

# Relationships Between Objective and Perceived Housing in Very Old Age

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**Purpose:** Our purpose in this study was to explore relationships between aspects of objective and perceived housing in five European samples of very old adults, as well as to investigate whether cross-national comparable patterns exist. **Design and Methods:** We utilized data from the first wave of the ENABLE-AGE Survey Study. The five national samples totalled 1,918 individuals aged 75 to 89 years. Objective assessments of the home environment covered the number of environmental barriers as well as the magnitude of accessibility problems (an aspect of person-environment fit). To assess perceptions of housing, we used instruments on usability, meaning of home, and housing satisfaction. We also assessed housing-related control. **Results:** Overall, the results revealed that the magnitude of accessibility problems, rather than the number of physical environmental barriers, was associated with perceptions of activity-oriented aspects of housing. That is, very old people living in more accessible housing

perceived their homes as more useful and meaningful in relation to their routines and everyday activities, and they were less dependent on external control in relation to their housing. The patterns of such relationships were similar in the five national samples. **Implications:** Objective and perceived aspects of housing have to be considered in order to understand the dynamics of aging in place, and the results can be used in practice contexts that target housing for senior citizens.

*Key Words:* Person-environment fit, Accessibility, Usability, Housing-related control beliefs

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Around the world, the home provides the major context for aging, yet there are still considerable knowledge gaps about how objective features and perceptions of housing interact with each other and impact elderly people's quality of life (Oswald & Wahl, 2004). With increasing age and declining functional capacity, the home environment and its close surroundings become the major living space where elders perform their everyday activities and spend most of their time (Baltes, Maas, Wilms, Borchelt, & Little, 1999), creating meaning for the aging individual (Rubinstein & De Medeiros, 2004; Sixsmith, 1990; Sixsmith & Sixsmith, 1991). Given the importance and complexity of older people's housing situations, objective as well as perceived aspects deserve consideration because the dynamics of their interaction are largely unknown. Only a few studies based on national data exist, and cross-national research is virtually nonexistent. This study is based on data from the European ENABLE-AGE Project (see Iwarsson et al., this issue); our aim is to reduce this knowledge gap.

With respect to objective aspects of housing, the ecological theory of aging (Lawton & Nahemow, 1973; Scheidt & Norris-Baker, 2004) has frequently

guided environmental gerontology research (Gitlin, 2003; Wahl, 2001). According to this theory, a person is defined in terms of a set of competencies, and the environment is defined in terms of its demands, labeled *environmental press* (Lawton & Nahemow). Applications of this theory have shown that barriers in the physical environment cause different magnitudes of problems for individuals with varying functional capacities (Fänge & Iwarsson, 2003; Iwarsson, 2005; Stark, 2004; Wahl, Oswald, & Zimprich, 1999; Wahl, Schilling, Oswald, & Heyl, 1999). This underscores the necessity for investigating person–environment fit (P–E fit) and the dynamics among its components, rather than studying personal and environmental factors alone (Iwarsson 2004, 2005). In this kind of research, the term *accessibility* has been introduced to denote P–E fit, that is, the relationship between a person’s functional capacity and the prevalence of physical environmental barriers in the home (Iwarsson & Ståhl, 2003). As a concept, accessibility originated in the field of rehabilitation (Steinfeld & Tauke, 2002). For decades, architects, public planners, and geographers with a specific interest in promoting possibilities for individuals with disabilities to participate in society have advocated accessibility and universal design. In rehabilitation services, occupational therapists continuously target accessibility in intervention processes. Within the field of environmental gerontology, this aspect of housing has been of interest in terms of descriptions of living arrangements and home modifications, most often referred to as P–E fit (Iwarsson, 2004). In our definition, accessibility is an objective aspect of housing and an aspect of P–E fit that can be assessed reliably and validly by professionals, in relation to existing norms and guidelines (Iwarsson & Slaug, 2001; Iwarsson & Ståhl, 2003). Throughout this article (and in Oswald et al., this issue), we use the term *accessibility* to denote this aspect of P–E fit.

Regarding research on perceived aspects of housing, researchers have traditionally used broad attitudinal, often single-item evaluations of housing satisfaction (Pinquart & Burmedi, 2004), although calls have been made for a more complex and sophisticated approach to investigating perceived housing. For example, perceived activity patterns in the home deserve explicit attention (Golant, 2003), and, according to literature within the field of occupational therapy, person–environment–activity (P–E–A) transactions are of critical importance (Law et al., 1996). Using the idea of P–E–A transactions as the starting point, Iwarsson & Ståhl (2003) defined an aspect of perceived housing, which they termed *usability* of the home, and the concept has been empirically validated (Fänge & Iwarsson, 2003, 2005a, 2005b). Usability includes P–E–A components and is defined as the extent to which the person’s housing needs and preferences can be fulfilled in terms of activity performance (Fänge & Iwarsson,

2005a). Empirically it has been shown that housing accessibility and usability are related but different concepts; usability also includes the activity component and is based on individual perceptions (Fänge & Iwarsson, 2003).

Furthermore, concepts based on theories of place identity (e.g., Proshansky, Fabian, & Kaminoff, 1983; Stedman, 2002) have been advanced. According to these theories, the home environment is a major carrier of meanings related to the person’s experience, biography, and personality. The meaning of the home concept covers subjective evaluations, goals, values, cognitions, and emotions of a person in relation to his or her home (Marcus, 1995; Moore, 2000; Oswald & Wahl, 2005). The meaning of home is thus the accumulation of a gamut of place-attachment processes, operating when people form affective, cognitive, behavioral, and social ties to a particular sociophysical setting (Brown & Perkins, 1992), thereby transforming objective spaces into personally meaningful places (Altman & Low, 1992; Rowles & Watkins, 2003).

Another important aspect of perceived housing is its relation to the concept of perceived control (Lachman, 1986; Lachman & Burack, 1993; Levenson, 1973, 1981), which is based on the notion that striving for control has advantages for all species capable of influencing their environment (Schulz & Heckhausen, 1999). The potential of control beliefs for explaining the course and outcome of aging (Heckhausen & Schulz, 1995; Levenson, 1973; Smith, Marsiske, & Maier, 1996) has not been widely applied in housing-related research, but it has been introduced recently and a self-rating scale has shown good psychometric properties (Oswald, Wahl, Martin, & Mollenkopf, 2003).

Even though previous research has acknowledged the importance of objective as well as perceived aspects of the home environment for autonomy, well-being, and participation in old age (Oswald & Wahl, 2004), there is still a lack of research that comprehensively considers the relationship between objective and perceived aspects of housing. The main reasons are that traditional research approaches mostly focused on objective aspects of housing; different conceptual approaches emphasize either the objective or the perceived environment; and there are methodological limitations (Malett, 2004). Further, there is a lack of cross-national research that illuminates national similarities and differences in the relation between objective and perceived aspects of housing (Iwarsson, Wahl, & Nygren, 2004). Besides its potential to provide fundamental insights on aging in place across countries, such knowledge would be an important stimulus for conceptual and methodological advances in research on housing and health in old age.

We hypothesize that it is not objective environmental barriers as such, but the aspect of P–E fit known as accessibility that is related to perceived

Table 1. Overview of Assessments Used To Capture Objective and Perceived Aspects of Housing

Aspect Type
Objective aspects of housing
<p>The Housing Enabler was used for assessment of environmental barriers and accessibility problems. The instrument consists of two components, and the assessment and analysis is accomplished in three steps.</p> <ol style="list-style-type: none"> <li>1. The personal component of accessibility: This is the presence or absence of functional limitations (13 items) and dependence on mobility devices (2 items).</li> <li>2. The environmental component of accessibility: This is the presence or absence of environmental barriers in the home (188 items). This is divided into four sections: immediate outdoor environment (33 items), entrances (49 items), indoor environment (100 items), and communication features (6 items).</li> <li>3. Accessibility problems: This is the magnitude of problems caused by a particular combination of functional limitations and environmental barriers. Higher scores mean more accessibility problems.</li> </ol>
Perceived aspects of housing
<p>Housing satisfaction captured the overall satisfaction of the condition of the home and was assessed with one question.</p> <p>Usability of home addressed to what extent the person perceived that the physical environment supported activity performance at home. Two aspects were used:</p> <ol style="list-style-type: none"> <li>1. Physical environmental aspects (6 items);</li> <li>2. Activity aspects (4 items).</li> </ol> <p>Meaning of home captured four aspects of older adults' subjective meaning of home:</p> <ol style="list-style-type: none"> <li>1. Physical aspects (7 items);</li> <li>2. Behavioral aspects (6 items);</li> <li>3. Cognitive–emotional aspects (10 items);</li> <li>4. Social aspects (5 items).</li> </ol> <p>Housing-related control beliefs assessment was used to capture to what extent <i>external</i> control beliefs such as luck, chance, and powerful others were present (16 items).</p>

aspects of housing. In addition, we expect that the relationships between objective and perceived aspects of housing would be at least partially comparable across different countries. That is, such relationships should reflect the fundamental character of the home environment and aging in place issues, which we assume to be independent from the wider sociocultural background and socioeconomic conditions of different countries.

## Methods

### Participants

The target sample in the five countries involved in this study was very old individuals living alone in geographically defined urban areas in Sweden, Germany, the United Kingdom (UK), Hungary, and Latvia (see Iwarsson et al., this issue). Because people have a longer life expectancy in Sweden, Germany, and the UK than they do in Latvia and Hungary, we ensured that the participants in Sweden, Germany, and the UK were adults aged 80–89 years, whereas those in Latvia and Hungary were adults aged 75–84 years. The total sample at the first measurement wave included 1,918 participants (78% women, 22% men). The corresponding national sample sizes and gender proportions were as follows: Sweden,  $n = 397$  (75% women, 25% men); Germany,  $n = 450$  (78% women, 22% men); the UK,  $n = 376$  (70% women, 30% men); Hungary,  $n = 392$  (81% women,

19% men); and Latvia,  $n = 303$  (86% women, 14% men). Socioeconomic background variables reflected cultural and national similarities and differences among the five countries. Concerning financial status, the proportion of participants perceiving their income as low was largest in Hungary and Latvia. The vast majority of the participants lived in ordinary housing, and in all countries except the UK, most participants lived in multidwelling blocks. In the UK, Hungary, and Latvia, the majority of participants owned their housing; in Sweden and Germany, about half of the participants were tenants. In all national samples, the average length of residence for participants in their current home was over 21 years. Background characteristics such as health and years of schooling varied among the national samples (see Iwarsson et al. and Oswald et al., this issue).

### Instruments

In this research, we used several assessments to capture the objective and perceived aspects of housing; an overview of these assessments is shown in Table 1.

### Objective Aspects of Housing

We operationalized objective housing as the number of environmental barriers in the home and as the magnitude of accessibility problems, which we

assessed by using the Housing Enabler (Iwarsson & Slaug, 2001). This instrument was developed on the basis of extensive research, and there is substantial support for its validity and reliability (Fänge & Iwarsson, 2003; Iwarsson & Isacson, 1996); it has been used in a range of empirical studies (Fänge & Iwarsson, 2005b; Iwarsson, 2005). In this project, we developed and tested a cross-national research version, which demonstrated acceptable interrater reliability (Iwarsson, Nygren, & Slaug, 2005).

One administers the Housing Enabler instrument in three steps by using both interview and observation, with the first step being an assessment of the personal component of accessibility. One measures this by the presence or absence of functional limitations (13 items) and dependence on mobility devices (2 items). The second step is an assessment of the environmental component of accessibility. One measures this by conducting a detailed observation of the presence or absence of physical environmental barriers in the home and the immediate outdoor environment (188 items), divided into four sections: outdoor environment (33 items), entrances (49 items), indoor environment (100 items), and communication features (6 items). The third step is the calculation of a score indicating the magnitude of accessibility problems in the P-E constellation assessed. For each environmental barrier item, the instrument includes predefined severity ratings (Steinfeld et al., 1979), operationalized as points quantifying the severity of the accessibility problems predicted to arise in each case. The severity scale is scored 1 to 4, where 1 represents a potential accessibility problem and 4 represents a very severe accessibility problem. On the basis of the assessments in Steps 1 and 2, with use of a complex matrix including the predefined severity ratings, the profile of functional limitations identified for each person is juxtaposed with the environmental barriers present in the home environment. One runs this analysis item by item, and one quantifies each accessibility incongruence by means of the scale. The sum of all the predefined points yields a score quantifying the magnitude of the problems anticipated. In cases in which no functional limitations or dependence on mobility devices are present, the score is always zero. In cases in which the person has functional limitations or is dependent on mobility devices, higher scores mean more accessibility problems. In this project we used the Housing Enabler software to calculate accessibility scores (Slaug & Iwarsson, 2001; demonstration version available at <http://www.enabler.nu>).

### *Perceived Aspects of Housing*

*Housing Satisfaction.*—For the assessment of overall housing satisfaction we used a single question, adapted from the Housing Option for Older

People (known as HOOP; see (Heywood, Oldman, & Means, 2002)). We measured housing satisfaction by using a 5-graded rating scale ranging from 1 (definitely not satisfied) to 5 (yes, definitely satisfied; see Sixsmith & Sixsmith, 2002).

*Usability of Home.*—To address the extent to which the physical environment of the home supports the performance of activities, we used the self-administered Usability in My Home questionnaire (Fänge & Iwarsson, 1999, 2003). This questionnaire consists of 16 items rated on a 7-graded scale, from 1 (not at all) to 7 (fully agree), targeting activity aspects, personal and social aspects, and physical environmental aspects. For this study, we applied a project-specific 5-graded scale with the same endpoint definitions as previously described. Because there was low internal consistency in this study (Cronbach's  $\alpha < 0.50$ ), we excluded the 6 items concerning personal and social aspects. Thus, retained for analysis were the Physical Environmental Aspects subscale, which included 6 items such as "In terms of how you normally manage your washing up, to what extent is the home environment suitably designed?" (sum score,  $\alpha = 0.84$ ), and the Activity Aspects subscale, which included 4 items such as "How usable do you feel that the entrance of your home is?" (sum score,  $\alpha = 0.84$ ).

*Meaning of Home.*—We assessed the meaning of home by using the Meaning of Home Questionnaire, which was developed to capture older adults' subjective meanings (Oswald, Mollenkopf, & Wahl, 1999). The 28-item questionnaire captures four different aspects of meaning of home. The physical aspect includes 7 items such as "Being at home means for me living in a place which is well designed and geared to my needs"; the behavioral aspect includes 6 items such as "... being able to do whatever I please"; the cognitive-emotional aspect includes 10 items such as "... feeling comfortable and cozy"; and the social aspect includes 5 items such as "... being able to receive visitors." Each item is judged on a scale ranging from 0 (strongly disagree) to 10 (strongly agree). Because the items were purposefully developed to represent a wide range of meanings related to the home, internal consistency was limited (Kline, 1993). To be specific, such consistency was as follows: physical aspects,  $\alpha = 0.69$ ; behavioral aspects,  $\alpha = 0.67$ ; cognitive-emotional aspects,  $\alpha = 0.66$ ; and social aspects,  $\alpha = 0.55$ .

*Housing-Related Control Beliefs.*—We assessed control beliefs related to housing with the 24-item Housing-Related Control Beliefs Questionnaire (Oswald et al., 2003), which is based on the psychological dimensions of internal control (8 items), external control: powerful others (8 items), and external control: chance (8 items). Each item is assessed in

terms of responses to a statement; the level of agreement is judged on a scale ranging from 0 (not at all) to 5 (very much). The term *internal control* means that housing-related events are highly contingent upon a person's own behavior, where personal responsibility implies that one is responsible for what happens. The term *external control* means either that some other person is responsible or that things happen by mere luck, chance, or fate. Psychometric analyses of the ENABLE-AGE data set indicated low internal consistency ( $\alpha < 0.50$ ) for internal control, whereas each of two dimensions of external control reached a medium level. Thus, we decided to exclude the dimension of internal control. After combination of the two dimensions of external control, this 16-item scale reached  $\alpha = 0.67$ ; we used it in the combined form in our analyses.

### Procedure

After project-specific training and completion of an interrater reliability study (Iwarsson, Nygren, et al., 2005), interviewers collected data at home visits. In Sweden, Germany, and Latvia, the interviewer teams consisted of occupational therapists; in the UK and Hungary, the teams were multidisciplinary (Iwarsson et al., 2004). Following the ethical guidelines and procedures of each country, we enrolled all participants after they gave informed consent. We handled all data with strict anonymity. Interviewers informed participants that they were allowed to withdraw from the interviews if they wished, including potential withdrawal of their data up to the time of the publication of results.

### Data Analysis and Statistical Methods

First, we calculated means or medians on background descriptors for each of the variables for each national sample. For an analysis of cross-national differences on the mean level, we used the Kruskal-Wallis or *F* test. Because the sample size was large, we set the statistical significance level at  $p < .001$ . Given the goal of obtaining measures of objective and perceived housing, the statistical exploration of relationships called for the use of multivariate analysis techniques. We used canonical correlations, which, according to Stevens (1996), is the most appropriate technique for exploring relationships among multivariate combinations of variables. Canonical correlations parsimoniously describe the number and nature of mutually independent relationships between two different sets of variables. In the present study, the objective housing variable set consisted of the total number of environmental barriers and total accessibility scores. The subjective housing variable set consisted of two Usability in My Home aspects, four Meaning of

Home Questionnaire aspects, the Housing-Related Control Beliefs Questionnaire external control scale, and the single item on housing satisfaction. We calculated the canonical correlations for each national sample separately.

The statistical procedure calculates linear combinations of the variables in each set of variables (i.e., canonical variates), such that the between-set correlation (i.e., canonical correlations, or *R*) is maximized. Computation proceeds in a stepwise fashion, with the first pair of canonical variates extracted by finding the linear combinations maximizing the covariance between them. The second canonical variates are calculated in the same fashion, and so on. The analysis focused on identifying the significant canonical correlations, meaning that from each national sample only statistically significant ( $p < .001$ ) linear composites for the first or second pair are reported. For the interpretation of the significant canonical variates, we used a cutoff correlation of  $>.35$  (Tabachnik & Fidell, 1989). Further, we used standardized canonical coefficients to provide information on the contribution of single variables to the linear combination in the canonical variates. Canonical coefficients yield information on patterns of associations, and their relation to the correlation of the variables gives information on redundancy, meaning that high correlation and low standardized canonical coefficients indicate redundancy. For comparison of the patterns of canonical correlations (i.e., loadings) across the countries, we used Tucker's coefficient of congruence (Broadbent & Elmore, 1987). This coefficient ranges from  $-1$  to  $1$ ; the closer to  $1$ , the higher the similarity between the samples. Tucker's coefficient was originally designed to compare patterns of factor loadings derived from different samples, but it is applicable to comparisons of canonical loadings as well.

## Results

### Descriptive Findings

Concerning aspects of objective as well as perceived housing, the descriptive analyses on the mean level showed statistically significant cross-national differences. As one can see in Table 2, magnitudes of accessibility problems were lower in the UK and Hungarian samples than in the others ( $p < .001$ ). Separate analyses of the personal and environmental components contributing to the magnitude of accessibility problems showed lower medians in the UK and Hungarian samples, with respect to functional limitations and dependence on mobility devices (*Mdn* 1 and 2 for UK and Hungary, respectively) and environmental barriers (*Mdn* = 37 and 39 for UK and Hungary, respectively), than in the other national samples.

As depicted in Table 3, the individuals in the Latvian sample reported the lowest usability in

Table 2. Objective Aspects of Housing in the ENABLE-AGE Survey Study Samples

Aspect	Sweden	Germany	The UK	Hungary	Latvia	Difference
No. of environmental barriers	64 (34-92)	66 (1-92)	37 (7-70)	39 (0-86)	55 (4-85)	***
Total accessibility score	124 (0-670)	122 (0-596)	20 (0-371)	52 (0-531)	103 (0-563)	***

Notes: ENABLE-AGE = Enabling Autonomy, Participation, and Well-Being in Old Age: The Home Environment as a Determinant for Healthy Ageing. For the study,  $N = 1,918$ ; Sweden,  $n = 397$ ; Germany,  $n = 450$ ; the United Kingdom (UK),  $n = 376$ ; Hungary,  $n = 392$ ; Latvia,  $n = 303$ . We performed the statistical test for difference with the Kruskal-Wallis test. We assessed accessibility by means of the Housing Enabler (Iwarsson & Slaug, 2001; Iwarsson et al., 2005). The median and range are shown for each national sample. For the total accessibility score, the higher the score, the higher the magnitude of accessibility problems; the total accessibility score is generated by the profile of functional limitations and dependence on mobility devices in the person (data not presented) and number of environmental barriers (Iwarsson & Slaug).

\*\*\* $p < .001$ .

activity aspects ( $Mdn = 15$ ), whereas those in the Hungarian sample reported the highest ( $Mdn = 20$ ). Concerning meaning of home, the lowest meaning in all four aspects was reported by the Latvian participants ( $M = 6.6-7.6$ ), whereas the German participants reported the highest meaning in all four aspects ( $M = 7.8-8.9$ ). The lowest external housing-related control was reported by the Hungarian participants ( $M = 2.3$ ), whereas the highest was reported by the Latvian participants ( $M = 3.1$ ). Regarding housing satisfaction, the Latvian participants reported the lowest satisfaction ( $M = 3.6$ ), and the Swedish participants reported the highest ( $M = 4.8$ ).

### Relationships Between Objective and Perceived Aspects of Housing

The canonical correlation analysis revealed two significant variates. In the first, the canonical cor-

relation coefficient for the Swedish sample was  $R = .56$ , explaining 83% of the overall variance. The corresponding values for the other samples were as follows:  $R = .42$ , or 93% for the German sample;  $R = .52$ , or 88% for the UK sample;  $R = .51$ , or 78% for the Hungarian sample; and  $R = .57$ , or 81% for the Latvian sample (see Table 4). When we considered the highest correlations ( $>.5$ ) in the first variate, we found that the following pattern emerged. With respect to the set of objective housing variables, only the magnitude of accessibility problems in the home in all five samples correlated rather consistently with perceived aspects of housing. That is, lower magnitude of accessibility problems correlated with higher usability in terms of activity aspects in the Swedish, German, UK, and Latvian samples and nearly passed the threshold of  $>.35$  in the Hungarian sample.

Further, we found a rather consistent relationship between lower magnitude of accessibility problems

Table 3. Perceived Aspects of Housing in the ENABLE-AGE Survey Study Samples

Aspect	Sweden	Germany	The UK	Hungary	Latvia	Difference
Usability of the home: UIMH						
Activity	19 (3-20)	19 (1-20)	19 (5-20)	20 (4-20)	15 (1-20)	***
Physical environmental	28 (8-30)	28 (10-30)	26 (12-30)	26 (6-30)	19 (5-30)	***
Meaning of home: MOH						
Physical	8.9 (1.1)	8.9 (1.1)	8.2 (1.5)	7.3 (1.7)	6.6 (1.4)	***
Behavioral	8.5 (1.6)	8.9 (1.3)	7.6 (1.7)	8.2 (1.5)	7.1 (1.7)	***
Cognitive-emotional aspects	8.4 (1.0)	8.7 (0.9)	8.0 (0.9)	8.8 (1.0)	7.6 (1.2)	***
Social aspects	8.6 (1.4)	7.8 (1.6)	8.3 (1.5)	7.8 (1.9)	6.8 (1.8)	***
Housing-related control: HCQ						
External control	2.8 (0.5)	2.8 (0.7)	2.6 (0.5)	2.3 (0.6)	3.1 (0.4)	***
Housing satisfaction						
Satisfaction with the condition of the Home	4.8 (0.6)	4.6 (0.7)	4.5 (0.9)	4.2 (1.2)	3.6 (1.3)	***

Notes: ENABLE-AGE = Enabling Autonomy, Participation, and Well-Being in Old Age: The Home Environment as a Determinant for Healthy Ageing. For the study,  $N = 1,918$ ; Sweden,  $n = 397$ ; Germany,  $n = 450$ ; the United Kingdom (UK),  $n = 376$ ; Hungary,  $n = 392$ ; Latvia,  $n = 303$ . UIMH = Usability in My Home questionnaire (1-5); higher scores indicate higher usability (Fänge & Iwarsson, 2003). MOH = Meaning of Home questionnaire (0-10); higher scores indicate more meaning (Oswald et al., 1999). HCQ = Housing-Related Control Beliefs Questionnaire (1-5); higher scores indicate higher control (Oswald et al., 2003). For the satisfaction with housing condition, higher scores indicate higher satisfaction (Sixsmith & Sixsmith, 2002). For each national sample, the median and range are shown for the UIMH and the mean and standard deviation are shown for all other aspects. We performed the statistical test for difference with the Kruskal-Wallis test for the UIMH and with the  $F$  test for all other aspects.

\*\*\* $p < .001$ .

Table 4. Relationships Between Sum Scores in Objective and Perceived Aspects of Housing

	First Canonical Variate					Second Canonical Variate				
	Sweden	Germany	UK	Hungary	Latvia	Sweden	Germany	UK	Hungary	Latvia
Eigenvalues	0.5***	0.2***	0.4***	0.4***	0.5***	0.1***	<i>ns</i>	<i>ns</i>	0.1***	0.1***
Canonical correlations	0.56	0.42	0.52	0.51	0.57	0.30	—	—	0.30	0.29
Explained variance (%)	(83)	(93)	(88)	(78)	(81)	(17)	—	—	(22)	(19)
Objective housing set <sup>a</sup>										
Total no. of environmental barriers	-0.39 (0.10)	-0.11 (0.03)	0.25 (-0.04)	-0.74 (-0.43)	0.18 (-0.15)	0.92 (1.0)	—	—	0.67 (1.0)	0.98 (1.0)
Magnitude of accessibility problems	-1.0 (-0.97)	-1.0 (-1.0)	1.0 (1.0)	-0.92 (-0.74)	0.99 (1.0)	-0.09 (-0.41)	—	—	-0.39 (-0.82)	0.14 (-0.19)
Perceived housing set <sup>b</sup>										
Usability of home										
Activity aspects	0.78 (0.38)	0.69 (0.29)	-0.67 (-0.24)	0.35 (-0.11)	-0.61 (-0.21)	-0.14 (-0.28)	—	—	0.54 (-0.35)	0.35 (0.11)
Phys. environ. aspects	0.82 (0.56)	0.63 (0.37)	-0.67 (-0.21)	0.75 (-0.54)	-0.26 (-0.02)	-0.23 (-0.15)	—	—	0.13 (-0.22)	0.44 (0.16)
Meaning of home										
Behavioral aspects	0.60 (0.31)	0.70 (0.45)	-0.76 (-0.50)	0.71 (0.20)	-0.89 (-0.70)	0.69 (-0.98)	—	—	0.45 (0.72)	0.26 (0.20)
Physical aspects	0.19 (-0.06)	0.48 (0.14)	-0.63 (-0.19)	0.79 (0.23)	-0.38 (0.21)	-0.06 (-0.11)	—	—	-0.07 (-0.34)	0.61 (0.92)
Cog.-emot. Aspects	0.02 (-0.14)	0.17 (-0.20)	-0.14 (0.33)	0.76 (0.12)	-0.46 (0.18)	0.34 (0.19)	—	—	-0.18 (-0.35)	0.17 (-0.01)
Social aspects	0.25 (0.00)	0.14 (0.05)	-0.27 (0.07)	0.69 (0.18)	-0.61 (-0.32)	0.12 (-0.08)	—	—	-0.29 (-0.28)	-0.07 (-0.45)
Housing-related control Beliefs										
External control	-0.50 (-0.18)	-0.60 (-0.37)	0.61 (0.32)	-0.64 (-0.19)	0.63 (0.28)	0.23 (0.35)	—	—	-0.31 (-0.19)	0.32 (0.66)
Housing satisfaction										
Satisfaction with home condition	0.12 (-0.16)	0.09 (-0.12)	-0.40 (-0.17)	0.18 (-0.14)	0.14 (0.19)	-0.36 (-0.30)	—	—	0.52 (0.32)	-0.07 (-0.29)

Notes: The relationships between sum scores in objective and perceived aspects of housing are the first and second variates of the canonical correlations analysis. For each aspect included in the canonical correlation,  $p < .001$ , correlations (cutoffs  $> .35$  are boldfaced) and standardized correlation coefficients (in parentheses) are given.

<sup>a</sup>Correlations of objective housing variables with the first and second canonical variate of the objective housing variable set. The objective housing variables are according to the Housing Enabler (Iwarsson & Slaug, 2000; Iwarsson, Nygren et al., 2005).

<sup>b</sup>Correlations of perceived housing variables with the first and second canonical variate of the perceived housing variable set. Perceived housing variables are according to the Usability in My Home questionnaire (Fänge & Iwarsson, 2003, 2005a, 2005b), the Meaning of Home questionnaire (Oswald et al., 1999), the Housing-Related Control Beliefs Questionnaire (Oswald et al., 2003), and the adapted satisfaction with the condition of the home instrument (Sixsmith & Sixsmith, 2002).

\*\*\* $p < .001$ .

Table 5. Pairwise Comparisons of Loading Patterns for the Five National Samples

Congruence Scores of Canonical Correlation Loadings	Sweden	Germany	UK	Hungary	Latvia
Sweden		—	—	0.30	0.57
Germany	<b>0.96</b>		—	—	—
UK	<b>-0.94</b>	<b>-0.98</b>		—	—
Hungary	<b>0.83</b>	<b>0.85</b>	<b>-0.89</b>		0.45
Latvia	<b>-0.86</b>	<b>-0.91</b>	<b>0.89</b>	<b>-0.88</b>	—

Notes: Tucker's coefficients of congruence are used (Broadbooks & Elmore, 1987). Congruence scores of the first canonical correlation loadings between each research site are listed boldfaced in the lower diagonal part of the table; congruences of the second canonical loadings are shown in the upper right part. Because of inverse loading patterns (see Tables 4 and 5), negative scores occur in some national samples.

and higher usability in physical environmental aspects in the Swedish, German, UK, and Hungarian samples. Concerning the meaning of home, we observed relationships between a lower magnitude of accessibility problem and higher scores in behavioral aspects (in all five samples) and physical aspects (in Germany, UK, Hungary, and Latvia), whereas relationships with cognitive-emotional aspects and social aspects only appeared in a minority of the national samples. In addition, lower external housing-related control beliefs correlated consistently across all countries with a lower magnitude of accessibility problems, whereas satisfaction with the condition of home did not.

The second variate also revealed significant patterns of relationships for three of the national samples, that is, for the Swedish ( $R = .30$ ), Hungarian ( $R = .30$ ), and Latvian ( $R = .29$ ) samples. However, the degrees of overall explained variance were considerably lower ( $\leq 22\%$ ) than in the first variate. The second variate revealed a pattern in which higher numbers of environmental barriers in all three samples were strongly ( $> .5$ ) related to activity aspects of usability in the Hungarian sample, and further with meaning of home in behavioral aspects in the Swedish and physical aspects in the Latvian sample, and finally with satisfaction with the condition of the home in the Hungarian sample (see Table 4).

The coefficients of congruence (Table 5) indicated a high similarity of the pattern of relationship represented by the first canonical correlations across all research sites; that is, the first canonical correlations appear to be general and not specific to the national samples, and they indicate a common pattern of relationships between objective and subjective housing.

## Discussion

In this study we aimed to shed new light upon the relationships between objective and perceived aspects of housing among very old adults. As we expected, the results for all countries demonstrated

that, among very old individuals, it was the magnitude of accessibility problems rather than the number of physical environmental barriers that was consistently associated with major aspects of perceived housing. Further, the result strongly indicates that, in spite of cultural differences and individual variability, very old people living alone in urban areas in different European countries share a common experience of the home.

Our results reveal the considerable contribution of the magnitude of accessibility problems to the patterns of relationships. This finding gives further evidence for the feasibility of operationalizing the objective home environment as the relationship between functional limitations and physical environmental barriers, as previously put forward by Iwarsson & Ståhl (2003; also see Iwarsson, 2005). Because accessibility is an aspect of P-E fit, this result also lends support to the ecological theory of aging (Kahana, 1982; Lawton, 1982, 1987; Lawton & Nahemow, 1973; Nahemow, 2000) for gerontological research on housing and very old adults.

Referring to the specific definition of accessibility used in the ENABLE-AGE Project, we are of course aware of the fact that different disciplines use different vocabularies. Besides increasing multidisciplinary research in general, in practice contexts many actors are involved in processes aiming to produce efficient housing solutions for senior citizens. Moreover, the terms used to describe environments that promote human functioning differ between countries (Ostroff, 2001). For example, there are differences between Europe and the United States. That is, in the United States the term *accessibility* has connotations related to regulations such as the ADA and the Fair Housing Amendments Act, whereas in Europe the definition we use (Iwarsson & Slaug, 2001; Iwarsson & Ståhl, 2003) is gaining increased acceptance. The problem is that words denoting core concepts are frequently being used in everyday communication between actors in planning processes, in legislation and other official documents, in disability movement material, in research reports, and so on, without explicit definitions. Consequently, the new knowledge contributed



by this study would not have been possible without the positioning and definition of accessibility and the valid methodological operationalization of the concept (Iwarsson & Slaug, 2001).

Another important finding is the substantial relationship between the behavioral aspects of meaning of home with accessibility in all five national samples, and that activity aspects of usability had an important influence on the pattern in four of the samples. We did not find this surprising, as these two aspects of perceived housing seem to be conceptually close to each other. More specifically, the behavioral aspects of meaning of home as well as activity aspects of usability are in different ways connected to the individual's use of space and construction of personal rituals that are implemented into routines (Pastalan & Barnes, 1999) and activity performance (Kielhofner, 2002). Further, in all national samples, the participants had lived a long time in their present dwelling, suggesting the existence of well-established personal routines and habits as a result of the ongoing interaction with the environment over time (Kielhofner, 2002; Shenk, Kuwahara, & Zablotsky, 2004). Physical aspects of meaning of home could have been expected to be more closely aligned to the magnitude of accessibility problems in all samples, because physical aspects address the experience of housing conditions, access, and furnishing (Oswald et al., 1999). We have no explanation for the differences among the national samples in this respect, and this has to be investigated further. The substantial relationship between the magnitude of accessibility problems and physical environmental aspects of usability in four of the samples is consistent with previous research showing that a more accessible home is perceived as a more usable home (Fänge & Iwarsson, 2003).

Furthermore, it does not seem as if accessibility per se is of great concern for the cognitive-emotional meaning of home, which is consistent with the theoretical notion that this aspect is more connected to internal psychological processes and interactions (Oswald et al., 1999; Oswald & Wahl, 2004). Taken together, these results demonstrate the importance of investigating usability and meaning of the home in relation to objective aspects of housing. More specifically, the results underscore the need to explicitly consider the physical environmental and behavior-related aspects of meaning of home, as well as P-E-A transactions in the home in very old age. The specific advantage of a usability and meaning of home assessment is that it enhances the understanding of perceived housing from the perspective of the impact of the home environment on everyday activity performance. Given that the performance of meaningful activities is known to support independence and health in old age (Clark et al., 1997), housing that is considered useful for the performance of activities is likely to support health and social participation among older people (Iwarsson, 2005;

Iwarsson & Isacson, 1997; see also Oswald et al., this issue).

Concerning housing-related control beliefs, this study demonstrated that, across all national samples, a high magnitude of accessibility problems was related to the high use of external control strategies (Oswald et al., 2003) in order to overcome age-related functional decline. It can be argued that the findings are of less importance as no conclusions on the dynamics between external and internal housing-related control (Heckhausen & Schulz, 1995; Oswald et al.) can be drawn, because this study did not include data on internal housing-related control. However, earlier longitudinal research (Baltes, Freund, & Horgas, 1999; Clark-Plaskie, & Lachman, 1999) has noted that in particular external control beliefs are sensitive to age-related changes, and thus they are crucial for analyses in relation to independence in everyday life and well-being in old age. Thus, the consideration of external control addresses a major facet of the full control dynamics as people age. Even though there is a need for more research, it could well be that intervention directed at decreasing accessibility problems in the home would have an impact on the use of external coping strategies. There is an obvious need for optimization of the subscales that do not fulfill psychometric properties for this study, but still the results provide knowledge furthering our understanding of how housing-related external control in relation to accessibility affects the maintenance of everyday activities and the ability to age in place (Oswald & Wahl, 2004). Such knowledge could alert health care professionals and others to acknowledge personal preferences of older people regarding their home environment.

Despite the exploratory design of this study, the Tuckers coefficient revealed a cross-national similar pattern of relationships between P-E fit and accessibility and the more activity-oriented aspects of perceived housing. The generalizability of our findings on national as well as cross-national levels is restricted by the fact that the sample was composed of rather healthy very old people living in urban districts. Further research is needed to reveal whether comparable patterns of relationships between objective and perceived housing among very old people can be found in other regional settings such as rural areas. Further, in order to investigate whether relationships between objective and perceived aspects of housing are stable over time, longitudinal research is needed. Information on the stability of the patterns over time would provide information vital to social planning and the specific factors of importance to supplying good housing throughout old age.

In conclusion, this study demonstrates the importance of bringing together objective and perceived aspects of housing in order to develop more knowledge and a better understanding of the

complexity of housing in very old age. The results revealed relationships between objective and perceived aspects of housing not previously presented, and they underscore the importance of describing objective housing in terms of accessibility as an aspect of P–E fit. Bearing in mind the explorative nature of the ENABLE–AGE Project, we find that the results demonstrate that very old people seem to share a common experience of objective and perceived aspects of housing across different countries and cultures. This study also contributes to the awareness that, in order for researchers to obtain a comprehensive and more accurate picture of housing in old age, they have to address objective as well as perceived aspects of housing in future research. The findings presented here support ongoing theoretical development within environmental gerontology and represent a resource for future empirical research. Further, the integrative, comprehensive, and systematic methodology that we used can be applied in practice contexts targeting older people living at home. The results have the potential to contribute to the development of more holistic housing interventions, involving very old people more actively in individual home adaptations as well as in housing provision targeting senior citizens in general.

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