Graduation thesis reflection and discussion (P4 report)

Charlotte in’t Hout (1502808)

13-05-2016

1. Scientific relevance

There have been some recent developments regarding the application of preference based design systems for optimization of the built environment (e.g. Arkesteijn et al., 2015; Van Loon, 2009). Based on the results achieved in these examples, it is assumed that such systems still hold a lot of undiscovered potential and could possibly be of significant value to the academic field of real estate.

This study adds a new approach, with results validated by practice, to the available literature. It is one of the first to construct a multi-actor multi-criteria preference based design system, and to utilize this to determine design optimization opportunities for an actual real estate development project. Specifically in the context of the residential property market there has not been any comparable research so far.

The proof of concept that has been delivered by this study hopefully encourages others to further explore the application potential of preference based design systems within the field of real estate.

2. Societal relevance

Most consumers do not have a direct influence on the design processes that determine the configuration of the future housing stock. Real estate developers regularly perform market research, but appear to easily disregard many possible design alternatives even though they might prove financially feasible. Because the design process needs to be quick, or because another design alternative already achieves the desired financial results. As end-consumers are often kept out of the decision making process during the design phase, it is difficult to ensure that their interests are sufficiently represented at this point. Simultaneously developers lack a clear overview of all possible design alternatives, and which might be best adjusted to the actual market demand. Taking consumer preferences into consideration may not necessarily be complicated or pose a burden, if the right method is developed. As such, resources could be allocated more effectively within the (capital-intensive) residential property industry. Ideally, this would lead to an increased profit-margin for developers while concurrently increasing the consumers’ satisfaction.

This study has provided a possible solution for the described situation, in which both consumers’ and developers’ interests are incorporated and protected during the design phase.

The developer involved with the case study stated that he expects such models to become increasingly more important in the future, especially in the student housing sector where a consumer’s spendable income is limited.
3. **Validity of the results**

Partly due to feasibility reasons, there are certain limitations to the performed research. The main complications are:

1. **Limited number of design variables included in the model**

   Due to the time-consuming aspect of programming a detailed model, and because of a lack of applicable existing literature, only four main design variables were selected and included in the research model. However, it is unlikely that this has significantly affected the validity of the research results. There is still a large number of possible design alternatives that can be generated by the model (105 for the flat, 762 for the low-rise extension). Also, the reflection interview with a questionnaire respondent - based on the model’s results - indicated that for this case study, the included number of design variables was sufficient. The model appeared to resemble the real decision making process for these consumers.

   Regarding the selected financial variable, the developer involved with the case study stated that within this specific project context the only financial criterion was annual return on investment (i.e. IRR). While different alternatives in reality would also entail different construction costs, these costs were not considered a criterion, as for a project with an appropriate IRR there would always be a party willing to finance it.

2. **Construction costs were not adjusted to correspond with specific design alternatives**

   The developer involved with the case study did not have any additional information on construction cost estimations for design alternatives other than the realized configuration. Also, for the transformation of this particular building, the costs for plumbing, electricity and technical installations determined approximately 2/3rd of the total constructions costs. The remainder of the costs consisted mostly of demolition and construction work for the interior walls and removal of asbestos. As the load-bearing structure did not need to be adjusted for any of the possible design alternatives, and the interventions made in the façade were very minor and needed for each possible design alternative, the differentiation in construction costs per design alternative is estimated between 0 and 6.4 percent (based on the actual contractor quotations for the realized design alternative). This would mean the total required investment sum could variate at the very most 4.5 percent. For the realized design alternative such a deviation affects the achieved IRR with a maximum of 1.0 percent point. While it would certainly add to the accuracy of the model results if the construction cost variable was adjusted to correspond with each specific design alternative, a 1.0 percent point accuracy margin does not indicate corrupted results. Due to the limited time available for this research, this accuracy margin was accepted and the construction costs were standardized to the actual contractor quotation for each design alternative.

3. **Small sample size for the questionnaires**

   As stated in the research design and methodology chapter, the three selected samples for the questionnaires were very limited (five to six persons per target group). Because the study had the objective to deliver a proof of concept for a preference based design system, through a qualitative approach, the decision was made to put more emphasis on the design of the
model and the generated design outcomes than on the generalizability of the questionnaire results. As the consumer preference input for the model was accurately measured and reflected the perception of actual target group constituents, the generated output is still a valid result. Also, the concept of preference based group-decision making remains the same. However, the stated limitations need to be taken into account when interpreting the case study results and associated conclusions.

4. **The applied independent housing design alternatives were not generated by the research model**

This decision was made because the pursued proof of concept could be delivered by only generating shared housing design alternatives with the model. Adjusting the entire model, to also generate independent housing alternatives, would require a lot more time to be spend on programming. Additionally, one of the three main applications of the model (as described in the research questions chapter) was applying the model to compare pre-determined design alternatives. While this study may not have proven conclusively that independent housing is not a financially feasible strategy for the Zusterflat project, the pre-determined floorplan designs have been adequately compared based on group-decision making principles corresponding with PFM theory. Still, the limited amount of compared design alternatives for independent housing needs to be taken into account when interpreting the case study results and associated conclusions.

5. **The conclusions are based on only one case study (involving one building, and a very specific market segment)**

It is easy to get enthusiastic about research results that are commended by the involved practitioners. While a suitable application for the constructed preference based design system has been demonstrated, it may prove more difficult to generate relevant results within the context of a different project. However, because the amount of design variables included was still limited (including e.g. the different types of rooms to be allocated), it is expected that such design systems may have even greater potential when applied to other types of design problems.

Despite these limitations, it can be stated that the found results related to the research hypothesis are valid. The answers to the posed research questions and the case study conclusions need to be considered in the context of the available literature on non-location related housing preferences (which is limited), and the specific conditions of the case study project.

4. **Utilization potential**

The research model that has been constructed is not a universally applicable model. It has been designed to fit the variables and constraints of a specific case study.

The delivered research results are also based on that same case study. The sample size was small, so the trend analysis of the decision makers’ stated preferences can not be generalized for the entire population that they represented. This is a consequence of the choice to perform a primarily
qualitative study, in which the aim was to deliver a small scale proof of concept for a multi-actor preference based design system.

The constructed research model and the study’s results and conclusions however may be utilized for the following purposes:

1. The applied combined research approach, which combines many different data collection methods, has been effective in delivering the specific types of data required for the case study-based research model. This approach may continue to be effective as a framework for future research on preference based design systems. It provides a clear overview of the different steps that need to be undertaken to deliver a valid, reality-reflecting model, that is also founded on the existing (scientific) body of knowledge. Due to its complex nature however, this combined approach might not be suitable for very time-pressed studies.

2. The literature review and questionnaire results may be used for determining the appropriate variables for similar preference based residential design systems. Regardless of whether the same or different residential target groups would be selected as ‘decision maker’, there is currently no other literature available which reflects on variables specifically suited for such a system.

3. The conclusions regarding the decision making process for the case-study may bring a new perspective to the general perception of conflicting developer and consumer interests. Relatively small adjustments to a residential floorplan design have been proven to significantly alter the project outcomes for both parties. The results from this study indicate that involving a model in the decision making process could lead to a more transparent initiative and design phase, in which each party’s interests are very clearly defined and directly represented. Simultaneously a very large number of design alternatives can be evaluated and compared without much effort (except for the effort required to construct the model itself).

Regarding utilization of the study by practice:

1. The research model itself (and its description) may offer a foundation for future research that focusses on the optimization of revenue streams for property development projects. It incorporates aspects of the property development process that would typically only be estimated, instead of accurately measured (i.e. design preferences). This study shows how to combine, as well as automate, the concept of financial feasibility analysis with high accuracy consumer feedback. This provides an opportunity for developers to protect consumer interests in the design phase, without reducing their own sense of control over the decision making process.

2. Another group that might benefit from these scientific outcomes are architects; the design professionals involved with property development. Their knowledge on the functionality and aesthetics of buildings builds a bridge between developers’ demands and end users’ wishes. Tangible knowledge on how specific design characteristics influence a project’s feasibility, both positively and negatively, can help them in creating designs that are appreciated by the consumer as well as valued by the developer.
References
