Designing homes with meanings:
Construction of a tool based on human values

Research thesis by M.E. Overtoom
Delft University of Technology, Architecture

October 2013
Summary

Houses were among the first structures that were built, and remain the most common type of building today. The design of housing has been the subject of architecture, while from a psychological point of view the meaning of home has been a major subject of research. These two different viewpoints are combined in this research to provide a tool for designers to design based on values. First a quantitative study was carried out to match activities and spaces in the home to human values (Schwartz, 2000). This resulted in a design-tool that consists of the ten values (hedonism, self-direction, universalism, benevolence, conformity, tradition, power, and achievement) associated activities and spaces, and hierarchical graphs based on space syntax. Lastly opposing spatial features were laid over the two dimensions (openness to change vs. conservation and self-transcendence vs. self-enhancement). Subsequently this tool was used to design seven houses which were used to find out whether the values designed in the houses were also recognised as such. Houses with values preferred by the interviewees, were chosen more often than values on the other end of the circle, indicating that the tool is of some help when certain meanings need to be communicated by design.
Introduction

Houses were among the first structures that were built, and remain the most common type of building today. The shapes, materials, and organisations of space however are quite varied and depend on climate, topography, available materials, level of technology, economic resources, function, and cultural conventions (Sanders, 1990). From an architectural point of view these elements are familiar, where only the element of cultural conventions might not be regarded consciously when designing. Unlike other types of buildings, there are two sides, namely the concept of 'house' as well as the concept of 'home'. The house usually describes the structure or some general form, whereas the home depends on a personal account of a specific house; the home cannot exist without a house-form. The current practice of mass housing projects does provide house-forms, but might not be as good in providing 'homes'.

The meaning of home has been researched primarily from a phenomenological perspective. Usually drawing from interviews, themes arose which were grouped around three to five higher order themes. The main purpose of these studies has been to explore the meaning of home and to understand more about the concept of home opposite the concept of 'house'.

A first model divided the meaning of home in three major themes, namely 'people/psychological processes', 'environmental properties' and 'temporal qualities' (Altman, Werner and Oxley, 1985). The binding sub-themes are appropriation, attachment and identity, social rules and relationships, and affordances. Specific for this model is that the three major categories bind the sub-themes, originally graphically represented by a circular structure.

A second model is based on an analysis of the meanings of home for students using interviews (Sixsmith, 1986). She found the three major themes of 'personal', 'social' and 'physical'. In the first theme 'personal', there are the sub-themes of happiness, belonging, responsibility, self-expression, critical experiences, permanence, privacy, time, meaningful places, knowledge and lastly the desire to return. In the 'social'-theme there are type of relationships, quality of relationships, friends and entertainment, emotional environment and being with others. In the last theme 'physical', are structure, services, architecture, work environment and spatiality. Compared to the first model the theme of 'temporal qualities' is subsumed by the theme of 'personal' in the second model. Also, the theme of 'people/psychological processes' is divided in the themes of 'social' and 'personal'.

A third model found seven general themes (Smith (1994)). These are 'physical environment', 'presence of good social relationships', 'personal privacy and freedom', 'self-expression and development of the self-identity', 'security', 'continuity' and 'ownership'. A fourth found two dimensions (Lawrence, 1987), a psychological dimension (self-esteem, personal identity, personal space and privacy, aspirations and goals, personal values; domestic spaces and objects, and personal preferences; house form and construction) and a social dimension (age and gender of residents, demographic structure and composition of the household, household income, employment status; social class, impact of domestic technology and socio-economic values; spaces and objects). In a study about the meanings of attics and cellars in houses (Korošec-Serfaty, 1984), there were five categories, namely appropriation, affluence and security, secrecy, remembering and forgetting, and continuity of generations. Then there is a study naming ten features of the home (Despres, 1991); security and control, a reflection of one's ideas and values, acting upon and modifying one's dwelling, permanence and continuity, relationships with family and friends, centre of activities, a refuge from the outside world, an indicator of personal status, material structure, and lastly, a place to own.

The themes found in these models are all somewhat similar. However, since these studies are exploratory there is no distinction between persons for whom certain themes are more important than others, or in other words, whether all of these themes are equally important for each individual. This is why these models are impractical to use for architects, as there is no indication of which features are important for whom, let alone how to translate this in a space.

From an architectural point of view, it can be said that there are two distinct methods of dealing with a design assignment. One is based on minimum sizes required for certain activities in the to be designed building (see Neufert & Neufert, 2005), the other is based on patterns in the environment to facilitate desired activities (see Alexander et al., 1977); the latter can be seen as a different interpretation of requirements. The pattern-approach is not specific enough in its guidelines nor does it explain which features in the to be created environment are the key elements once the environment becomes more complex or detailed. The definition of the human measurement in Neufert's Architect's data (Neufert and Neufert, 2005) however does not get much further than the space that is required to move around for certain activities and furniture; meaning is transformed into functionality.
Either approach (psychological or architectural) cannot really exist without the other, for ultimately a structure needs to be built, with sizes, while at the same time it will have meanings for people that are most likely not solely based on size. Therefore in addition to the physically required size, meanings should be translated into spatial arrangements. There have been attempts of designing houses based on lifestyle in one study, but the results indicate that the largest differences in design were not caused by a different lifestyle design goal, but by the lifestyle adhered to by the design-student (Mueller, 1981).

Preferences for housing however have been categorised by life-style, life-phase or socio-economic status (Michelson, 1977; Coolen & Ozaki, 2004). An explanation for these mixed results is that it is hard for designers to truly identify with their user-group, while the user-group is able to differentiate between styles of housing based on for example life-style, life-phase or socio-economic status. Research does indicate that architectural education changes the preference for certain design-styles, moving away from the opinion of the 'general' public (Wilson, 1996). Life-style as such is therefore hard to use as a basis for meaningful housing design.

One approach that has been developed to combine both quantitative data and meanings of spaces is space syntax (Hillier & Hanson, 1984; Hillier, 2007) where the emphasis lies on the configuration and depth of spaces. Spaces that are connected in a linear way are said to have more 'depth' than spaces that are connected grid-wise. Based on these principles certain rooms are assigned meanings. For example spaces that have a lot of other rooms connecting to them can be said to be more central points of the structure.

As a tool for analysis space syntax can be useful, but for design this would be complicated. It can be defined beforehand how many connections spaces should have, but this does not answer questions about types of connections, relative size or position, or the lay-out of a room. The problem with a size-based system to design houses is that it facilitates the basic spatial needs of the specific activities, but that at the same time it neglects the psychological aspects as described above (the concepts of 'home'). Activities should be defined by more than just the necessary space to be able to design appropriate spaces.

Activities have been defined as having four components, i.e., the activity itself, the specific way of carrying out, additional, adjacent or associated activities, and the meaning of the activity (Rapoport, 1982). The requirements-based approaches described above only take into account the activity itself, and maybe some additional or adjacent activities. The specific way of
by doing the activity and the meaning of the activity are left out or at least taken for granted, but could nevertheless have an influence on the space needed.

The other way around, meanings can be derived from the decoration or personalisation of the home (Rapoport, 1981). Cues communicating meanings can be found in the environment, and depending on their recognition they can be followed or not (Rapoport, 1982; Rapoport, 2005). In an archaeological work describing the plans of Roman villas to find out more about the social structure (Smith, 1997), the hierarchy of spaces within the villa is used as a basis to describe the use of spaces. Also considering relative size, furnishings, fittings, and abundance, changes in social structure and prosperity can be distinguished. Space syntax is able to take into account part of the spatial hierarchy, namely that of hierarchy in routing, but meanings of activities, relative size, furnishings, and fittings of spaces are not a part of meaning making in space syntax.

Objects in the house can be regarded potentially as representative of the owner, where objects signal status and social hierarchy (Csikszentmihalyi & Rochberg-Halton, 1981). Important to note here is that these authors look at the meaning of objects not as an origin, but as a goal. These objects mean something to the owner as desired in the future. Continuing, they argue that even the simplest functional objects can be viewed as representations of a certain culture. Therefore, what one considers 'normal' in a home environment can also be thought of as the standard of the desired life for that person.

Status is described as “the ability to control meaning in one's community.” Csikszentmihalyi and Rochberg-Halton (1981, p. 30). Various things can be controlled, like wealth, power, wisdom, beauty, etc, but in turn these symbols can be manipulated to function as status symbols. Thus what status actually means in a culture, is highly variable. It could be any of wealth, power, wisdom, beauty, etc. Additionally in relation to objects, the person not only influences the meaning of the object, but subsequently the meaning of the object can influence the person (Csikszentmihalyi & Rochberg-Halton, 1981). Described as such, a house communicates meanings to both residents and visitors.

Just what is considered to be normal or desirable to communicate and how this should be done differs per culture, and within culture, for individuals. Art and architecture can be described as “attempts to give sensible form to moods, feelings, and rhythms of functional life” (Tuan, 1977, p.165). Meanings are thus engraved in buildings, activities and objects. Since today most residents do not design their own houses the designer needs to integrate the meanings of activities, objects and houses for these residents in the design. Note that for each of these no
culture- or person-specific meanings are given. The hardest thing for designers is not to convey meanings in their designs, but to choose the appropriate ones.

Conceptually the built environment consists of three categories (Sanders, 1990): naturally fixed (climate, topography), flexible (available materials, level of technology, economy) and culturally fixed (function, cultural conventions). More importantly, the third group ‘culturally fixed’ usually overrides the other two groups (Sanders, 1990) which means that culture influences the use of materials, how climate is dealt with and what the available materials are.

In order to communicate meanings by objects, facilitating activities and houses, designers need to know which meanings should be communicated and to whom. Houses are the most personal buildings used, which makes meanings more specific. Findings on meanings in the design of houses are for example the overall aesthetic experience as dependent on attributed meanings (Brebner, 1980), the changed relations of living, eating and cooking as the position of women in society changed (Ozaki, 2003), more visibility of the ‘true’ identity of the residents to visitors (Rechavi, 2009), and that the conceptual categorisation of spaces for older residents reflects more traditional roles than it does for younger residents (Lawrence, 1987).

Then what should lie at the basis of something that architects can use to convey desired meanings in houses should consist of several things. These are the incorporation of (slow) changes or differences in cultures and individual differences within cultures, the relative importance of some meanings compared to others, and that for objects as well as activities. Last of all, it should be translatable into spatial structures without determining any specific outcomes which would compromise the architect's way of working.

Lifestyle as a means of design seems not to work (Mueller, 1981), possibly because lifestyle as such does not address the motivations but merely the outcomes. The theory of planned behaviour (Ajzen, 1991) tries to explain the outcome of behaviour with the help of attitudes towards the behaviour, subjective norms and perceived behavioural control which shape the intention and finally the behaviour. Further on he explains that attitudes are formed by beliefs about an object by associations, and that because of that the possible outcomes are valued as either positive or negative. When the belief is stronger, then the probability of the behaviour occurring is more predictable. Contrary to attitudes and values, lifestyle, like personality, does not concern intentions, is not about relative importance but about how much of something, and are more about actual behaviours than desired behaviours (Bilsky & Schwartz, 1994). Lifestyle can thus be seen as a choice resulting from values that a person adheres to.
The necessity of making choices based on values can be described as “an organised set of preferential standards that are used in making selections of objects and actions, resolving conflicts, invoking social sanctions, and coping with needs or claims for social and psychological defences of choices made or proposed” (Rokeach, 1979, p.20). Values can be thought of as the frame against which to judge the things around us, things that were, and things we want to be in the future. The way in which this is done is by dividing experiences in either good or bad, or any other opposites on the same line (Rokeach, 1979). In an analysis of definitions of values, six main features arose that are specific for values: Values as beliefs, values as reference to desirable goals, values as transcending specific situations and actions, values as serving standards or criteria, values as ordered by importance and values as having relative importance of multiple values that guide action (Schwartz, 2006). Narrowing down the values that could be universal for all cultures has been done and resulted in ten different values which are also situated on opposite ends of each other. These are (in circular order) self-direction, stimulation, hedonism, achievement, power, security, conformity, tradition, benevolence and universalism (Schwartz, 2006).

Self-transcendence has been shown to increase the willingness to reduce car use (Nordlund & Garvill, 2003), achievement has been linked to increases of general energy-saving behaviours and purchases (Mirosa, Lawson & Gnoth, 2011), male seafarers who emphasise conservative values express more safety-behaviour (Hystad & Bye, 2013), and different values have been linked to different vacation behaviours and preferences (Mehmetoglu, Hines, Graumann & Greibrokk, 2010).

Furthermore, life-values (a somewhat earlier version of Schwartz's values, namely happiness, freedom, togetherness, inner harmony, security, pleasure, excitement, morals, recognition, and comfort) have been shown to influence housing evaluations through activities possible in the house (Lindberg, Garling, Montgomery & Waara, 1987). Houses with attributes which facilitate activities that would help attain desired life-values, were valued more positively. Increasing size of a room for example was found to be related to a higher instance of relaxing, inviting friends, and giving parties, leading to happiness, freedom and togetherness. So there appears to be a connection between what activities are facilitated by spaces and how they relate to the user's values.
Thus, values explain the intentions for certain behaviours, associations with objects and desired outcomes while at the same time differentiating between and within cultures. For the concept of home which is strongly imbued with meanings, people might seek those features in a house which build on their values, in the same way as values guide other choices in life. What needs to be figured out then is how these values are translated from and to spatial structures.

The features of spaces around us and how we orient ourselves in space is related to the human body (Tuan, 1977). For example space in front or upwards is seen as future and illuminating, while the experience of spaciousness is related to freedom. Consequently, space that is behind is seen as the past, or dark; something more important or superior is elevated and faced towards you. Depending on the culture either left or right is seen as more pure, while the other side is seen as dirty. The meanings attributed to attics and basements (Korosec-Serfaty, 1984) also distinguishes the two by describing them as opposites; the attic and cellar as hidden opposed to the living space as visible and 'high'-status; and the cellar is dark and enclosed, and once appropriated, not dirty any more. Also when the attic and cellar are full of things, they give security or affluence, knowing there is enough food or seeing all the things someone owns.

Another way in which people distinguish features of space is by spatial styles (Beck, 1970). There are five spatial styles that people use to differentiate between elements in the environment (without attaching any meanings to them). These are diffuse space vs. dense space, delineated vs. open space, verticality vs. horizontality, right and left in the horizontal plane, and up and down in the vertical plane. As such, orientations in space do seem to have meanings in the same way as values; as two opposites on the same line. However, which values relate to which activities, which spaces, and which spatial oppositions is not known. This research is a first attempt towards building a design-tool based on human values.
I. Relating activities, spaces, and values

There are several things that need to be determined before an attempt of building a tool can be made. First of all a connection between activities, values, and spaces needs to be found. This connection should be such that persons adhering to certain values associate activities and spaces more to these values than to values on the opposite end of the circle. Second, the spaces and activities per value should make sense spatially and hierarchically. Third, spatial oppositions based on meanings should map over the circle with values. If this is to be correct, houses designed with the help of this tool should be recognised as such; that is, if someone values self-direction and achievement, the house designed based on these values should be preferred (all other things being equal).

I.i. Method

A questionnaire has been developed to find out which meanings people attribute to activities and spaces in and around the house. First there is a short introductory text, explaining the content of the questionnaire, the expected time and that the results are anonymous and will only be used for this study. The 58 statements from Schwartz's value-domain questionnaire were used as a basis to find which values are expressed in which room in the house (entry, living room, kitchen, toilet, bathroom, study, parent's bedroom, children's bedroom, garden, façade and 'not applicable'). The participants could choose multiple rooms for each value-question. What followed was the original value-domain questionnaire from Schwartz, where the participants needed to choose how important each value was as a guiding principle in their lives, on a scale from -1 (contrary to my beliefs) to 7 (extremely important). Lastly the participants were asked to group eleven activities (eating, cooking, sleeping, washing, working, loving, having guests, relaxing, celebrating, storing things and going to the toilet) in one of the ten value-domains from Schwartz, namely power, success, hedonism, stimulation, self-direction, universalism, benevolence, tradition, conformity or security. The activities and spaces used were derived from a study of Oseland and Donald (1993) and Tagg (1974) which is described further in appendix II.

There was a short explanation of each domain in the question. Concluding there was the question how they would describe their ideal home in a few words, what their current living situation is, their gender, age and occupation and if they are religious. If desired, participants could enter their e-mail address to receive the results when ready and they were thanked for their time.
Sample

A total of 73 respondents started the on-line questionnaire, but only 31 filled it in completely. Three respondents started the questionnaire but did not answer the questions about values and rooms and where thus left out. One respondent did not fill in the question about gender, but is included in the rest of the analysis. For these 31 respondents age ranged between 23 and 64, with a mean of 35 years. 16 of the respondents are male, 14 are female. Also the current dwelling, household-type and income are equally distributed. All participants were Dutch, except for one participant from Belgium).

I.ii. Spaces and values

First the scores on the values were calculated to see whether this relatively small sample was representative. The means of scores from the items of each value domain were calculated by adding each item score of the domain and dividing by the total number of items in each value-domain. The means of the value domains from this sample seem to follow the circular structure (opposing value domains in the circle score either high or low). A factor analysis (principal component, varimax) which extracts two factors also seems to divide the value-domains in the same way (Bartlett's test of sphericity = 0.000, KMO = 0.668) with benevolence, conformity, security, tradition and universalism in the first factor, and achievement, power, stimulation, self-direction and hedonism in the second factor.

As the sample is Dutch and thus from Western Europe, there is as predicted more emphasis on the values related to self-expression (self-direction, hedonism), achievement, and benevolence (Esmer and Pettersson, 2007). The means of importance of this sample for the value-domains are represented graphically below, also showing the circular structure.
I.iii. Activities and value-domains

The frequencies of activities that were matched with each value-domain by the respondents were calculated to see which values are associated with which activities. The same procedure was used for spaces and value-domains, and for spaces and activities.

Values and activities

Illustration 2: Associations between values and activities

When visualised in the same way as the value-profiles, the activities appear to follow the same structure, with higher scores on the top left of the value-circle. A higher score on one end of the value circle means a lower score on the other end. For example, sleeping (yellow) scores high on security but low on self-direction, and relaxing (light green) scores high on hedonism but low on conformity. Activities scoring higher on a certain value could be interpreted as being more associated to that value. Then the activities associated with achievement would be working, receiving guests and celebrating. For self-direction the associated values would be working and relaxing. For both values the activity of working is the most associated with the value, but the meaning of working is probably different. For persons adhering to achievement work has more to do with achieving something with work, while for self-direction work has more to do with giving direction to one's life. So even though the activity has the same name, that does not mean that the activity is carried out with the same goal in mind. This would have consequences when translating the results into a spatial structure, where depending on the categorisations used, spaces can be organised differently.
**Spaces and value-domains**

*Illustration 3: Associations between values and rooms*

For the associations between values and rooms the same principle can be found; rooms scoring high on one value, score relatively lower on the value on the other end of the circle. For the living room differences are less visible, but this is probably due to the high usage of the living room, which is also dependent on time and number of people (Rechavi, 2009). Also visible in this illustration is that some rooms are more associated to values than others, for example the entry, toilet and children's bedroom are not as much related to values as are the living room, study and kitchen. Also, the study is more specifically associated to achievement and self-direction, whereas the façade is specifically associated to power. Thus some spaces are more value specific than others. One explanation could be that depending on the value that is associated to the room, the meaning or use of the room is still different.

This blends in with the idea that activities consist of four aspects: The activity itself, the specific way of performing, additional, adjacent or associated activities and the meaning of the activity (Rapoport, 1982). Especially helpful in explaining the relations between values, rooms and activities are the last two aspects.
Spaces and activities

Illustration 4: Associations between rooms and activities

Some activities are carried out much more in certain rooms than in others. One very likely reason is the possibility of carrying out the activity, but also social rules are regulatory. The kitchen and garden seem to allow for the most diverse activities, while the living room, kitchen and study have a stronger association with activities in general.

When looking at the study, it is clear that it is used most for working and storing things. If combined with the previous conclusions, that would mean that when a person thinks achievement or self-direction is important, a study for working and storing things would be useful. For someone adhering to security or benevolence however, a study would not fulfil the same function.
I.iv. Results spaces, activities and values

The distinction between values and certain spaces and activities implies that depending on the values someone has, certain activities with associated spaces are more important than others, which is in line with other research (Lindberg et al., 1987). When comparing both activities and spaces with values, activities seem to show more distinctiveness than spaces. The associations of values with spaces was measured using the 58 items, while the associations with activities were measured using the ten value-domains.

A reason for the difference between associations with activities and spaces could be that meanings of activities shape the meaning of spaces more than meanings of rooms shape the meaning of activities. In other words, doing an activity in another (or adjusted) room is often easier than changing the activity and staying in the same (unadjusted) room. An example of this is Japanese culture where the same room is used for various activities during the day but where the lay-out of the room is changed in order to facilitate these activities.
II. Development design tool

The associations of values with rooms and activities can be used as a basis for the relations between spaces in houses. Following space syntax (Hillier and Hanson, 1984), spaces are defined by their boundary type and their respective position in a plan. The categorisation of the interior follows cultural rules, used for control over the spaces. Depending on the type of boundary, or barrier, the use of the adjacent spaces in the building can change dramatically. Their method of graphical analysis is based on lines, for connectivity, and dots, for spaces. The dot signifies the entrance of the space and in a way serves as a boundary. However, Lawrence (1996) comments that boundaries are not always spatial structures, and following the definition of privacy (Altman, 1976), boundaries are culturally defined and therefore not static as they are shown in space syntax. Even more so, the cultural meanings behind the spatial categorisations are not represented in the graphical analysis, they only follow after qualitative interpretations. This does not necessarily pose a problem when analysing existing buildings or building systems, but it does make it hard to use when designing buildings.

The first step is to define how spaces in the house need to be categorised, and how they differ per value. From the previous questionnaire the most associated rooms and activities can be listed, which results in the following table:

Table 1.

Associations between values, spaces and activities

<table>
<thead>
<tr>
<th>Values</th>
<th>Activities</th>
<th>Spaces</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Self-direction</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independent thought and action, choosing, creating, exploring</td>
<td>Working</td>
<td>Living room</td>
</tr>
<tr>
<td></td>
<td>Relaxing</td>
<td>Study</td>
</tr>
<tr>
<td><strong>Stimulation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excitement, novelty, and challenge in life</td>
<td>Cooking</td>
<td>Living room</td>
</tr>
<tr>
<td></td>
<td>Working</td>
<td>Study</td>
</tr>
<tr>
<td></td>
<td>Caring</td>
<td></td>
</tr>
<tr>
<td><strong>Hedonism</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pleasure and sensuous gratification for oneself</td>
<td>Eating</td>
<td>Living room</td>
</tr>
<tr>
<td></td>
<td>Caring</td>
<td>Kitchen</td>
</tr>
<tr>
<td></td>
<td>Relaxing</td>
<td>Parents’ bedroom</td>
</tr>
<tr>
<td><strong>Achievement</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal success through demonstrating competence according to social standards</td>
<td>Working</td>
<td>Study</td>
</tr>
<tr>
<td></td>
<td>Receiving guests</td>
<td></td>
</tr>
<tr>
<td><strong>Power</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social status and prestige, control or dominance over people and resources</td>
<td>Working</td>
<td>Living room</td>
</tr>
<tr>
<td></td>
<td></td>
<td>façade</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Values</th>
<th>Activities</th>
<th>Spaces</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Security</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety, harmony, and stability of society, of relationships, and of self</td>
<td>Sleeping</td>
<td>Living room</td>
</tr>
<tr>
<td></td>
<td>Storing</td>
<td></td>
</tr>
<tr>
<td><strong>Conformity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restraint of actions, inclinations, and impulses likely to upset or harm others and violate social expectations or norms</td>
<td>Receiving guests</td>
<td>Living room</td>
</tr>
<tr>
<td></td>
<td>Storing</td>
<td></td>
</tr>
<tr>
<td><strong>Tradition</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respect, commitment, and acceptance of the customs and ideas that traditional culture or religion provide for the self</td>
<td>Eating</td>
<td>Living room</td>
</tr>
<tr>
<td></td>
<td>Receiving guests</td>
<td></td>
</tr>
<tr>
<td><strong>Benevolence</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preserving and enhancing the welfare of those with whom one is in frequent personal contact (the ‘in-group’)</td>
<td>Receiving guests</td>
<td>Living room</td>
</tr>
<tr>
<td></td>
<td>Celebrating</td>
<td></td>
</tr>
<tr>
<td><strong>Universalism</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Understanding, appreciation, tolerance, and protection for the welfare of all people and for nature</td>
<td>Cooking</td>
<td>Living room</td>
</tr>
</tbody>
</table>

The activities related to the specific values are most central to the tool as the meaning of activities is most important compared to the activity itself, the way of carrying out the activity, and adjacent activities (Rapoport, 1982). Also, the link from values to activities seemed more distinctive than the link from values to spaces. So the second step of the tool is to add the associated spaces to the values. Even though the living room is associated to all but two values, this does not mean it can be left out. Based on the four aspects of activities, the activities taking place in that space also shape its meaning. Thus, the word is the same, but the meaning might not be.

Third, combining the associated activities, spaces and values, schematic hierarchies of rooms in the house can be drawn. Based on the idea of space syntax with hierarchies of spaces, spaces that are more central to the value of importance are more central in the lay-out. Also the strength of the boundaries (walls, windows, doors, etc) can be defined here. The differences in spatial organisation by means of hierarchy and centrality should be somewhat opposite for opposite values. If that is not the case, than the activities and spaces are not distinctive enough for those values. However, there seems to be a gradual change along the circle.

With the activities, spaces and schemas in place, there is one thing left; organising the spaces spatially in such a way that the appropriate meanings are communicated. The schemas have left us with small clusters of spaces which should be positioned close to each other, but it says nothing about direction. These spaces could still be almost anywhere around the centre. The spatial oppositions mentioned before will be guiding here, but remains most controversial.
The five spatial directions mentioned earlier were diffuse space vs. dense space, delineated vs. open space, verticality vs. horizontality, right and left in the horizontal plane and up and down in the vertical plane (Beck, 1970). Apart from their meaninglessness, not all of these directions are useful for the design of buildings since people move around in them. Left is not always left, nor is right always right. The symbolism accompanied by these directions should be more helpful.

Tuan (1977) relates the front with being larger and illuminated, elevation with importance and superiority. Freedom comes from the ability to move around. Also, visibility is related with status and therefore hidden spaces with secrecy, while spaces with lots of objects give a feeling of security and affluence Korosec-Serfaty (1984).

Taken together these can be categorised in five binary oppositions, namely hidden vs. visible, front vs. back, opportunity vs. certainty, open vs. closed, and ground-bound vs. elevation. In turn these five can be related to the five spatial styles described above. Thus, organisations in three-dimensional space should be able to convey meaning, somewhat related to values.

II.i. Results

The ten human value-domains (Schwartz, 2006) are opposites of each other, as are the five described above. These have some overlap and can be laid down over the circle with values. The result is a first step of how spaces in the house should be categorised, depending on the values the residents adhere to. Including the spaces and activities that are associated to the value, the following illustration can be drawn.
The graphs in the most outer circle consist of the relationships between, and availability of, rooms in the house, based on the activities and rooms associated with a certain value and the appropriate binary oppositions. These are schemas and do therefore not determine the position or shape of a room nor explicit architectural style, they only show the connections and relative sizes between rooms. As an example, for the value of universalism, cooking is an important activity, and the living room is an important space. Furthermore, the house should be open and ground-bound or open in the horizontal plane. Even though the value design tool is focussing on the internal spaces of the house, there are consequences for the façade and orientation as well. A relatively open plan on the horizontal plane, also means open to the outside, more public sphere. Then the importance of cooking can be emphasised by positioning the kitchen in a visually central place.
III. Design of dwellings using the tool

To have the tool tested, it is necessary to design houses based on the tool. As an example, designs will be made for an existing site with an existing assignment. A new railway station and municipal office plus 1200 dwellings and some commercial spaces are planned to be finished by 2020 in Delft, the Netherlands (Spoorzone, website).

One block within the designed urban plan is chosen to be developed further to demonstrate the value-based design tool. The block is fairly large, and is divided in three on several scales comparable to fractals. Relationships between spaces and recognisability of control over areas are thus defined as points and lines, where an urban entity is a point and a connection between is a line. Comparable to Voronoi-diagrams, the borders between the points on each scale are drawn, creating the borders of the entities. This method creates different shapes and façades for the buildings, increasing the uniqueness of each object from the start making it easier for the residents to identify with their house and differentiate from the neighbours' house.

This method is employed down to the scale of the dwellings and gardens themselves, which are designed using the value-based design tool.

For seven houses two values were chosen to base the design on. As the location is situated in a Western culture, houses with the values that are generally more important like self-direction and achievement should be preferred. Doubling the values per housing design and using them in different combinations, in addition to the relatively odd-shaped boundaries of the dwellings, hopefully shows the versatility of the tool.

Two examples will be described, one house designed with the values of self-direction and stimulation and one house with the values power and security.
House 1. Self-direction & Stimulation

Self-direction is related to working and relaxing, with the living room and study as important spaces. For stimulation working, cooking and caring are important activities, and again the living room and study are important spaces. From the binary oppositions future, front and openness should be used.

The house is further meant to have at least one bedroom and one bathroom, and some private outside space which is a basic requirement for all seven houses.

The first step is choosing a location of the house within the dwelling block. A corner of the dwelling block should be able to facilitate the openness (more view on the surroundings). 'Future' has a direction going upwards or forward, so the most important spaces are clearly directional. For the study it is oriented at the garden, for the living spaces the orientation is horizontal but by moving it up one level the view offers more gazing opportunities. Finally the bedroom and bathroom are located on the third floor. The study is separated clearly from the living spaces, whereas eating, cooking, inviting guests etcetera all take place at the first floor and are only slightly separated by the constructive elements needed where the kitchen-counter divides the space in two halves. The kitchen with eating area is oriented towards the balcony and garden, in contrast to the living area which is oriented at the nearby square. Being so oriented at viewing angles and the mixing of spaces might give the house a larger focus on self-direction than on stimulation, when looking at the design-tool.
House 2. Power & Security

For power it is important to have a place for work, while the living room and façade are the most important feature and space of the house. The differentiation between spaces should be clearer as well. For Security storing things and sleeping are important activities, with the living room as the most important space in the house. Also for security spaces should be differentiated, with additional spaces for storing. The binary oppositions to take into account are elevation, closed, and back. For the position of the house this means that it should stand out in a way, while at the same time being more distant from the 'public' zones.

The house designed has a small part of its façade on the building line, with the other parts of the building following the wall-line of the surrounding houses, creating some sort of courtyard-garden aligned to the street. Going up three steps there is an elevated terrace, leading to the front door. From the entrance, the kitchen with eating area is on one side, with the living room on the other. The stairwell is at the back of the entrance, leading up to the other two floors with a total of three bedrooms, one study, and a bathroom. The repeating lay-out of the entrance in the stairwell creates some extra spaces which can be used as storage. One of the bedrooms has a small roof-terrace, overlooking the canal next to the street. Looking back at the design tool, there might be more emphasis on the value of security than on power.
V. Testing of the value-based design tool

To test whether the houses designed based on values are also recognisable as such, semi-structured interviews were conducted, accompanied by the value questionnaire from Schwartz (2005). A total of twelve Dutch post-graduate architecture students participated. Even though architecture students might judge the designs differently since they are educated in architecture (Wilson, 1996), they do have more experience with looking at models and describing designs. Also, the questions were not about style or beauty but focused mainly on the spatial lay-out and first personal impressions. During this interview the interviewees were first given a short introduction of the plan explaining the location and urban plan, and how they could use the 1:50 models of each of the seven houses. They were asked to describe each of the seven houses with a few words or sentences to become familiar with the models, followed by stating their preference for one of them. They were then asked to elaborate their preference, focussing on expected experience of the house, activities and uses as if it were theirs. Maximum interviewing time was thirty minutes, after which the value questionnaire was shown they would answer on their computers. The value questionnaire was filled in afterwards not to have them focus on the value-statements from the questionnaire.

VI. Results

The interviews were voice-recorded and transcribed before being analysed. From the description given for each house, the most descriptive words were selected. Again after a preference had been stated, that particular house would be described more elaborately regarding activities and uses. These were selected as well. The descriptive words for the houses are included in Appendix I.

The scores from the value-questionnaire were calculated by adding the items for each value and dividing by the total of items for that value, acquiring a mean score for each of the then values per person. There were no missing values so all twelve (six male, six female) participants were used. To account for differences between persons for scoring each of the items, the means of the values were centralised (subtracting the mean of all values from each participant for each value mean), as suggested by Schwartz (2008). Also the z-scores were calculated to see how the participants within this sample differed from each other. The values related to self-direction are valued more in countries doing economically well, so even though a centralised high score might
point towards for example hedonism, the score might not be that exceptional compared to the other participants.

The variables are normally distributed with for all value means a skewness and kurtosis between -1.300 and 0.800. The means of the values are from high to low self-direction \((m = 5.36)\), benevolence \((m = 5.12)\), hedonism \((m = 4.96)\), universalism \((m = 4.58)\), achievement \((m = 4.48)\), security \((m = 4.08)\), conformity \((m = 3.97)\), stimulation \((m = 3.53)\), power \((m = 2.83)\), and lastly tradition \((m = 2.82)\).

Not all combinations of values were used in the houses, as only seven houses were designed. The combination of achievement and hedonism was not included, nor was the combination of security and tradition.

Four participants preferred house number one, designed with self-direction and stimulation. When looking at the centralised scores (the light line), all four seem to value hedonism and self-direction, where interviewees one, four and nine also value achievement, interviewees one, two and four value benevolence. The lack of a house with the combined values of hedonism and achievement might be the reason house number one was preferred instead, since it is also most opposite to tradition and security which for interviewees one, four and nine had a relatively low score. For interviewee two the preferred house does not seem to match well with the value-profile, as it mainly leans towards the top-right of the value circle except from the score for hedonism. House number three (self-direction and universalism) was described by this participant as a sort of tower-idea and having your own place which he liked, and that the relationship between the kitchen and living room would be very good. Also when deciding on which house to choose, he mentions that it could also have been house number three or four (benevolence, conformity, tradition) but that it ended up being house one because of the wide view over the water and the square.

Another four participants preferred house number three (self-direction and universalism). Interviewee three would based on the scores for the values be oriented more towards the bottom-left, but the description of the house as being very luxurious does involve the values of hedonism and power. Also when describing the use of the house the kitchen is mistaken for a workplace, which relates more to the bottom-left of the circle for associated spaces. For the other interviewees most values that are thought to be important are indeed positioned on the top-half of the circle, as was predicted. The score for the value of security for interviewee eleven might have
to do mostly with cleanliness, which scored very low as an item (opposed to my values) but was mentioned in the interview where a closet underneath the stairs would hide the 'mess' or 'stuff'. After the interview interviewee seven also mentioned that he thought house number one and five were most opposite to each other, which fits in well with the design-tool.

House number five (power and security) was preferred by interviewees eight and twelve. For interviewee eight it is quite clear that the values point in the direction of house number five, whereas for interviewee twelve it is somewhat more complex. House number two was judged as being too light, but at the same time also very nice. The closedness to the outside while maintaining openness inside the house is what attracts him the most in house number five. His description of the house seems closer to the preferred house than his value-profile. However, his z-scores do point slightly more towards the bottom half of the circle. An extra house with the combination of achievement and hedonism might have made the outcome more clear.

Finally house number six (stimulation and hedonism) was chosen once by interviewee ten, and she also valued hedonism as most important. The extra room next to the parent’s room is also mentioned as an asset, providing some extra luxury.

All value-scores can be seen in the figure below, where the rounded line outside the circle denotes the preferred house by the interviewees.
Value based housing design: Construction of a tool

centralised scores

Z-scores

house choice

House 1

House 1

Interviewee 1

Interviewee 2

Interviewee 9

Interviewee 4

House 1

House 1

Interviewee 3

Interviewee 5

House 3

House 3

Interviewee 7

Interviewee 11

House 6

Interviewee 10

House 2

Interviewee 6

House 5

Interviewee 8

House 5

Interviewee 12
Overall, the words describing the houses and the preferred choice do highlight some of the designed features of the houses. However, individual values are not easily differentiated which could be part of the circular structure of the value system where the values blend into neighbouring values, but also because houses were designed using two values instead of only one. Not all combinations of values were available to choose from which might have affected the outcome too. Nevertheless, for most value-profiles the direction of housing choice can be deduced by looking at the individual value-profiles.

The activities and even more so the spaces are specific for houses in the Western part of the world. Other spaces that could be added are for example a garage, an attic or storage room, but for this first attempt that would have resulted in too many options. To make this tool more widely applicable other spaces could be added. When considering buildings other than houses, such as offices or public buildings, other activities should be included. However, as more people are using the same building in such cases, finding generally accepted values to base the design on will probably be more difficult.

The distinction in the value tool between open vs. closed and hidden vs. visible is also recognised, where open vs. closed is about the connections within the house, and hidden vs. visible is about connections with the outside of the house. This is also related to the positioning of the houses on the plot, where spaces more to the back are valued by participants adhering to values on the bottom-right side of the circle, and spaces oriented at the edge of the plot are valued by participants adhering to values on the top-left of the circle. The separation of certain spaces, like the study, from the rest of the house and how it is materialised is recognised too, as some participants asked the question why certain houses had studies and others did not.

Of the two dimensions from the original value circle, openness to change vs. conservation and self-enhancement vs. self-transcendence, the first dimension seems more recognisable than the second. Houses with more spaces situated at the 'back' of the plot and more compartmentalised plans relate more to conservation, whereas houses with spaces situated at the edge of the plot and more open plans relate more to openness to change. For the other dimension, self-enhancement vs. self-transcendence, such a clear distinction is not discerned. The house with values opposite to benevolence and universalism was not designed however and might have contributed if it had been.
VI. Conclusions

The gap between the meaning and the design of housing still exists, despite research efforts on the topic from both sides. This research tried to bridge the first part of the gap by combining the practice of both architecture and psychology. The main focus has been to develop a tool based on meanings instead of sizes or patterns. Minimum sizes as set out in Neufert's Architects' data (Neufert & Neufert, 2005) are helpful in the way that they can guide the first steps in the design process, however, these sizes have only been based on the physical space needed to move around. Only three of the four aspects of activities are addressed (the activity itself, the way of carrying it out and sometimes associated or adjacent activities, the meanings of the activity are not included) so as a design-tool, it is incomplete.

Then there is the pattern approach (Alexander et al., 1977), which again is good to use as a starting point, but it does not prove useful as a concept as the patterns are often too specific and do not explain why specific things in the pattern should work. Space syntax (Hillier & Hanson, 1984) does include spatial hierarchy based on openings in spaces, but it fails to take into account other aspects of space which also have their meanings, such as relative size, type of partition, furnishings and decoration, and elevations.

The tool which was set up in this research is instead based on the ten value-domains which are cross-culturally valid (Schwartz, 2006). These value domains were linked first with meanings of activities, and then with meanings of spaces in the house. Small space syntax-like graphs were added to these results which show the relationships between spaces (hierarchical and central). Lastly spatial oppositions were laid over the value circle to give direction for the organisation of the rooms in three dimensional space.

Houses designed with specific values using the value-design-tool were mostly preferred by those who adhered to those values. The combinations of two neighbouring values however is not always similar to the value-profiles of the persons choosing the house, which leads to less optimal choices. Nonetheless, either strongly adhered to values or strongly opposed to values do give an indication of housing preference based on human values. Given the six features of values (values as beliefs, as a reference to desirable goals, transcending specific actions and situations, serving as standards or criteria, as ordered by importance, and the relative importance of multiple values guiding action (Schwartz, 2006)) and what a home means to someone, human values can contribute to designing meaningful homes using the value-design-tool.
As a tool for design the value-design-tool is different from previous tools like minimal sizes and requirements and patterns in that it relies heavily on the architect's skills. Computer optimisation models that try to mimic an architect's way of working by stating beforehand what sizes, connections or what more needs to be acquired, are either too large to approach reality or too general when reduced in size (Tzonis and White, 1994). By implementing meaning in a design-tool it is easier for designers to see which spatial features they could use to achieve the desired meanings in the final design, while at the same time being able to argue why.

The values that lie at the basis of this tool are cross-cultural, but the activities and spaces that relate to them are less universal. For a group with different associations between activities, spaces and values, the value-tool would need to be adjusted for that particular culture. Where the façade is associated with power in this sample, it might have a different association somewhere else leading to a different combination in the value-tool to design for the value of power. Some activities or spaces might not be specific enough to clearly link to a value, or some values might not be expressed as much in the spatial features but more in the furnishings. If that is the case, then the spatial lay-out should give the residents the opportunity to do so. Also to what extent values can contribute to the meanings of other types of buildings would be interesting to find out.

The tool can be used as an addition to the programme of requirements or to shape the programme of requirements. Guidelines for minimum spaces already exist, as do guidelines for installations and services. Using the value-design tool as an addition, gives direction for the variance in housing designs without limiting the creativity of the designer. As an advantage, the differences between houses can be based on specific residents, or residents with a certain value profile while at the same the reasons for doing so can be validated.

In summary, the houses designed with the tool developed in this paper using associations of activities and spaces in the home with human values, have meanings that are recognised and appreciated. For the part of architecture that is concerned with housing (or possibly beyond), this is a first attempt of creating and using a tool that includes meaning, which seems promising: Not only does it allow designers much freedom in form, it also helps with identifying what a future resident feels is very important and how this is communicated.
References


Appendix I.
The following descriptions of the houses were given:

**House 1 (Self-direction and stimulation):**
separate/alone, open(4), light (3), living area, closed, private area is closed, living area open (4), view(2), combination of work and living, controlled, very directed, more spacious, visible for everyone, extrovert, large, modern style.

**House 2 (Universalism and benevolence):**
high ceiling(2), spacious(4), large, combined eating and living area, open (2), luxurious, spacious (3), public ground floor, wide view, small (2), large garden (2), lot of space for routing, intimate atmosphere, contact with neighbours, economic, light, interesting, not standard, compact.

**House 3 (Self-direction and universalism):**
hemmed in, personal, able to see but not be seen(2), social contact between spaces (3), luxury, spacious (2), view (2), private, open (2), new type of people, industrial, making outside inside, vertical, horizontal, large (2).

**House 4 (Benevolence and conformity/tradition):**
enclosed, more spaces, compact, practical, playful, compartmentalised (2), defined living area and kitchen (2), traditional (2), closed (3), less contact with outside, spacious, light, private living, family house, less luxurious.

**House 5 (Power and security):**
very enclosed(3), open (2), different, view inside, compact but large, characteristic, private spaces (2), individual, playful, least connected to the street, inward looking (4), traditional(2), logical, large (3), Greek patio, compartmentalised, lot of rooms, separated, most private, classic, practical, stands out.

**House 6 (Hedonism & stimulation):**
closed, urban, garden oriented (3), private, traditional, tour (2), large kitchen, two sides (2), intimate, playful, logical, compact, all space is used, spacious rooms.

**House 7 (Power and achievement):**
open/closed, playful, representative, for a lot of people, complex (3), view (2), entrance area, high (2), large (2), luxurious, intimate, ceremonious, view on living room, height, closed, views between spaces (2), highest, divided, least standard.
Appendix II.
Activities and spaces.

Donald and Oseland derived their list of fifteen activities used in the study on a more elaborate list of activities originally created by Tagg (1974). These activities were the following:
Sleeping
Washing clothes
Playing games
Studying
Watching television
Washing/hygiene
Chatting/talking
Washing dishes
Cleaning
Reading
Relaxing
Entertaining
Listening to music
Eating
Cooking

Another study by Canter and Tagg (1980) used a set of spaces in the home and associated activities generated by a sample of students as there was no existing list to use. Spaces used were the kitchen, bathroom, bedroom, library, sitting room and dining room. The additional spaces that were used in this study like the façade, toilet, guest room and the separation of children’s and parents bedroom was to make sure not to miss some hidden meaning. For the activities ten activities were chosen that appear in these lists, sometimes grouping them or rephrasing. Entertaining was used as inviting guests and the activities of cleaning, brushing teeth, shaving, etc were grouped as personal hygiene for example.


Appendix III.

Questionnaire
Appendix IV.

Interview transcripts