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The Interface Between Social Dynamics and Thermal Effects in the Design of Subsidy Housing in South Africa

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Abstract
The quality of subsidy housing provided by the government influences the lives of millions of South Africans directly. One of the problems experienced by residents in subsidy houses in South Africa is the problem of lacking thermal comfort. This leads to high levels of indoor pollution through the use of coal burning heating devices. For households who use electricity as a heat source this leads to high running costs. The resultant peak demand is a major problem for local governments and electricity suppliers. This paper proposes a framework that analyses the interface between social dynamics and thermal effects in order to formulate hypothesis for further research. The method is demonstrated with recent social research done in eMbalenhle in Mpumalanga, South Africa.

1 Introduction: Importance of the analysis of the interface between social dynamics and thermal effects

Solutions to improve indoor thermal comfort in low-income housing should contribute to an enhanced quality of life not only by establishing a more comfortable living environment, but also by reducing indoor air pollution that is associated with coal burning space heating devices uses in a large number of households in South Africa. However, if a proposed technical solution is unacceptable to the household[1], or implemented incorrectly by the household, or if this solution creates unacceptable new problems[2], chances of a sustainable improvement in the indoor thermal comfort and general quality of life are minute.

Researchers and policy makers influencing housing design must detect the social effect of technology driven solutions aimed at improving indoor thermal comfort. They should also study the effect of social dynamics on the way in which existing solutions are accepted and implemented by household members. This can only be done if these interfaces are detected. Detecting the interfaces facilitates identification of gaps in the existing *solutions for thermal comfort and indoor air quality* offered in the low-income housing environment. It also becomes feasible to design alternatives for better thermal comfort and air quality.

The Nova Institute has developed a conceptual framework to detect the interfaces between social dynamics and thermal effects in low-income housing. Nova is a multi-disciplinary team with experts in the fields of architecture, engineering, medicine and theology who have been commissioned and funded by the Thermal Insulation Association of South Africa (TIASA) as well as the Department of Trade and Industry's THRIP Programme to research and produce model dwelling designs for intact low-income households.

In this paper we shall briefly introduce the conceptual framework for the detection of the *social-thermal-interfaces* by observing specific usage patterns, thereby highlighting important aspects to consider when designing low-income housing. An example of how the Nova framework helped to analyse the interface between a social dynamic and thermal effect are given.

2 Explanation of the Nova thermal & social interfaces framework

Table 1: The interface between social dynamics and thermal effects

Social dynamic	**Determinant for choice of a usage pattern**	**Usage pattern**	**Thermal factor**	**Thermal effect**	**Side effect / synergic potential**

2.1 Aim of the framework

The aim of the Nova framework is to detect the interfaces between thermal effects and social dynamics. This enhances the understanding of the effects of existing *usage patterns* on indoor thermal comfort and helps finding better alternative solutions.
When applying the framework the researcher starts with the centre column (*usage pattern)* because it is an observable phenomenon that can be examined by the researcher. Once a specific *usage pattern* is recorded in the centre column, the rest of the framework should be completed from centre to left and right.

2.2 Definitions

A ***usage pattern*** is observed as people being motivated by certain values who use products for a specific purpose in a particular environment. It is thus an integrated pattern of thinking and doing that is part of the household culture. A usage pattern can be determined through observation by the researcher or by self-evaluation by users. The main methods used to determine the usage patterns for this study were interviews, group interviews and questionnaires. The researcher determines the specifics of the usage pattern by observation and interrogation.

The choice of usage pattern***s*** is influenced by ***determinants*** such as *cost* (capital and running costs), *availability* (of products, maintenance, information and rights), *trust in effect of product* (the perception of the effect as well as the side effects of a specific product group) and *identity effect* (the symbolic value of a product or usage pattern for private and public relations). The researcher should

explain why a certain usage pattern is chosen. This phase is thus more theoretical than the observation of the usage pattern because hypotheses are set forth to explain the usage pattern in an understandable way. Interviews and group interviews aid the researcher in verifying her/his explanations of usage patterns.

A ***social dynamic*** is a macro pattern of *behaviour* or *thought* in society. The researcher should attempt to understand the social dynamic behind the determinant for the choice of a specific usage pattern. This phase is somewhat speculative in the sense that any assumption about something on the macro-scale almost by definition lacks sufficient evidence. On the other hand there is a lot of consensus about macro-patterns in society because they are so pervasive. For instance, not many people would doubt that poverty as a macro pattern influences many peoples' lives in the South African context.

A ***thermal factor*** contributes to a thermal effect. In low-income housing, the following is of particular importance:

a) Internal heat sources
b) Size of structure
c) Location
d) Orientation
e) Shade
f) Thermal mass of structure
g) Insulation of outside of structure
h) Ventilation

A ***thermal effect*** is a measurable change in temperature inside a structure. The temperature as well as the rate of change is important.

Finally, a ***side effect*** is an unintended negative effect inherent to a usage pattern, for example the harmful side effects of air pollution caused by using coal for space heating, whereas a ***synergic potential*** is the possible mutually supportive application of thermal factors.

3 Applying the Nova thermal & social interfaces framework

As part of the project *Fast track implementation of energy efficiency standards in SA housing for improved comfort, health and reduced carbon emissions* [1] a stakeholders workshop with low-income housing residents in eMbalenhle near Secunda was held to determine social and energy efficiency issues relevant to housing policy [2].

The workshop was aimed at formulating a questionnaire on social and energy issues in low-income housing of eMbalenhle and Zamdela. This was conducted from 26 to 30 January 2004. Three hundred questionnaires were completed in Zamdela and three hundred in eMbalenhle. A total of seventy two were rejected due to poor quality. House numbers were randomly selected in two sets of hundred and fifty RDP households and hundred and fifty informal households. The Nova thermal & social interfaces framework was used on the 528 legitimate questionnaires [3].

4 Analysing usage patterns and its design implications

4.1 Example: Poor ventilation and fear

An illustration of how the framework was applied will now be presented, showing how this helped to identify the social dynamic of *fear* and its effect on low-income housing design.

The abovementioned workshop and survey results indicated that *people prefer windows and keep these closed at night.* This can be analysed as follows:

Usage pattern: Almost all residents in the survey indicated that they close windows at night, even in summer. The reasons given were fear of crime (96%) and fear of witchcraft (78%).

Determinant for choice of usage pattern (trust in effect): Residents believe that closed windows offer more protection against burglars than open ones. Other research in the same area has indicated that crime is indeed a problem. However, fear of burglary is not the only reason why people keep their windows closed. The number of people who fear being attacked by means of witchcraft was a surprise to the research team. Since then it has transpired that such a high figure of people who actively fear being bewitched is also supported by other research into this phenomenon [4]. The belief that closing windows is effective against witchcraft is related to the belief that one is bewitched by something material (*umuti* in isiZulu, *sehlare* in Sesotho sa Lebowa) and that even where you are personally attacked by witches or their familiars, they are still material [5]. In other research done by the same research team, one respondent has told the story of a witch turning into a fly and flying from Pietersburg (Polokwane) to Pretoria. A closed window can prevent someone from throwing muti into your house of even prevent a fly from entering.

Social dynamic: The social dynamic underlying the closing of windows is fear. It takes the shape of fear of crime as well as fear of witchcraft. The fear of crime seems justified by crime statistics but the fear of witchcraft remains a problem for the researchers because we couldn't really associate with it. That the belief in witchcraft is a reality in the lives of people living in subsidy housing is again underlined by the finding that 96% of respondents to the above mentioned questionnaire agreed with the statement: “Witchcraft is a problem in our community”.

Thermal factor: The thermal factor influenced by the usage pattern of closing windows at night is ventilation.

Thermal effect: The thermal effect of the usage pattern of closing windows at night regardless of temperature is that structures overheat because they cannot cool down at night through natural ventilation. This means that in summer the current subsidy houses as well as informal houses are thermally uncomfortable during the day and during the night. Research done by the research team as part of another study in the same area indicates that people experience a general problem with lack of rest - which is compounded by the lack of sleep - because of overheated structures.

Side effect: The feeling of relative safety that is achieved by closing windows is achieved at the cost of thermal comfort in summer and indoor air quality in winter.

Design implication: Interpreting the fear of witchcraft in order to design a building is a very uncomfortable task because two seemingly incommensurable paradigms clash in the process. Design is by its definition an exercise in the rational control of nature based on past empirical research. The fear of witchcraft is based on a hermeneutical model where the absence of evidence is the strongest

proof of the power and evil intentions of a witch. Design is based on data. The data underlying the fear of witchcraft can change with every dream or consultation with a spiritual specialist. This raises the question: of what use will research regarding the current beliefs about the mechanisms of magic - such as the question whether magic always has a material basis - have? The belief that there are witches that can turn into a fly might lead to protected ventilation openings with mosquito gauze over these openings, but before long the perception could arise that a witch can indeed turn into a gnat that can pass through the gauze. The whole exercise seems pointless.

A more fruitful approach could be to analyse the social and psychological factors underlying the fear of witchcraft and witchcraft accusations that tend to increase in communities under pressure. Numerous case studies have been undertaken in this regard. The work of Niehaus [5] is pariularly informative but see also Kgatla [6]. Among all the different causes for fear of witchcraft and witchcraft accusation there are two types of relationship that are of particular importance. The first type of relationship can be called *suspicion* and the second *jealousy*.

Suspicion is the feeling of mistrust towards someone perceived as a social outsider. It could be a new comer in the community or a person that does not fit in or cooperate with the broader community. Living alone is often a cause of suspicion. For that reason old people are often the victim of witchcraft accusations [7].

Jealousy is the feeling of envy towards another member of the in-group like the community or family. Achievement or good fortune of an individual amid the struggles of the broader community will often cause people to feel jealous. The inverse of this is that people who achieve something or experience good fortune may suspect that others may be jealous of them and want to harm them.

The logic of witchcraft determines that when one experiences good fortune, it is often accompanied by the suspicion that someone will soon try to bewitch you because of jealousy. When one experiences bad luck or ill health, it is clearly a sign that one might already be bewitched.

The question arises whether a house could be designed that minimises the social pre-conditions of witchcraft fear and accusation. In other words, can one design a house that minimises suspicion and jealousy? The house and general town layout will have to be designed in such a way that the inhabitants will feel safe. The house has to be burglar proof and ventilate well at the same time. An alternative system of ventilation is needed that enables the residents to control ventilation while at the same time offering protection from criminals.

Clearly being burglar proof will not be enough. The house will have to be witch proof as well. The ventilation openings will have to be constructed in such a way that people will not feel that this leaves them open to the threat of witches. The question to what exactly that means is not so easy to answer.

The one answer is the religious answer. Both Christians and traditionalist use rituals of different kinds to protect them against harm from others. Many churches give people sacred flags to put up on their property. For other Christians who do not have specific rituals, the faith in the protection of God is very important. The answer from within the community is to counter the supernatural power of the witch by a stronger and benevolent supernatural power, be it God or ones forefathers.

The answer from outside the community could be to design the human environment in such a way as to minimise the underlying psychological and social factors that are associated with fear of witchcraft. These are the dynamics of suspicion and jealousy but also the more tangible dangers of everyday life such as crime. Our hypothesis is that suspicion and jealousy is related to the polarities of individuality and commonality and thus to the spatial values of openness and privacy [8].

Our hypotheses are as follows:

- *Suspicion* is related to being in the community but closed off from the community. A suspicious house is one that closes one off from the community. A degree of openness and publicly visible space would make a house appear less suspicious.
- *Jealousy* is related to appearing more fortunate than ones peers. Conspicuous wealth may give rise to jealousy by peers or fear of others on the side of the owner. The ones feared are either criminals motivated by greed or witches motivated by jealousy. A house that does not give rise to jealousy would fit in with the rest of the houses in the community.
- *Suspicion of jealousy* is the mistrust that other insiders may for some reason want to harm you. A house that permits too much openness will enhance the feeling of being under constant public surveillance and with it the suspicion of jealousy. A degree of privacy is thus also important.

Future research needs to test these hypotheses. What is clear from the analysis, however, is that the ventilation in subsidy houses will have to be redesigned to fit in with the current usage patterns until such time when the underlying social dynamics that drive the usage pattern change.

Notes

1. An example of an effective but unacceptable solution in the low income housing context is the use of LPG for cooking. Although the technology is reliable, effective and clean, we have found in our interviews and surveys the widespread belief that LPG is very dangerous and that a LPG device can explode at any moment. On the other hand paraffin is used widely with the resultant accidents and poisonings.

2. High cost is one of the problems that new and effective technology might cause for already cash strapped households. In the area of our study (eMbalenhle, Mpumalanga) public violence erupted recently that was associated with residents' electricity and water services being cut of due to their non-payment.

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