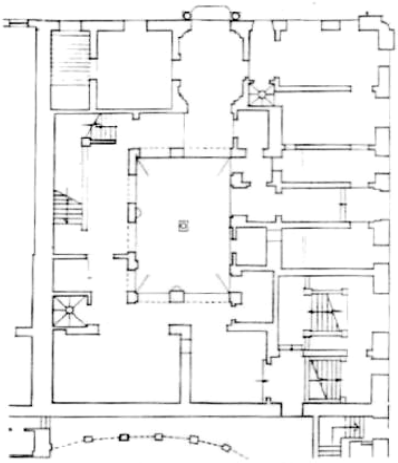

Figure 4: Blg.4: 115, Street, Valletta

RESULTS & DISCUSSION

Before reporting on the findings proper, an overview is first given with information concerning the four case studies surveyed. This is reported under questionnaire and interviews respectively.

The Questionnaire Survey *Sample Size:* Due to the small population sample, after the questionnaire survey, follow-up structured interviews were carried out based on a standard set of questions. Since the number of users in each building numbered less than twenty, no sample representation was done. Instead, the subjective survey was aimed at accessing the full staff contingent and regular users of the buildings. Table 1 gives an overview of the sample size and respondents for each case study building.

Table 1: The four case studies - samples and response received

Building	Use	Occupants	Responses
ONE	**Offices**	**18**	**16**
TWO	**Residence**	**5**	**5**
THREE	**Offices**	**16**	**16**
FOUR	**Café**	**8**	**6**
TOTAL		***47***	***43***

After subsequent collection and analysis, interviews were carried out over three consecutive days on Tuesday, Wednesday, and Thursday, in April intentionally selected as mid-week days, away from any potential weekend comparative influences. April is also considered as a representative 'average' month being in mid-spring, also having weather conditions reasonably identical to autumn. These shoulder months were considered practically free from the influence of peak summer/winter conditions when subjects answered questionnaires.

On the three days of the interviews for the full survey the weather was fair, with outdoor air temperatures varying between 18 - 21°C and relative humidity between 63-85%. Wind speed stood at an average 3.5m/s. This was extracted from collected official Meteorological data for the respective months of the full survey.

Questionnaire Response: The questionnaire was personally delivered to each subject at the respective building by the author. Out of a total (full) population of 47 persons a good representative sample of 43 responded. The other four lost the enthusiasm they showed when receiving the questionnaire, a fortnight earlier. This sample response, equivalent to 91%, is considered as 'very good'. Babbie [12] classifies response rates of 50% as adequate, 60% as good and a response rate in excess of 70% as very good in such questionnaires. Although such a high response rate was achieved, some secondary and more personal questions related to behavioural patterns after working hours were either left unanswered or invalidated by comments. However the questions related to the thermal environment of the building were all correct and fully answered. These are the ones reported herewith. For reasons of a small sample survey and some partially incomplete questionnaires a more specific in-depth subjective assessment of the building was felt necessary through a one-to-one interview.

The Structured Interview Interviews have distinctly different purposes – from press interviews, therapeutic interviews, to employment interviews. There are essentially two different types of interviews concerned with subjective surveys [1]. These include exploratory interviews, better known as in-depth, free-style interviews, or standardised interviews, normally used for large samples such as opinion polls, market research, population census and government surveys. In this context the exploratory or in-depth, free-style structured interview was conducted. A set of questions was posed in accordance with the aims set out following the introduction to this paper.

Interview Feedback: The users were generally unaware of the in-built passive physical features of the buildings. At the time of the survey no mention was made of these originally designed features such that the occupants will not be influenced in their responses. There was also a fear by architects and owners that staff could raise an eyebrow over potential health problems (typically Legionnaire's disease, Sick Building Syndrome) [13] and associated sickness benefits.

Given the limited length of this paper, only an overview of general findings is given. Output results were detailed at length in a comprehensive research project conducted by the same author [11].

GENERAL FINDINGS

The fieldwork revealed that with a refurbishment and re-use of historic buildings, inherent traditional physical features were abandoned for new technological solutions, such as air conditioning. Users were largely unaware of the potential of such features to modify the indoor environment, to deter seasonal discomfort. On the other hand, building owners, if aware of them, blatantly ignored them, for lack of knowledge about their quantifiable effects. A subtle lack of faith was expressed in the potential effectiveness of such features to achieve 'natural comfort' and a significant energy saving.

The use of natural ventilation was greatly under-estimated in terms of its potential to cool the buildings, particularly through night purging. One reason for its disregard was due to noise pollution from traffic and regular street vendors, since most (converted) office buildings lay in a mixed residential and commercial area. Another concern was air pollution, though to a lesser degree. Night ventilation was claimed "unthinkable" for security reasons.

The heavyweight construction was never perceived as a positive asset – as a thermal sink. To the contrary, the monolithic construction was negatively viewed as a source of dampness, increasing the %RH of the space, apart from promoting flaking stonework and decoration, with the occasional foul smell.

Simple suggestions made by some respondents include the use of mechanical ventilation to lower high RH levels and expel foul smells from rising damp. Night purging, if seriously considered, was suggested to come with security grills and insect screens. Finally it emerged that a greater awareness among users was necessary to operate shading devices and open windows for the right ventilation regime.

CRITIQUE

Admittedly the author's original ambition was to use findings from this survey to compare results with other buildings at EU level or worldwide, thus increase the scope of the study, but this was not possible due to the small sample size as aforesaid; experience in earlier work also shows that occupants tend to fear loss of confidentiality, thus questionnaire response may not be so frank and spontaneous, given the small office staff contingent. The importance of a broad sample for pertinent benchmarking was also highlighted by O'Sullivan, Jones, Vaughan et al [14] in 1987 and also in their LINK project in 1994 [15].

CONCLUSIONS

Contrary to omitting questions about spring and autumn as suggested by Bordass and Leaman [7] for the PROBE 2 study, independent studies by O'Sullivan et al [12] and the author [9] had revealed that these months were actually more critical for energy savings. Based on trends in seasonal use of environmental control systems during shoulder months, spring and autumn, between relatively mild winters and hot summers (typical Mediterranean climate), it is evident that HVAC systems were being switched on as early as April-May and Sept-Oct, as a reaction to the onset of nominal thermal discomfort in spring and autumn respectively. This attracted a greater demand for electrical energy per annum.

Through this subjective survey it was established that occupants now prefer to rely on the in-built physical features of the buildings, rather than switch on air conditioning during spring and autumn when temperatures are less mean. This naturally attracts not only an energy-cost saving but also an environmental benefit in reducing the carbon footprint of the building. Moreover, such inherent features are also exposed as part of the cultural heritage of the country. Hence such refurbished building stock may be deemed as being sustainable all round.

OVERVIEW

Today business managers argue that instead of moving into an 'out-of-town' large modern open plan expandable office with leading edge facilities, it is worth considering the trade-off to having a small compact office with adequate facilities in a more manageable historic edifice with a prestigious address. This has been found to curtail human resource complaints, building maintenance and utility bills. This results in an overall reduction in the carbon footprint of the edifice.

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