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Assessing Housing Wellbeing in Sustainable Buildings and a Large-Scale Test

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Abstract
The exploration of subjective aspects in architecture mainly concentrates on life-style preferences and on issues of aesthetical and architectural psychology. In this research it is usually taken for granted that particular physical building parameters have positive effects on residents' wellbeing whereas others have not. Empirical research on what residents actually experience however and how they evaluate their housing environment in reality is rare. Following a three-years monitoring experiment of the residents of the VELUX Model Home 2020 in Hamburg, Germany, the material gained from interviews and survey questionnaires in that process was analyzed in order to uncover the underlying structure of housing wellbeing in energy-efficient housing and develop a multi-facetted measurement instrument that can be put to an empirical test with subjects from outside the model home. Subsequently, the calibrated measurement instrument, the Housing Wellbeing Inventory (HWI), was incorporated into a large-scale population survey of 14 core European countries, the Healthy Homes Barometer (2016) with N = 14,000 respondents, to validate results.

Keywords – Housing wellbeing; architectural psychology; energy-efficiency; comfort; monitoring; psychophysics; healthy homes barometer

1. Introduction

This papers reports on the measurement of wellbeing in sustainable houses, in particular in active houses that seek to bring to a balance "comfort, energy and environment."[1] Since there is little relevant research to rely on, the measurement of housing wellbeing was carefully explored in an experimental study first. The opportunity for this was provided by the VELUX Light-Active House in Hamburg,

[1] *Active House—The Specifications for Residential Buildings* (2nd edition). Active House Alliance 2015, Brussels, Belgium (www.activehouse.info).

Germany, as part of the European Model Home 2020 project (Velux 2015) and Hamburg's *International Building Exhibition* 2006-2013 (IBA & Hellweg 2014). One of the goals of the model house in Hamburg was to gain experience with regard to renovating existing houses according to energy-efficiency standards. During this experiment the house was closely monitored both in terms of physical performance and of the psycho-social functioning of the residents. Several methods were used for exploring wellbeing with the residents: group discussions, self reports with diary methods, online and face-to-face interviews as well as in-depth interviews at the end of the yearly seasons. These different procedures led to the accumulation of a very detailed recording of the family's wellbeing in the house that could be related to the physical building environment.

Subsequently, this material was analyzed with factor analytic methods in order to uncover the underlying structure of housing wellbeing that was then put to several empirical tests with subjects from outside the model home. As a last step, the calibrated measurement instrument, the *Housing Wellbeing Inventory* (HWI), was incorporated into the *Healthy Homes Barometer 2016*, a large-scale population survey of 14 core European countries with N = 14,000 respondents, in order to develop a benchmark for the measurement of subjective housing quality in sustainable buildings. We thus work our way from experiment to testing the generalizability of outcomes cross-nationally.

We begin by defining housing wellbeing by way of four propositions which are then being put to work in assessing housing wellbeing empirically.

2. Four propositions

Building constructors usually see themselves on the supply side of the housing industry. However if the idea of sustainable buildings is to spread, the *demands* put forth by users need to be given serious attention. Thus, switching from the supply side (of house builders) to the demand side (of users) we ask: What is it that people actually want in housing? If sustainable housing is to proliferate, we must take the *wellbeing* of users into account. They will not buy and move into houses they do not find worth living in.

Looking at the demand side, we must relate the wellbeing of users to the physical properties of buildings, sustainable buildings in particular. In quantitative terms what this means is establishing functional relationships between wellbeing scores and physical building parameters. This is basically what *classical psychophysics* has been doing for roughly 150 years: mental sensations are studied as causally determined by physical objects and their intensities. Housing wellbeing w is then a function of housing assets a, formally $w = f(a)$.

But what *is* wellbeing, housing wellbeing in particular? There are four propositions we like to make:

1. Housing wellbeing is different from the feeling of *comfort* people have.
2. Housing wellbeing is a descriptive, *not a normative* concept.
3. Housing wellbeing originates from individuals, but must be conceptualized as an *attribute of buildings*.
4. Housing wellbeing can be measured representing a *multi-dimensional construct*.

We will elaborate on these four propositions in turn.

3. Proposition I

The heart of the matter is that house builders think in terms of comfort and not of wellbeing. Note that comfort is always tied to particular physical modalities that produce comfort (or discomfort, for that matter). We speak of comfort with regard to shade and brightness of light, for example, temperature, humidity, indoor climate and noise level, the space that is available and the composition of rooms. Thus there are many different comfort domains based on particular aspects of our living environment. In classical psychophysics, these domains are studied in their relation to felt comfort one by one.

Wellbeing in contrast is a state of mind, a compound measure and overall evaluation of the entire housing situation of a person. Certainly, comfort sensations of all sorts are important ingredients of housing wellbeing, but wellbeing is more than that. We do not exhaust the concept of wellbeing by simply summing up comfort feelings in different domains, apart from not knowing according to what aggregation rules the different comfort judgments are supposed to be pooled. So if we want to measure wellbeing (instead of isolated comfort dimensions) we must break away from classical psychophysics and turn to a more elaborated version that explains wellbeing by the complete vector of relevant housing parameters.

Historically, today's wellbeing research originates from 18th century welfare economics (e. g. Jeremy Bentham) where one of the key issues was to define subjective welfare functions that a benevolent ruler would be indulged to optimize. Welfare is thus comprised of everything that a person finds important for his or her *good life*.[2] It is all the different things we believe we are justly entitled to. This is why it does not make sense to isolate any aspect of an individual's wellbeing (or welfare) and give it

[2] In economics, since John Stuart Mill, it is *utility* as a basic concept that defines welfare. Utility is considered to be the motivational force behind all our actions.

the dominant emphasis. Any attempt to do so would predetermine what a good life is for particular individuals—as if under the sway of a dictator.

Therefore the question "What is wellbeing?" has no answer unless we go out and investigate this with real people. Wellbeing is what people take it to be. Like beauty, wellbeing is "in the eye of the beholder." Certainly this applies to the wellbeing of residents of houses in particular.

4. Proposition II

This immediately draws on the second proposition: We should not think of housing wellbeing as a normative concept. If wellbeing is what people take it to be, building constructors must not define on their own what is good for the users of their houses. Instead, wellbeing should be conceived as a genuinely *descriptive* idea to be assessed and measured empirically. It is something to be explored, not prescribed.

The difficulty of course is that engineers and architects usually know well from experience and by training what occupants of houses need—in terms of temperature, light, air quality etc. But they can be massively wrong in this, in particular if overall housing wellbeing instead of isolated realms of comfort are considered. Most so-called *post-occupancy evaluation* studies (POE) however focus on conventional pre-defined comfort dimensions only (Edwards & Naboni 2013; Bordass & Leaman 2005). These studies are far from actually assessing the day-to-day experiences and the overall wellbeing of individuals living in energy-optimized, active houses (or any other houses). Taking the non-prescribing character of housing wellbeing seriously, maybe building constructors should return to operate behind a *veil of ignorance* (John Rawls), instead of pressing forward with dogmatic beliefs about user benefits.

5. Proposition III

If we go out and assess empirically what constitutes the wellbeing of users of sustainable houses, we should quickly go beyond simple post-occupancy evaluation studies but find ways of measuring the wellbeing of users head-on. Also, model homes studies are fine but they should result in designing standardized devices for measuring the housing wellbeing. The main purpose of this then is not to describe the feelings of the inhabitants of the houses per se, but to characterize the *houses* they live in. The wellbeing of its users is the quality imprint of the house just like its size and location, building material, energy balance and the esthetics of its physical appearance. Thus while housing wellbeing originates from individuals, it must be conceptualized as an attribute of buildings.

Measuring wellbeing as a feature of a house, we are confronted with an *aggregation problem* (Wegener 2013). Is it possible to combine wellbeing scores of different individuals in the house, family members, say, in order to come up with an aggregate value of wellbeing for a house? In general this is not possible, because individual preferences may be based on very different idiosyncratic considerations. But we can define specific *groups* that have by and large similar characteristics and aggregate their wellbeing to a common value. Thus a house may have several wellbeing scores attached to it depending on different user groups and times.

6. Proposition IV

Wellbeing can be measured. It is considered to be an attitude: an individual mental evaluation of objects that is reflected in different value dimensions. Assessing housing wellbeing is thus an exercise in attitude measurement. Following the standard model of attitude measurement in psychology (Rosenberg & Hovland 1966), Wegener and Fedkenheuer (2014) have proposed a multi-component view of housing wellbeing distinguishing between *affective*, *cognitive*, and *conative* (behavior-related) reactions in attitude formation. Measuring housing wellbeing therefore, we must first explore what elements constitute wellbeing for users in these three dimensions. The first results of this empirical exploration have been laid down in the *Housing Wellbeing Inventory* (HWI) as a standardized measurement device for occupants of energy-efficient houses (Fedkenheuer, Scheller & Wegener 2014; Fedkenheuer & Wegener 2015). In the section to follow, this multi-facetted *Housing Wellbeing Inventory* is described in more detail.

7. Housing wellbeing as a multidimensional construct

In the Light-Active House experiment, several methods were used for exploring wellbeing: initial group discussions with family members, self reports using diary methods and digital logbooks. In addition, approximately every four weeks respondents completed an online questionnaire including both standardized and open-ended questions about the various dimensions of their wellbeing. About every six weeks, in-depth interviews were conducted in the form of video calls. Finally, extensive structured face-to-face interviews were carried out in the model home itself at the end of the yearly seasons. These different procedures led to the accumulation of a very detailed recording of the affective, cognitive and behavior-related dimensions of the family's wellbeing in the house.

Subsequently, this material was analyzed in order to uncover the underlying structure of housing wellbeing that would then be put to an empirical test with subjects from outside the model home. The ultimate goal was to design the *Housing Wellbeing*

Inventory (HWI) that can serve as a standard for the measurement of the subjective quality of sustainable housing.

Based on the explorations in our test family in the Light-Active House, we were able to accumulate a pool of roughly 250 questionnaire items that represented the categories of wellbeing that had proven to be important to the family. The methodological task, if confronted with such a collection of survey items, is to reduce this excess of data empirically. The standard way of doing this is to have a sample of respondents answer all of the questions in the pool on a metric scale (from "very strongly agree" to "very strongly disagree," for instance) and analyze the resulting correlation matrix statistically. Using factor analysis methods it is possible to disaggregate a correlation matrix into a small number of factors that emerge when one looks in iteration cycles at the correlations of the questionnaire items with the generated factors (Rummel 1970).

Accordingly, the 250 wellbeing items of our exploratory study were presented to a sample of 60 social science students who gave their responses that were then aggregated into a correlation matrix. The correlation matrix was factor analyzed yielding 10 meaningful housing wellbeing factors: Factor 1: *Emotional attachment*, Factor 2: *Size*, Factor 3: *Modernizing status*, Factor 4: *Daylight*, Factor 5: *Neighborhood*, Factor 6: *Heating control*, Factor 7: *Energy costs*, Factor 8: *Humidity*, Factor 9: *Sleeping comfort*, Factor 10: *Ventilation*. (Table 2 below gives the most salient questionnaire items and their factor loadings as they were recovered in the subsequent large-scale test.)

8. A comparative housing wellbeing and health survey of 14 European countries

Equipped with the results from our experimental explorations, we now turn to the validation study with population surveys in 14 European states: Austria, Belgium, Czech Republic, Denmark, France, Germany, Hungary, Italy, Norway, Poland, Spain, Switzerland, the Netherlands, and the UK. The study is part of the *Healthy Homes Barometer*, a yearly survey of attitudes and behavior regarding home comfort, health, energy consumption and environmental impact in Europe (HHB 2015). In the present report, the HHB 2016 is used that was administered as an online survey in the involved countries simultaneously in October 2015.

8.1 Method

Based on online panel sampling procedures (Callegaro, Baker et al. 2014), national representative samples of 1,000 respondents, aged from 16 to 65, were drawn in each country, representing more than 375 million Europeans, accounting for more than 70 % of the total European population. When conclusions are addressed on a pan-

European level, responses have been weighted according to a specific country's share of the population of the 14 European countries surveyed as a whole (country weights). For analytic procedures that address functional relationships between variables, no weighting is applied.

The *Healthy Homes Barometer* questionnaire—of about 18 minutes mean fill-out time— addresses perception of health issues and wellbeing in relation to respondents' homes, comfort and environmental concerns. Part of the question program was a condensed version of the *Housing Wellbeing Inventory*: Respondents had to rate 20 statements representing the 10 housing wellbeing dimensions that had been established in our model homes experiments. This was supplemented with detailed information about respondents' health status and domestic energy behavior as well as individual evaluations of their homes. With these data, the 20 housing wellbeing items could then be subjected to a factor analysis in order to test whether this would recapture the 10 housing wellbeing dimensions of the *Housing Wellbeing Inventory* established so far on a broad international data level.

The *Housing Wellbeing Inventory* can thus be subjected to a validation test. Validity in measurement theory is concerned with the question whether a measurement device or scale measures what it is suppose to measure and how well it performs doing this. Of the different validity types distinguished in psychological testing theory (Lord & Novick 1968), we are concerned here particularly with two: *construct validity* and *criterion-related validity*. The former is the assertion that an operationalization accurately reflects the construct it was designed for. In criterion-related validity, it is examined whether the operationalization behaves the way it should, given the theory of the construct; it assumes that the operationalization should function in predictable ways in relation to other operationalizations and variables. In more concrete terms, the *Housing Wellbeing Inventory* possesses construct validity to the extent that we can replicate its factor structure in different settings—in a large populations survey, say, and not just in the experimental environment of model houses. The *Housing Wellbeing Inventory* displays criterion-related validity on the other hand, if we can show that correlations with and the effects on other variables are in line with theoretical predictions.

Both types of validity measures can be assessed with the rich data source of the *Healthy Homes Barometer* giving the measurement credibility beyond experimental settings.

8.2 Theory

We start out from housing wellbeing theory to identify the position and effects of wellbeing within a set of housing characteristics (Fedkenheuer et al. 2013). Housing wellbeing theory assumes that wellbeing as a compound measure is determined by the

properties of the house as well as by external factors, which together make up the *stimulus* of housing wellbeing; and that the attitude of wellbeing itself is at the same time influenced by formative factors like perception of one's health, level of information, residents' behavior and other factors. Thus there are *exogenous* drivers of wellbeing and *formative* drivers. The manifestations of wellbeing then can be observed as responses to the different HWI questionnaire items by which housing wellbeing is operationalized (*reflective* measurement model).

The exogenous factors of the house shape the perception of the house as a stimulus. As listed in Table 1, generally the following six exogenous parameters of healthy housing are considered today (Haselaar 2006: 7). Distinguishing between *conditions*, which are either build into the house or come from the outside environment resisting manipulation, and transportable *agents*, three more agent dimensions are added of which housing wellbeing of course is the most central.

Table 1. Healthy housing parameters

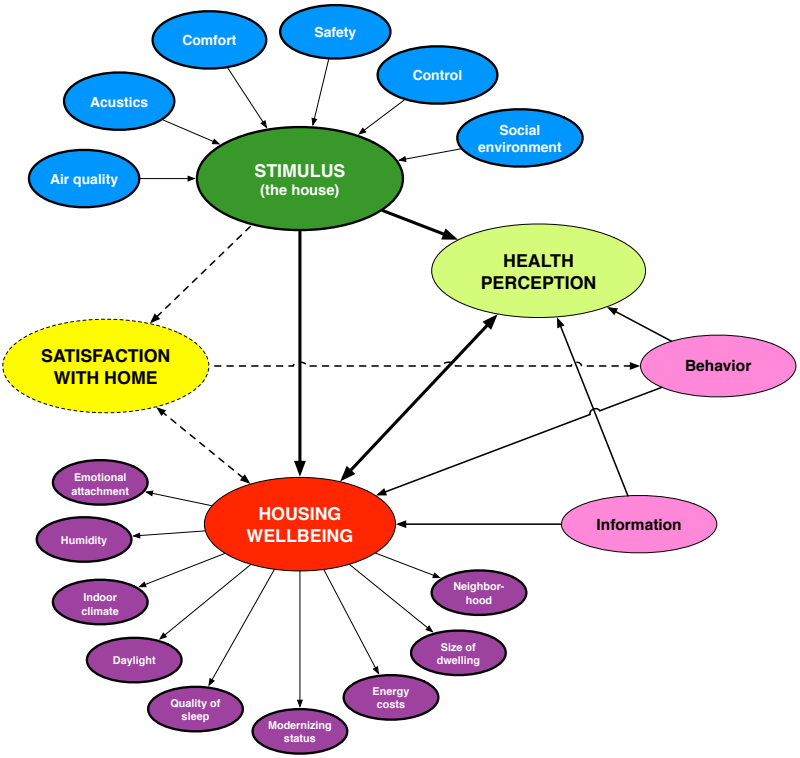
— Conditions —	
Air quality	Biological and chemical agents
Acoustics	Noise from outdoors, neighbors, appliances
Comfort	Temperature, daylight, air currents, and view
Safety	Falls, smoke and fire, poisoning from building materials
Control	User control over the indoor environment
Quality of the social environment	Privacy, security, social support
— Agents —	
Behavior	User competence to adapt the environment to needs (learning-by-doing)
Information	Health perception is based on (true or false) information and beliefs
Housing wellbeing	Individual welfare in the house

Of the agent types, *behavior* specifies the sense of being in control of one's environment. This is an important factor of a person's wellbeing because lacking control evokes feelings of helplessness. Psychologists have clearly demonstrated that adverse or noxious stimuli are less irritating if the subject perceives to have control over them. Lack of control over the environment produces stress. Under stress, bodily

defenses against environmental hazards, e.g. infectious agents, toxic or irritating chemicals are diminished. Therefore we consider learning to being able to proactively intervene with the home environment adapting it to one's personal needs as an ingredient of housing wellbeing and health.

Also the *information* a person has is a factor influencing wellbeing. Certain self-reported health effects, for instance, are believed to be the result of constructed health risks, meaning that the occupant is deceived by (false) information about risk agents and projects these risk on negative perceived health. A person's perception of health risk often increases the actual harm suffered by that person (Broadbend, Petrie et al. 2006; Kamp, Leidelmeijer et al. 2003). Exposure risk to the electromagnetic fields of high voltage power lines and multi-chemical sensitivity (MCS) have been associated with these individual constructs (Baliatsas, Kamp et al. 2012).

Fig 1 A Healthy homes and wellbeing model



Of the *formative factors*, health perception stands out in that we assume that health perceptions do affect wellbeing, but that the features of the house also affect health. Thus there is a direct and an indirect path of the house to housing wellbeing via the perception of health. Conversely it can also be expected that the wellbeing of a person affects her or his health perceptions, we therefore model also an interaction effect of wellbeing with health—as can be seen from the complete healthy homes and wellbeing model of Figure 1 derived from housing wellbeing theory.

The satisfaction with the home of course contributes to the wellbeing in the house directly and we can also assume that wellbeing affects home satisfaction. But satisfaction is to be distinguished from housing wellbeing in general. The latter is defined as the affective, cognitive and behaviour-related evaluation of the housing situation as such whereas home satisfaction is focussed on the physical setting of the house stimulus. This is in line with the results from subjective wellbeing and life satisfaction and happiness research where the distinction between satisfaction and subjective wellbeing is also made (Diener 1994; Diener, Lucas & Oshi 2002).

8.3 Results

With the data of the 14 surveyed countries, we factor analyse the correlation matrix of the 20 housing wellbeing items using principal component analysis. The results are depicted in Table 2. The most parsimonious solution leads to the extraction of nine factors, leaving out three of the 20 questionnaire items because they do not yield meaningful correlations with the rest of the items.[3] The remaining 17 questions represent the HWI factors: *Emotional attachment, Humidity, Indoor climate, Daylight, Quality of sleep, Modernizing status, Energy costs, Size of dwelling*, and *Neighborhood*. We therefor conclude that the *Housing Wellbeing Inventory* displays a high amount of construct validity in that its structure can almost completely be reconstructed from the larger data set representative for 14 European countries. Only the factor *Heating control* found salient in our experimental studies does not appear in the international survey, all other factors seem to be robust in terms of their construct validity. This result is impressive since we are dealing here with samples of very heterogeneous national populations. At least in the European countries under study, the perceptions of housing wellbeing are strikingly similar with regard to their affective, cognitive and behavioral structure.

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[3] What this means is that these items correlate to a substantial degree with several of the other factors and are thus not discernable as separate factors by respondents. These are the items: "During the winter months I have to adjust the temperature in my home too often," "In the room where I sleep there is too much light," and "My dwelling can easily be aired out."

Table 2. Factor matrix of nine housing wellbeing indicators

	EMOTIONAL ATTACHMENT	HUMIDITY	INDOOR CLIMATE	DAYLIGHT	QUALITY OF SLEEP	MODERNIZING STATUS	ENERGY COSTS	SIZE OF DWELLING	NEIGHBORHOOD	Unexplained Variance
I feel at home where I live.	**0.476**	0.074	0.251	0.049	0.064	0.066	-0.001	-0.037	0.066	0.330
I don't really like to spend much time in my dwelling.	**-0.858**	-0.006	0.040	0.004	0.025	0.039	-0.002	-0.029	0.044	0.125
I sometimes have damp on my window panes.	0.083	**0.696**	-0.092	-0.071	-0.016	0.015	-0.028	0.033	0.020	0.288
I have a problem with mould in my home.	-0.064	**0.673**	-0.113	0.023	-0.049	0.019	0.065	-0.083	-0.028	0.299
The temperature in my home can easily be adjusted according to my needs.	-0.041	-0.058	**0.570**	0.094	-0.196	0.150	0.128	-0.079	0.011	0.365
My dwelling can easily be aired out.	0.013	-0.151	**0.631**	-0062	0.044	-0.139	-0.047	-0.000	-0.024	0.335
In my home I can make full use of the daylight.	-0.070	0.087	0.354	**0.577**	0.040	0.039	-0.034	0.043	-0.010	0.253
In my home I am too much dependent on artificial light.	-0.022	-0.007	0.061	**-0.784**	0.024	0.028	-0.031	0.024	-0.008	0.170
Sleeping conditions allow a restful sleep.	-0.015	-0.045	-0.067	0.009	**0.973**	0.059	0.049	-0.037	-0.001	0.044
My dwelling is in need of renovation.	-0.053	0.152	0.137	0.116	0.062	**-0.554**	-0.056	0.061	0.024	0.303
The technical equipment in my home is up to date.	-0.048	0.073	0.023	0.052	0.083	**0.800**	-0.074	0.060	0.007	0.187
I sometimes wonder if my home uses up too much energy.	-0.067	0.082	0.160	0.111	0.030	0.060	**-0.670**	0.032	-0.029	0.258
Compared to other dwellings, the cost for energy in my home is low.	-0.054	0.098	0.170	0.068	0.090	-0.019	**0.722**	0.070	-0.025	0.247
My dwelling is too small.	0.043	-0.025	-0.037	-0.016	-0.036	-0.000	0.034	**0.712**	0.010	0.158
I wish I had more room because everything is happening at one and the same spot.	-0.013	-0.018	-0.024	0.029	-0.016	0.058	0.011	**0.685**	-0.006	0.171
I have nice neighbors.	-0.084	0.057	0.089	0.045	0.010	0.018	0.026	0.010	**0.709**	0.204
I don’t feel accepted by my neighbors.	-0.035	0.065	0.111	0.054	0.012	0.021	0.027	0.006	**-0.699**	0.211

These results portrait the construct validity of the measurement and the reflective measurement model of housing wellbeing theory. For addressing the *criterion-related validity*, we analyse the effects the wellbeing factors have on home satisfaction. Several measures were used in the study to assess home satisfaction, the most straightforward being: "All in all, how satisfied are you with your current home?" In Table 3, we distinguish three groups of countries in Europe: the Northern countries (Austria, Belgium, Denmark, Germany, Norway, Switzerland, the Netherlands, the UK), the Eastern countries (Czech Republic, Hungary, Poland) and the Southern countries (Italy, France, Spain). As we can see, while there is high level of satisfaction in all countries, satisfaction in Northern countries is highest and it is lowest in the Southern countries (mean rating scale values of 3.57 for North, 3.42 for East and 3.28 for South).

Table 3. Home satisfaction in country groups

	All countries	**Northern countries**	**Southern countries**	**Eastern countries**
Not at al satisfied	3.9%	3.8%	3.4%	4.9%
Slightly satisfied	12.1%	12.6%	15.0%	7.7%
Moderately satisfied	31.0%	24.8%	39.2%	39.5%
Very satisfied	38.4%	40.4%	35.3%	36.1%
Extremely satisfied	14.6%	18.4%	7.1%	11.8%

How do the housing wellbeing factors influence home satisfaction? Based on regression analyses, the radar diagram of Figure 2 gives the answer. For the groups of countries and all countries together we see from Figure 2 that *Size of dwelling* is considered most important for predicting home satisfaction in all 14 countries, but looking at the country groups, *Indoor climate*, *Modernizing status* and *Quality of sleep* are emphasised even more strongly. The supply with *Daylight* ranks lowest and second to lowest in Eastern countries, but like all other factors listed, *Daylight* exerts a statistically significant effect on satisfaction. Note that *Emotional attachment* is not part of the list because "satisfaction with own home" is conceptually too close to include *Emotional attachment* as a predictor. The full regression models for the country groups are documented in the Appendix (Table A1).

9. Conclusion

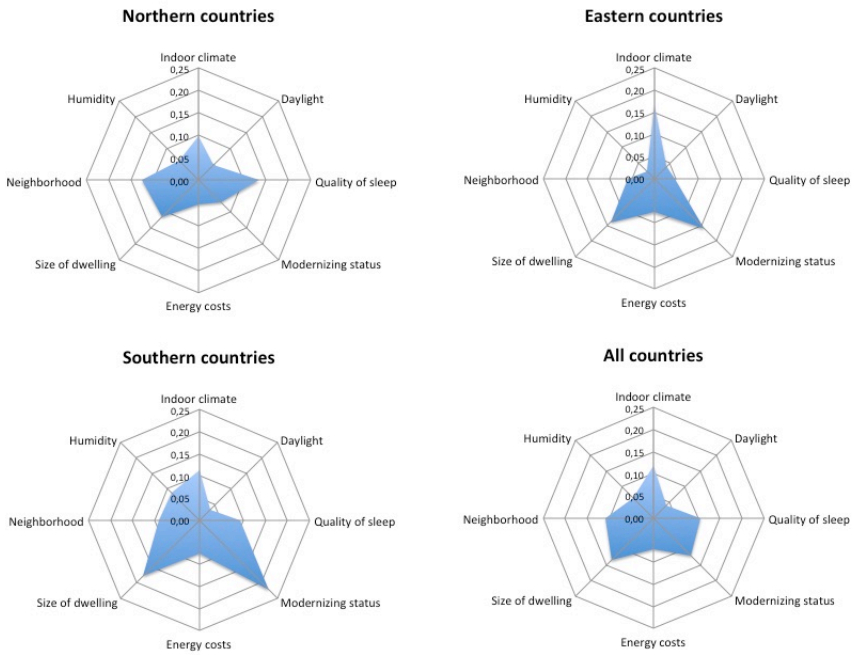
House builders usually think that they are quite well informed about what the users of the houses they are constructing like. There are defined "ranges of comfort" with respect to temperature and light, air quality and acoustics that practitioners take for granted. Many of these standards have been implemented in formalized "social performance" guidelines and norms. But empirical research on what residents actually

experience and how they evaluate their housing environment in reality is rare. Instead architects and lawmakers entertain a normative bias, stipulating future users as to what is good for them.

We report here on an initial attempt at letting the users have a say on what determines their wellbeing in the house. Following a two-years monitoring of the residents of the energy-efficient model home in Hamburg, the material gained from extensive interviews and survey questionnaires was analyzed in order to uncover the underlying structure of housing wellbeing in energy-efficient housing and develop a multi-facetted measurement instrument that can be used with subjects from outside the model home.

The main thrust of this study is that housing wellbeing is not comfort. Measuring comfort is part of classical psychophysics that relates isolated physical modalities to isolated felt sensations. Wellbeing research in contrast is focused on a multi-facetted concept of wellbeing as an appraisal of the entire living situation of an individual vis-à-vis his or her beliefs of what a good life in housing is.

Fig. 2 Radar diagrams of nine housing wellbeing factors influencing home satisfaction for country groups and all countries



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Appendix

Table A1. Home satisfaction on housing wellbeing factors, regression analyses

	All countries			Northern countries			Southern countries			Eastern countries		
HOME SATISFACTION	regr. coef		beta	regr. coef		beta	regr. coef		beta	regr. coef		beta
Humidity	0.06	***	0.07	0.06	***	0.06	0.09	***	0.10	0.02		0.02
Indoor climate	0.12	***	0.10	0.10	***	0.08	0.11	***	0.10	0.17	***	0.15
Daylight	0.04	***	0.04	0.05	***	0.04	0.03	**	0.04	0.04	**	0.04
Quality of sleep	0.11	***	0.11	0.13	***	0.14	0.09	***	0.10	0.05	***	0.05
Modernizing status	0.12	***	0.12	0.07	***	0.07	0.22	***	0.25	0.16	***	0.17
Energy costs	0.07	***	0.07	0.05	***	0.05	0.08	***	0.07	0.08	***	0.07
Size of dwelling	0.13	***	0.16	0.12	***	0.13	0.18	***	0.22	0.14	***	0.18
Neighborhood	0.11	***	0.11	0.13	***	0.12	0.09	***	0.10	0.06	***	0.06
When was your property built?	0.01	*	0.02	0.04	***	0.07	-0.01		-0.02	-0.04	***	-0.06
Owner of dwelling = yes	0.10	***	0.05	0.10	***	0.04	0.11	***	0.05	0.15	***	0.06
Years in that dwelling	-0.00	***	-0.03	-0.00		-0.02	0.00		0.01	-0.01	***	-0.07
Age	-0.00		-0.01	-0.00		-0.01	-0.00		-0.03	-0.00		-0.01
Female = yes	-0.02		-0.01	-0.02		-0.01	-0.01		-0.00	-0.03		-0.02
Education	-0.01		-0.01	-0.01	*	-0.02	-0.01		-0.01	0.02		0.03
Child at home = yes	-0.06	***	-0.03	-0.07	***	-0.03	-0.03		-0.02	-0.01		-0.01
Constant	0.71	***	.	0.84	***	.	0.22	*	.	0.99	***	.
Observations	12282			6963			2673			2646		
R-squared	0.24			0.21			0.37			0.21		