

OCCUPANT INTERACTION WITH VENTILATION SYSTEMS

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A SOCIOLOGICAL PERSPECTIVE ON TENANT BEHAVIOUR
WITH REGARD TO DOMESTIC VENTILATION - AN EXAMPLE
AT LAUSANNE, SWITZERLAND

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Synopsis

Airing is a simple and daily action. However, it is difficult to define - within the complex relationship of the architectural and technical data of an apartment building - the thresholds of personal comfort of each tenant and the general attitude towards energy-saving and environment pollution.

This research attempts to offer partial answers as to "how" and "why" inhabitants of a rented apartment building behave as they do in aeration. In order to do this, the authors adopted a two-fold approach: first, by using computerized data recording of outdoor and indoor temperatures per room, the number of hours of sunshine, the surface temperature of radiators and the opening of the windows in each room; second, through interviews with the tenants, sometimes filmed, in order to ascertain their behaviour patterns and underlying motivations in ventilation.

The results of this study point to the importance of the diversity of interactions, taking into account the existing infrastructure and a person's awareness of energy problems, his technical knowledge, his "thermal" background, his needs and expectations of comfort. Combining with all these elements are the different types of motivations for window opening: domestic, ecological or environmental, communicational and social, those concerned with health and hygiene and of a physiopsychological nature.

Among the explanatory reasons for this plurality of motivations and ways of interaction are: the problem of the flow of information and contradictory orders between heating specialists and hygienists, the lack of understanding about the effects on energy an open window can have, the desire to safeguard the individual freedom of action in domestic situations, the tendency to leave necessary measures to the "specialists".

A Sociological Perspective On Tenant Behaviour with regard to Domestic Ventilation - an example at Lausanne, Switzerland.

1. Introductory

Concern about energy-saving has led engineers to design increasingly more personalized and efficient heating processes. However, this technology often comes up against one basic and paradoxically unpredictable variable: the behaviour of occupants. Consequently, we call upon the social sciences to serve as interface and link between the "users" and the external "deciders".

Individual behaviour in relation to heating problems intervenes on two levels:

- 1) heat emission - in the choice of temperature, i.e. turning radiators on and off or requesting individual preferences to those in charge of the household heating
- 2) Heat regulation - through air ventilation or airing (kitchen and bathroom ventilators, opening and closing of windows).

This potential for individual action creates a series of presuppositions relatively independent of technical constraints (referred to later), but also leads to engineering concerns for hygienic housing: if there is insufficient ventilation, the physical deterioration of the building increases on a medium or long term basis.

"If uncontrolled ventilation is acceptable in temperate regions or on our latitude during a temperate period, in cold regions and during winter it accounts for approximately 20% of all energy costs for heating. Since the energy crisis, some measures have been taken: weatherstripping window joints, limiting of window openings, reducing the air flow or the duration of mechanical ventilation. These measures have proved effective for heating conservation but disastrous for housing hygiene, both for the health-giving qualities of air and the dryness of walls." (Iselin and Guillemin, 1984:49, on Occupant Behaviour in Ventilation - A Sociological Perspective).

Ventilation is therefore a complex problem that, among other things, depends largely on its users. There are certain exceptional and rare cases such as mechanical ventilation of certain rooms, particularly W.C.s and bathrooms.

Studying occupants' behaviour in relation to their habitation gives us a thorough understanding of what is happening and the underlying motivations. We should then be able to create suitable technically innovative improvements.

For several years, a certain amount of social science research has been devoted to this particular problem of energy control. Two recent studies deal specifically with ventilation and are worth mentioning here: Vezin's synthesis of various studies that focuses directly or indirectly on the psychosociological dimensions of domestic ventilation (Vezin, Lorimy, 1985); and Dard's study that examines mechanical ventilation, among other aspects of energy consumption. Many other studies approach ventilation as a practice of household energy consumption (cf. especially the studies of E. Monnier, 1985 and IREC-IES on "Energy Cultures" to be published in 1986).

In this context we adopt a double strategy for our research: firstly, the psychosociological and cultural dimensions of the ventilation of a rented urban habitat; secondly, the combination of a qualitative approach (concentrated interviews recorded on video) and a quantitative one (recorded indoor and outdoor temperatures of the housing under study and the recording of window manipulations).

2. Research objectives and description of the survey's "terrain"

Our work is part of the task of Annex VIII ("Occupant behaviour towards ventilation systems") on the conservation of energy in buildings, studied by the member countries (e.g. Switzerland) of the International Energy Agency. Its purpose is to answer the following two questions:

- 1) How do the occupants of rented flats in apartment buildings react to ventilation?
- 2) Why do they behave in such ways?

The final objective is to make information available that can motivate housing designers and occupants and make them more aware of ventilation problems within the habitat.

The survey was made in an apartment building of 24 rented flats located in the northern suburb of

Lausanne near two busy roads. Monitored for six years by an acquisition data device with 600 measure points recorded automatically every five minutes, this building has already been the object of much research. The recordings were indeed various, the most important for our survey being the outdoor temperature and the number of hours of sunshine, the indoor temperature, the surface temperature of the radiators, the opening of the windows of each room (15 hooked-up apartments) and the electricity consumption of each household. Moreover, from the start, we used relevant previous information accumulated from studies on the behaviour of the tenants in relation to their building environment and boiler heating system. Our procedure took these various quantitative elements into account and compared them as closely as possible. The survey itself consisted of a series of detailed, focused interviews with the building's tenants about their reactions to ventilation and the different practical and symbolic aspects that correspond to them. Video filming - in order to include an audiovisual document - completed our approach.

Several of the most informative graphs used as references are included in the appendices (can be referred to when measuring is mentioned in the text).

3. Findings: first reflections

Owing to the strong social homogeneity of the building's inhabitants or more exactly to the (quantitative) non-representativeness of the disparities observed in relation to the social norm, we had to give up one of our original objectives: the pinpointing of average behaviour profiles from sociological variables such as age, training or the socio-professional status. Our statistical analyses refer instead to thermal data created by the practice of opening windows. These are linked to variables that are infrastructural (residential location according to floor levels), functional (assignment of functions to the different rooms in the flat), and environmental (geographical position of the apartment).

These analyses have taken into account the climate criteria, especially outdoor temperatures. Thus, within our survey's target period, we singled out the two weeks that recorded the most important disparities: the week of 18th to 24th January 1986, with an average outdoor temperature of 3.2°C, and

the week from the 8th to 14th February 1986 with an average outdoor temperature of minus 7°C, i.e., a "warm" week and a "cold" week for the season. The comparison of the indoor temperatures and the number of times windows were opened helped verification of the influence of the climate factor.

4. Observations

The average number of times that windows are opened clearly decreases when the outdoor temperature drops, creating a homogeneous indoor thermal situation.

The radiators in the various rooms of the flats are the object of differentiated manipulations: the bedroom radiator is probably adjusted whatever the outdoor temperatures and tends to be closed at night. The living-room radiator is left open, unlike the kitchen radiator which is closed.

Opening the living-room windows seldom varies when the outdoor temperature drops; on the other hand, tenant behaviour is very different in the bedrooms. Window opening duration is more important here than in the living-room and clearly affected by the outdoor temperature.

We can already draw two intermediate conclusions:

- a) A flat's aeration/ventilation in winter is primarily done through the bedroom;
- b) Maintaining a constant indoor temperature in the bedroom seems to come more from manipulation of the windows (which decreases when weather gets very cold) rather than from the radiators.

We have identified fluctuations in the opening of windows and in the use of radiators, according to floor levels. Although behaviour patterns and the radiator manipulation are quite similar, the fourth floor (the highest and best insulated at the top) constantly recorded indoor temperatures relatively high (over 25°C in the living-rooms, whatever the outdoor temperature is).

Paradoxically, whatever the outdoor temperature - especially when the weather is fine - the fourth floor tenants open the windows more often than those of the other floors (especially at night). The tenants on the first floor open their windows more during the day when the weather is not too cold. Here

we enter head-on into the role of behaviour patterns and, at this stage, into the realm of suppositions.

Are the first floor tenants more often at home? This would explain the constant in the number of times that windows are opened. To put it another way, do the second and third floor tenants go out more during the day? Do all the fourth floor tenants at night have indetical behaviour towards aeration? Or rather, do these ventilation behaviour patterns depend on indoor temperatures? We could believe so since paradoxically it is those who open most often (fourth and first floors) who also benefit from the highest indoor temperatures. Finally, we wonder if each floor level hasn't its own culture of warmth and cold - as if neighbours communicate and share together norms of comfort and behaviour regarding the manipulation of radiators and windows. Two other factors also play an important role thermally: the flat's position in space and its orientation. The occupants who have a living-room facing south (the sunniest) have the highest indoor temperature. Paradoxically, they tend to open their windows more frequently at night.

By deduction and interpretation of the measurements, we could almost point out the biggest "ventilators": those who use ventilation sparingly; those who are "chilly", those who like the cold; those who manipulate the radiators and/or windows, or those who do not.

The interpretation of these quantitative data gives general indications of what is happening in the building concerning the appropriation and use of the rooms. They also suggest differences in behaviour according to floor levels and the orientation of the flats and the rooms.

We are thus able to describe, to observe situations or behaviour patterns generally, but we have no explanation. To explain and analyse we must go into further descriptive detail, focusing on the individual rather than the group - in order to be better able to generalize again.

5. Qualitative approach of occupant interaction in ventilation

The information gathered from direct contact with our tenants enabled us to progress methodically through each nuance and complexity. It proved quite difficult to study the behaviour patterns of the interviewees and the concrete, specific findings as recorded by the measuring equipment. Nevertheless, it was this generality of daily actions (in domestic ventilation) that we wanted to explore. The work brought to light numerous an interesting dimensions: male-female ventilation responsibility, the contrast of people's thermal sensitivities (those who are warm, those who are cold), the social behaviour and the period of socialization, the different national cultures, the reactions to the window-radiator relationship, the technical ignorance and lack of knowledge of energy problems, the personal hypotheses and preferences regarding the installation of heating systems and aeration. All these elements have their importance. As we cannot go into too much detail here we will merely point out two key fields observed with our inhabitants of the target building: the diversity of interactions and motivations in domestic ventilation.

6. The many facets of interaction

Contrary to what one might imagine, the action of airing is of considerable diversity. It depends first on an existing infrastructure, the type and number of windows, the position of the flat within the building, its noise environment, the number of hours of sunshine, the quality of the building's exterior, its heating installations, and many other elements that are "imposed", that the tenant-user has practically no control over.

However, further factors arise in the infrastructural context - factors concerning the tenants' personal taste in relation to the functional specialization of the different rooms of a flat. Thus, interactions in ventilation can differ according to the size of the household, the degree of occupancy of the flat and even in relation to its interior arrangement. Furthermore, it is clear that practices vary according to the type of room: one does not air in the same way a living-room, a kitchen, a bathroom or a bedroom.

Other variables, referring to the user himself, add to the great variety of these factors. Here are some of the points worth brief mention.

First, the level of awareness of energy problems. Is the individual interested in energy and especially, in what way does he feel concerned? Is he able to place ventilation within the energy context, does he see the mutual relationship and effects? These questions, among others, can locate the threshold awareness and responsibility with regard to energy consumption.

The following point, closely connected to the preceding one, concerns technical knowledge on the domestic use of energy. Does the user know the official rules recommended in ventilation? Does he adopt rational measures in his behaviour towards ventilation, particularly the window-radiator relationship and the duration of opening? Does he look for and is he capable of understanding the information offered on energy and its domestic management?

Moreover, it seems to us important to report the role of particular behaviour and habits that have an effect on ventilation: smoking or living with smokers, cooking habits (Spanish cooking, frying), steam from the kitchen or the bathroom. These reasons create a need for air renewal and can have important thermal consequences. The same with habits: the occupant's "thermal history" must be considered through the succession of different apartments rented and their thermal functions, and through these people's work environments. As we observed in our apartment building example, heating and aeration demands are different for different people - a car mechanic exposed to draughts or someone working in an overheated laundry.

We must also mention people's different needs and expectations of comfort. Everyone or at least every household have their own notions of comfort. The quest for comfort and well-being is closely connected to everything about heating, its regulation and ventilation. There are those who like dry heat, those who prefer the cold, those who seek out draughts, or on the contrary, avoid them. There are people who appreciate a uniform temperature level in every room and others who adopt a thermal strategy specifically for each room of the flat. This search for comfort also includes using shutters or blinds

and their indirect thermal effects, the bathroom and the kitchen; all behaviour/interactions orientated by the concern for comfort directly influence energy consumption through the heating-aeration relationship, or more precisely, the window-radiator dialectic.

Furthermore, another element deserves to be considered and linked with individual behaviour: how occupants open the windows. We are impressed by the number of ways there are. There is diversity first in the angle of opening: certain people open a window completely, others hardly leave it ajar, still others use only one side. Some people have their own ways of blocking the opening. The angle variable is naturally associated with the opening time. Three extreme cases are roughly presented: 1) large angle of opening during a short time, 2) limited angle of opening over long periods (3-36 hours), 3) limited angle of opening for short periods (5-20 minutes).

Furniture arrangement also often determines the angle of opening and particularly when there are indoor plants near windows. Other sources of opening determiners are tables, chairs, pedestal tables, bed position and even knick-knacks placed on window sills.

Choosing which window to open affords even more diversity: some households never open certain windows, other often. These differences are often explainable by reasons of domestic convenience and household maintenance: such and such an open window would get in the way, another is more accessible, still another, if it were open, could damage the furniture... or even a clock, as we ourselves have observed.

Such diversity of behaviour has multiple origins, shaped by the individual: his value system and awareness of energy problems, technical knowledge, concept of comfort, habits, idiosyncrasies, housing history and professional thermal background, domestic environment and activities, personal appropriation of interior spaces and interpersonal relations with neighbours.

7. Reasons for opening windows

We are not the first to point out the multiplicity of reasons that in a general way can lead to opening

windows. There has already been mention of the variety of functions that windows can fill. However, we find it interesting to re-examine these two key elements of ventilation with the residents of the building studied, in relation to their sociocultural specificities and their location in the building.

Bearing in mind that each flat has a balcony (or for first floor tenants, direct access to the lawn surrounding the building), the various reasons for opening a window or window-door of the balcony fall into five main categories. Each of them includes a different number of motivations whose importance is not necessarily meaningful or revealing for the individual except perhaps for the quantitative loss of energy. It was not intended to take into account "emotional" or psychosociological factors.

For each of the five following types, we have again used the (nonexhaustive) list of the modifications.

1. Domestic motivations

The activities that involve the management and maintenance of the inhabited space - the satisfaction of needs called "elementary" - are the basic motivations given for airing. In fact, housekeeping, temperature regulation, the drive for optional comfort, meal preparation or the consumption of hot water all have effects on ventilation behaviour.

The persons questioned about their motivations for window opening gave the following reasons: steam and cooking smells, to hang out the wash, dry the freshly washed kitchen floor, air out after sweeping, clean and shake dusting cloths, to sweep the balcony, eat on the balcony, eliminate odours from entertaining, to hang out the floor cloth on the window sill.

It is obvious that "eating on the balcony" concerns only summertime or between-seasons. There could therefore be temporal overlapping and our intention is to give an overall view.

2. "Ecological" or environmental motivations

In our first chapter, we briefly made mention of the window's role as an extension of the inhabited space, as a true link with the surrounding environment, between public and private life. The use of

the window also appears as a link with nature, as an ecological contact or relay, especially in our case study of tenants. Of course having a balcony no doubt contributes to reinforcing and making easier the natural liking for contact with the outdoors. Nevertheless, we are quite surprised to find this motivation type with such intensity and as such a constant.

The list of motives which were referred to are as follows: to check what the weather is like, enjoy the view, the greenery, look at the mountains, the trees, grow potted herbs and flowers, sunbath, feel the fresh air, look at the snow, feed the (winter) birds.

Here again, some of these motivations concern only summer or the fair-weather days of the other seasons.

3. The communicative and social motivations

The window is important for sociability even if this function is not recognized or referred to by everybody. In fact, certain people affirm that the window is useful for communication, even if briefly; others admit using it as a social control tool for the apartment building, or as an aid in watching over children.

The following reasons have been mentioned: to communicate, to say hello or talk to the neighbours, to talk with passers-by, to watch and check on the children - their comings and goings - when they are on a visit, leaving for school (girls, especially), coming home late.

Certain of these motivations are less frequent than others (such as talking from the window). Some are important, even part of the daily routine.

4. Motivations linked to health and hygiene

The tenants of our building all know to a certain degree that airing is indispensable to an organism's health and, for the most part, necessary for housing hygiene. Moreover, almost everyone questioned mentioned the need to freshen indoor air. A whole series of habits goes hand in hand with this explanation of hygiene. It is sometimes difficult to distinguish between a legitimate practice for health's

sake or for comfort's sake. We can use the example of opening bedroom windows during the night: the majority of those who state explicitly that they "cannot sleep with the window closed" justify the habit to sleep cooler (or at a lower temperature from elsewhere in the flat) "because it is pleasant" rather than "because it is healthier"; a few tenants stated both reasons together.

The motivations that make up this type include: making the flat healthier, avoiding dampness and mildew, opening for sleeping, needing fresh air, going to the balcony to smoke (in order to avoid disturbing others).

5. Physiopsychological motivations

Sometimes the interviewees had trouble explaining and justifying the need to open a window. This behaviour appears instinctive, compulsive and hard to clarify. It is often expressed as a "need" or desire.

Among the motivations of this type: the need to just "go and see," the need to look outside, the desire to daydream at the window, the need to breathe in fresh air, to open when doing the dishes.

As we see from this brief description of motivations and summarized typology, the act of opening a window has multiple origins. Each has an importance within the residential microcosm of the Lausanne building's tenants. We do not attempt to organize them into a hierarchy or give greater importance or place to one over another.

Furthermore, if the interviews did help to describe and clarify the motives that triggered the opening of windows, they also pointed to reasons that accounted for closing them. For the most part, these were due to the surrounding environment, seasonal weather conditions and a number of cultural habits: various noises (cars, children playing in the yard, rain on the blinds); cold, or hot weather (sic); dust from polluted outdoor air from the immediate environment (re-sic); security reasons; keeping out cats.

8. Confusing communication

Our intention with regard to the users of heating and ventilation devices has never been to find fault with their lack of coherence. That would mean denying individual freedom and the irreducible sphere of individual needs and choices of expression. It would also imply that there is a "right way of doing things" - a behaviour pattern in ventilation that emerges as so rational that it is imperative in itself. This rational model should even in the last instance integrate the potential of individual freedom of action. There is no need to emphasize an absolute reference of this type: today we must bring together the plurality of viewpoints on domestic air regulation and its consequences. It is indeed clear that this situation has strong effects on the users' behaviour and state of mind.

Those in charge of applying rules and regulations often make distinct but contradictory speeches through the media - the town administrators, real estate promoters, the public services, the construction, scientific and heating milieux, the architects.

Here is an example: We all know the injunction "opening seldom but widely is better than opening a little and a long time." This idea springs from a desire for minimum energy loss and a probably more effective air change (it would be necessary to actually see the context of such a measure). However, there is another viewpoint partially opposed to this widespread and official diktat: the analysis made by Iselin and Guillemin (1984), experts in applied research in housing hygiene. Roughly speaking, they say that however windows are open, they do not provide a sufficiently effective air change; either for eliminating the excess steam accumulated in the construction material and which provokes a faster deterioration; or for getting rid of all kinds of pollutants inherent or introduced into the domestic environment. Therefore, according to this last viewpoint, the widely accepted practice can increase costs owing to the premature aging of an apartment building.

Another example: the gap between the individual user's sense of responsibility and industry's tendency to waste, e.g., proprietors buying combustibles who have little interest at stake in energy-

saving. The remaining question: what is the importance of energy in relation to a person's manner of opening windows within the material framework of an apartment building - an apartment building within the context of a specific region or country. Although our case study at Lausanne used a specific boiler-heater during a normal winter, the effects of window opening on the indoor temperature were minimal: even the most conscientious tenants lived with rather high temperatures. The energy consequences of self-discipline are therefore hard to comprehend by the individuals concerned and involve a large reality of abstraction. All these elements came up during the interviews - directly or indirectly, explicitly or implicitly. The result: feelings of powerlessness, inadequacy; cynicism, insincerity; the absurd, a lack of confidence or interest, or a feeling of irresponsibility. Almost all persons interviewed were honest about their lack of knowledge and curiosity for information, their reliance on experts when problems arise; with a vague feeling of the somewhat magic idea of being able eventually to intervene in the process, in order to "pay for what we actually consume."

The technique is not their problem. They make do with what they have. Some are sure of themselves, others doubtful, still others wonder what they must do, none manifest any absolute coherence for a climate that doesn't allow for it. Everyone, however, does have his own coherence, to a certain extent. Over and above all material, technical or moral factors or rather, by integrating them in a personal way, each user expresses through his own manner and way of doing things, a certain domestic sovereignty, a potential for individual manoeuvring within an overall system hardly favorable for it.

We can note at best a reinterpretation of the relationships between the technical devices; most often an absence of relationship beyond the one generally perceived, or rather, based on "doing," between the window and radiator manipulation. The overall relationship with the energy problems is, for the most part, an abstraction. Through the estrangement of the meaning of things (absence of evident cause and effect, contradictions in the facts and discussions about "being able" and "knowing how"), the absence of significant perceptions in user-behaviour variations, create a vicious circle leading to more and more personal detachment. It is interesting to

see the contrast here with the hypersensitivity of the exogenous and artificial temperature variations (modification of the boiler-heater's regulation curve).

Consequently, all communication with the user in energy matters should essentially take into account (and somewhat paradoxically) the following elements:

- technology and science still take more responsibility than the users are ready to assume (at least for now);
- the diversity of motivations and ways of doing things, which make up the sphere of individual domestic freedom, are respected as much as possible, even esteemed (the "symbolic" purification combines with the "rational" purification of the air);
- the message is compatible with (1) the general functioning and regulation of the building heating system (taking into account thermophile pressure groups within the building); (2) as much as possible, energy, construction, town and country planning/national and regional development policies.

More than a guilt-provoking message or one trying to build up personal involvement, the graphs analyses, and especially the interviews provide a means of communication with the user which aims at being a better integral part of the overall reality of energy.

9. Short provisory assessment

There is no "big" window opener, so to speak, in the entire apartment building. The tenants seem to be happy to open slightly, once or twice per day or less, but rarely "wide open." We have seen that this way of interaction hardly affects the indoor temperature insofar as the loss of heat during openings was largely and rapidly compensated for by the supply of heating, influenced by the outdoor temperature. In the end, the combination of window-radiator manipulation turns out to be an important indication of user behaviour; not so much step by step as, generally speaking, a strategy of indoor climate regulation or negotiation of various relationships with

the outdoors worked out by the windows and the distribution of activities within the domestic time-space.

It is difficult to compare things that have no common basis for comparison. Nevertheless we will briefly summarize what seems to us to be the essence of our research:

- the concrete bringing into perspective of a qualitative survey with multiple, automatic measures with a view to getting a realistic and finely tuned picture of the behaviour and representations of users in domestic ventilation
- a somewhat strict or at least plausible methodology for raising verifiable issues
- partial "finds" on the diversity of interaction and their corresponding points of view
- correlations between significant traits of domestic ventilation and the users' environment, age, occupation, location in the building, state of health, education and native culture
- the bringing to light of a widespread technical ignorance and a feeling of non-responsibility with regard to people who have knowledge and know-how (the specialists)
- the highly confused and incomplete nature of relevant information from the mass media
- the relatively unconscious aspect of the activities of ventilation, sometimes - concerning theorizing - the potential for a wide gap between theories and practices
- the weak general effect of the strategies of window opening on the indoor climate as experienced in the Lausanne building
- the "energy-greedy" existence of a real pressure group of particularly thermophile tenants; through their demands on the landlord's agents, they force the entire building to live with excessive heat. At the same time they nullify the potential for individual strategy in domestic ventilation.

Need it be said that each point has some common basis and is interrelated? Each detail from this research must therefore be seen within the overall context.

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ANNEX

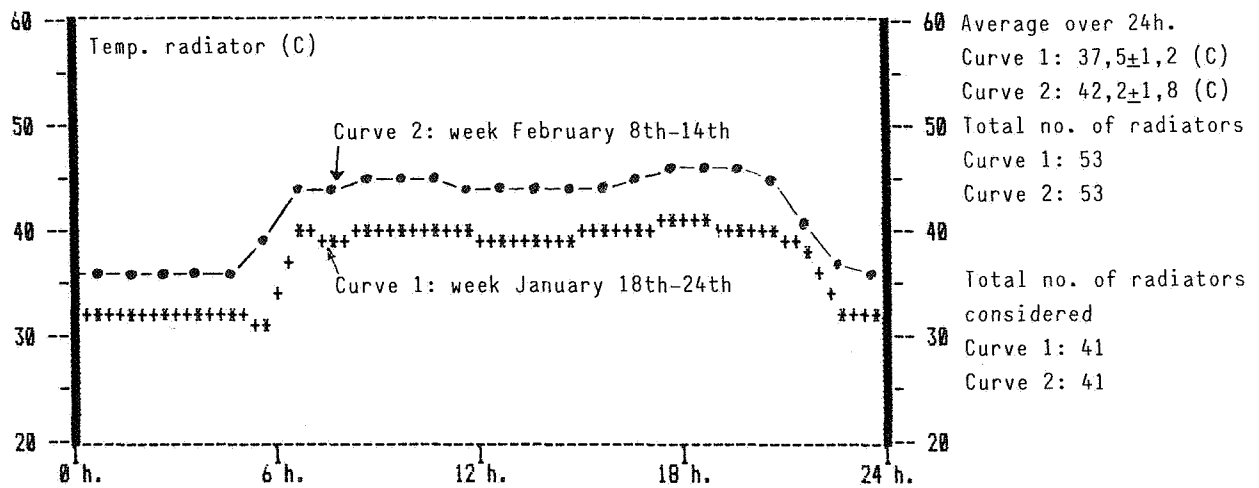


Fig. 1: Daily profile (hourly rate) of radiator surface temperatures over the "cold" week (Feb. 8th-14th) and "warm" week (Jan. 18th-24th) for all the rooms of the building

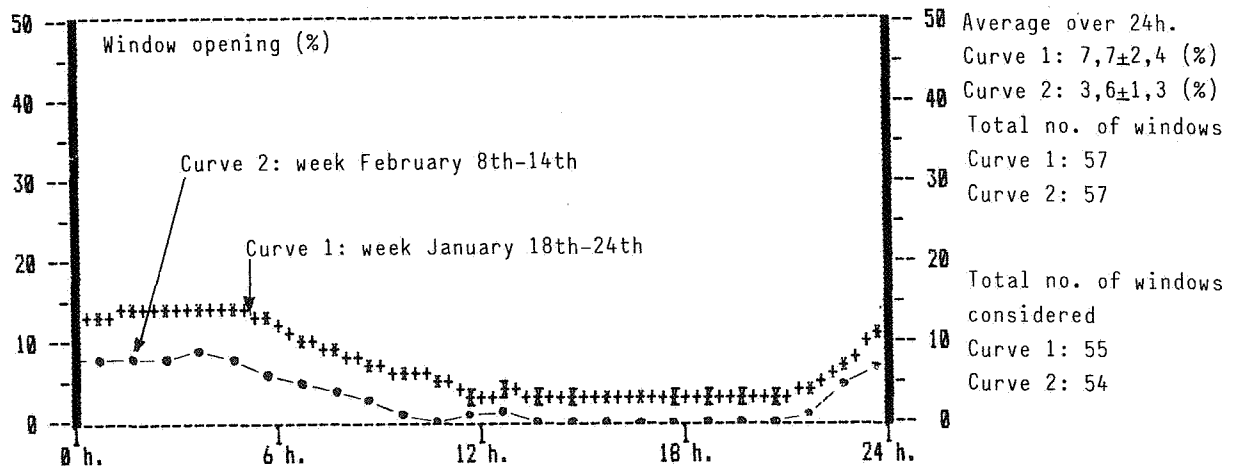


Fig. 2: Daily profile (hourly rate) of window openings over the "cold" and the "warm" weeks for all the rooms of the building

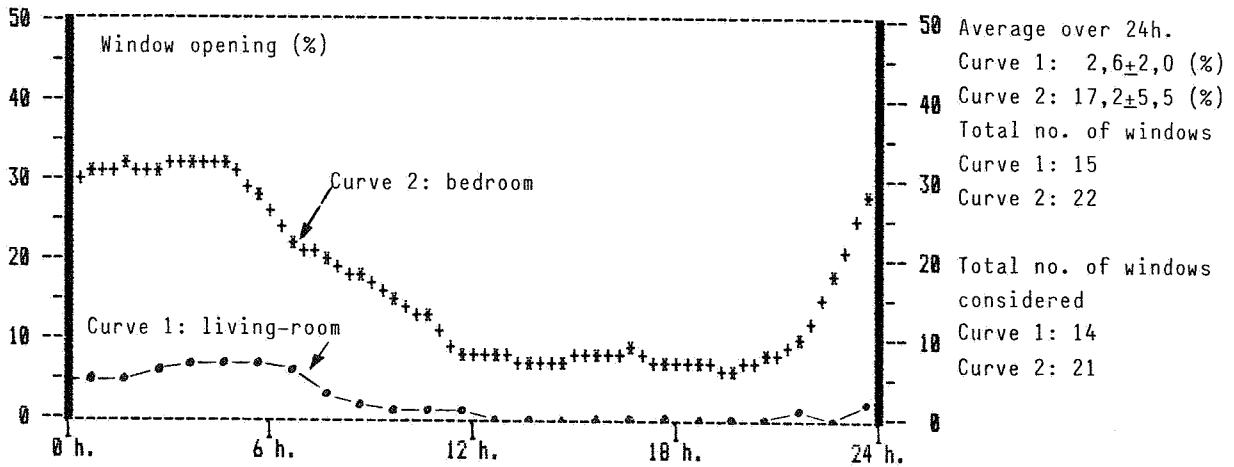


Fig. 3: Daily profile (hourly rate) of window openings over the warmest week for the living-rooms and bedrooms only

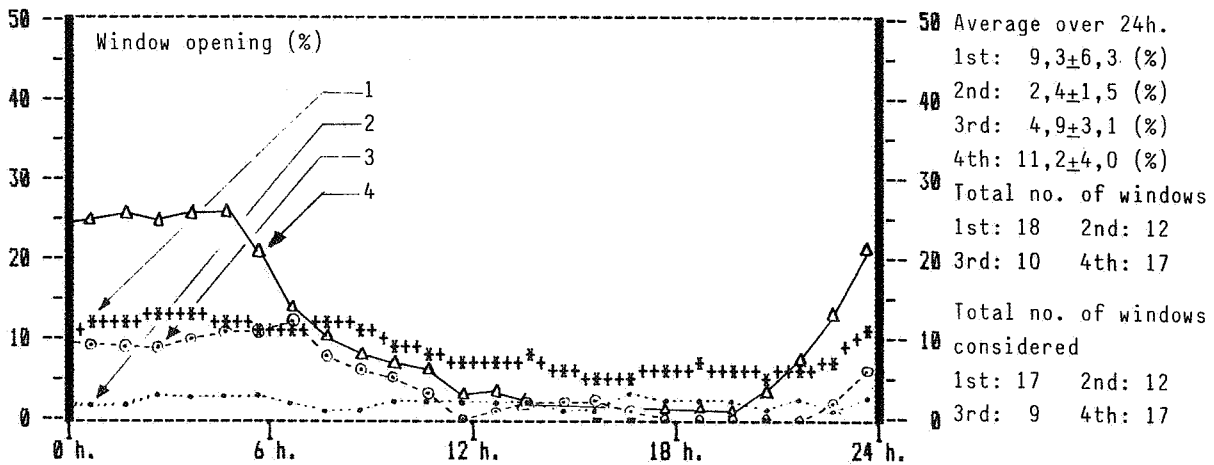


Fig. 4: Daily profile (hourly rate) of window openings over the warmest week for all the rooms of a floor only

