The perveived quality factors of the environment and their ecoefficient acceccibility

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In relation to the debate about the sustainable urban form, the official urban planning recommendations in Finland as in the most Western countries have for long promoted densification-oriented policy. Related to this policy, the traditional urban spatial planning functions, like the locations of homes, workplaces, schools, shops, etc. and their spatial relations with each other – issues that have been claimed to be the most significant in relation to sustainable urban form – have been vividly studied. Less well known is, what kind of influences this policy has to the perceived quality of the living environment by the inhabitants.

We don't know enough about the *'quality factors"* of the inhabitants, what they are, how reachable they are and how the densification policy affects to them. Urban environment can be seen as a functional system, consisting of a multitude of individual *"quality networks"*, where each inhabitant can create her/his own quality network according to her/his preferences, abilities, personal projects, mobility possibilities, and restrictions. In a pilot study we have developed a GIS-based query method to collect locally the meanings that inhabitants attach to their environment. The theoretical foundation of the method is in transactional environmental approach, which is elaborated in the following.

The perceived environmental quality

There have been various studies on the quality of an environment as perceived by its inhabitants, both in Finland (Nevalainen et al. 1990, Kyttä et al. 2000) and other countries (Bonnes and Bonaiuto 1995, Skjaeveland and Gärling 1997). The studies have produced a considerable number of criteria with which to determine either the perceived environmental quality, or the general criteria for a human friendly environment.

Existing studies on perceived environmental quality share an *essential flaw*: in the research carried out in this field, the perceptions have not been attached to specific physical settings. For example, if an inhabitant has the opinion that his living environment is very natural, we cannot be sure whether he is referring to the view from his living room, to the qualities of the back yard, to the neighbourhood park, or the green area situated further away, or perhaps to all of these. Thus studies on criteria cannot be seen as examples of transactional person-environment studies, which emphasize the mutual activity in the interaction between people and their environments (Altman and Rogoff 1987).

In transactional research the person-environment relationship is seen as a dynamic, interactive system, the components of which should not be taken out of context. In environmental psychology the transactional approach stresses the active role of both parties in this interactive relationship. People are active agents and are perceptive in their environments: They can influence their environments and

change them. In the same way, the environment plays an active role with regards to human beings on all different levels. The material, social, and cultural environments all influence people by providing prerequisites for certain functions or by facilitating social encounters in the environment. In this system neither of the components, environment or humankind, hold a deterministic role, but rather a probabilistic one.

The study of the quality of living environments in close connection with the physical environment requires concepts that do not create dualism between man and his environment. The notion of affordances that is used in ecological perceptual psychology is a worthy candidate for such a concept (Gibson 1979). The term "affordances" has traditionally referred to the perceived opportunities and restrictions concerning a person's actions in a given environment (Gibson 1979, Heft 1997). This concept can be expanded to include also the emotional, social, and socio-cultural opportunities and restrictions that an environment offers (Kyttä, 2003, 2004). The concept of affordances breaks the subject-object dichotomy: an affordance is not a characteristic of the environment, nor a characteristic of the individual, but rather it is something combining them. An environment needs to have something that an individual can perceive as an opportunity, but such a perception will only be formed if the individual is inclined (e.g., by his physical proportions or social needs) to find his equivalent in the environment. By applying the concept of affordances, the transactional relationship between man and the environment can be operationalized.

In this study we operationalize the perceived individual quality factors through the concept of affordances. The quality network is defined by the actualization of affordances on one hand (perception, utilization, or shaping) (Kyttä 2002, Heft 1989), and by the availability of affordances on the other hand (Kyttä 2004). These two dimensions determine the individual eco-social niche in which a person lives and that consists of a network of multiple places (see Bonaiuto and Bonnes 2002, Jovero and Horelli 2002). Figure 1 depicts this as a two-dimensional model. The model should also include a third dimension. The third dimension can be, for instance, the degree of perceived well-being, the hypothesis being that the degree of compatibility, or fit, between the person's eco-social niche and his own needs determines the experienced well-being (see Kyttä et al. 2004, Wallenius 1999).

The accessibility of quality factors connects the perceived quality with ecoefficiency and the discussion about the densification of urban structure. Where are the quality factors located? To what extent are the inhabitants able to go on foot or use public transportation to access the environmental quality factors that matter to them personally? How often do they do so? Do they do that because they want to, or because they have to?
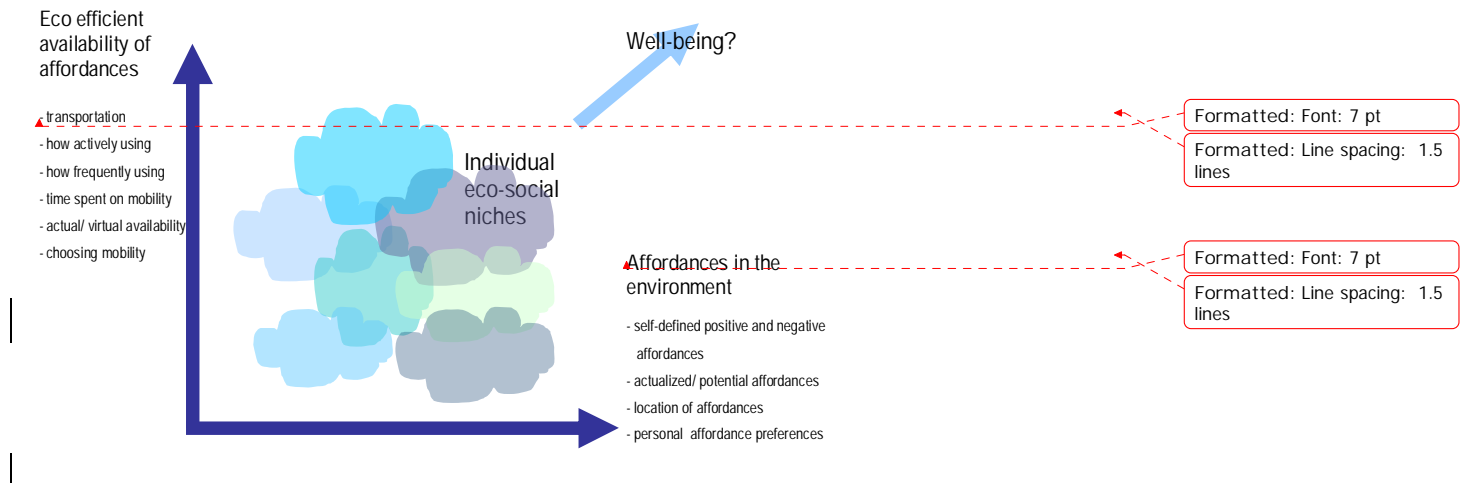
Eco efficient
availability of
affordances

- transportation
- how actively using
- how frequently using
- time spent on mobility
- actual/ virtual availability
- choosing mobility

Well-being?

Individual
eco-social
niches

Affordances in the
environment

- self-defined positive and negative
  affordances
- actualized/ potential affordances
- location of affordances
- personal affordance preferences

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Figure 1 A model representing the study of the affordances of an environment in connection with the physical environment.

Figure 2 depicts the "quality network" of three fictitious individuals living in the same area. The basis of the study is not the establishment of the superiority of a specific kind of network, such as the superiority of an extensive quality network. Instead, the connection of the network with perceived well-being and its degree of choice/necessity includes the normative dimension. The research can also reveal the connection of various background variables to the extent, density and degree of active use of the quality network. For instance, an individual's personal history and his or her childhood environment may be connected to the qualities of his or her network. Different surroundings and different degrees of density may give different possibilities for creating a quality network. Some areas may force their inhabitants to look for quality factors from a wide area. To give an example, functional and differentiated urban planning may produce wide quality networks.
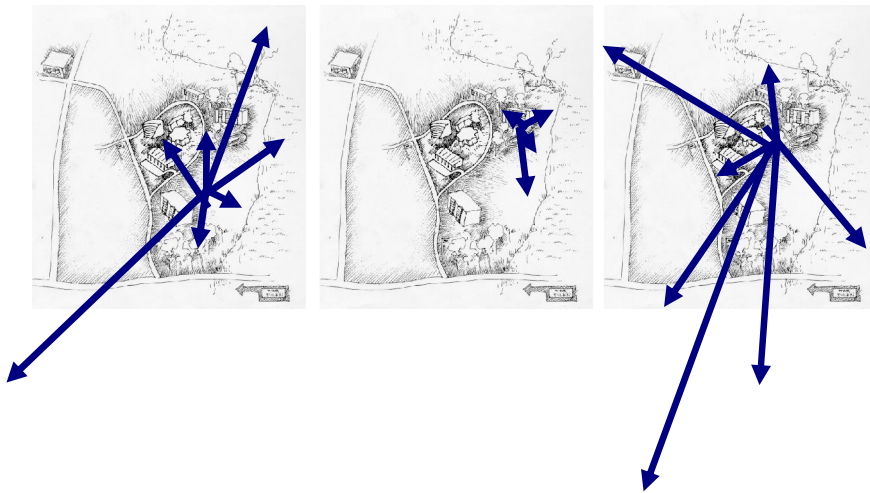
Figure 2 The quality network of the environment of three fictitious individuals who all live in the same area.

Method

To study the perceived quality factors (affordances) and individual eco-social niches, a GIS-based internet method was developed. The objective was to create a so called 'soft-GIS' method that could ultimately become a special layer of the geographic information system. The softGIS method was designed to be easy to use and suitable for all age groups from school children to the elderly. It has a tube-structure and it proceeds step by step, which means that each visitor of the page follows the same route through the application if they fill the whole web questionnaire (see Table 1). Special attention was paid to the quality of the maps used in the application. Aerial photos in scale 1:4000 were used and the orientation was aided by highlighting roads and landmarks (see Figure 3). Due to the technical restrictions, only spotlike information was possible to mark on the map, not routes or areas. Later we will try to overcome this restriction.

The technical development of the JavaScript/HTML-based application was realized by a group of media technology students in the Espoo-Vantaa Institute of Technology[1]. The English version of the application is available in www.netcode.fi/pehmogis[2] .

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[1] Project leader: Jarno Pitkänen
[2] User: marke, password: gissi

Table 1 The structure of the softGIS application.

1. Introduction	General information about the study
2. Background information	Age, Gender, Family type, Number of Children, Occupation, District, Housing type, House type, Size of the dwelling, Number of rooms, Time of dwelling, Childhood environment, Situation of filling the questionnaire
3. Identification	(Voluntary) Alias, Password
4. Quality factors	- general introduction - name 3 positive quality factors - name 3 negative quality factors
4. Introduction to the 'map tool'	- mark the location of home - mark the location of work/study place
5. Positive and negative quality factors revisited	In this phase the application 'remembers' the already written quality factors - actualization, importance and control of the quality factor - the location of the quality factor - for each location a mini questionnaire appears: - place/ route/ area? - description of the setting - activities - actualization - importance - how often visit - the means of travel - time spent on travelling - obstacles of access
6. The questions concerning the community	The pulling, pushing and binding factors
7. The location of basic services	- mark the location of daycare and schools (only asked if children in the family) - mark the location of the daily grocery store
8. The perceived well-being	GHQ-12 (General Health Questionnaire)
9. The ending	- lottery - free word

The first version of the softGIS method was used in the city of Järvenpää between 10/2004-12/2004. The questionnaire was available in the front page of the homepages of the city of Järvenpää. The web survey was advertised in two local newspapers and in local libraries.
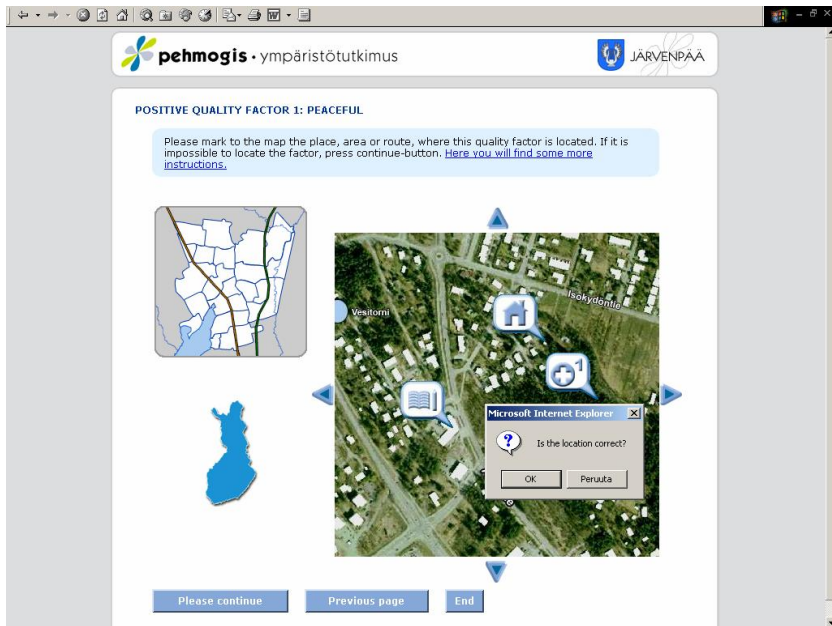
Figure 3 The softGIS application.

Subjects

During the three months 427 inhabitants filled the internet questionnaire. The age of the respondents varied between 13 and 73 years. The sample was dominated by young adults (25 – 29 years) and middle age persons between 40 – 45 years (see Figure 4). Most of the respondents (64 %) were women and the majority (56 %) had children. Most of the subjects, 70 %, lived in an owned apartment or house, most often in single family house (32 %) or in detached house (32 %). Clerical employees and experts were the dominant socioeconomic group of the respondents (43 %).
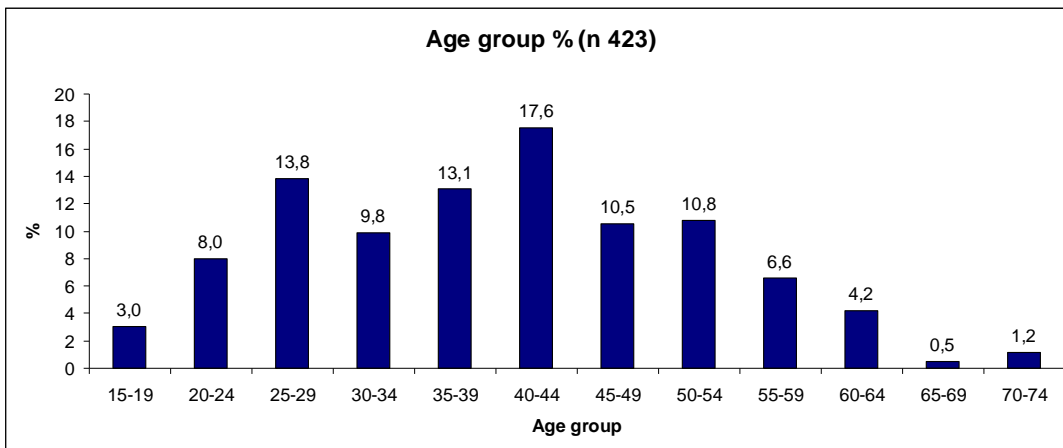

Figure 4 The age groups of the respondents.

The majority of subjects filled the web questionnaire at home (47 %). 34 % were at work, 4 % in public places and 6 % in other situations. When the respondents were able to send comments to the researchers at the end of the application, the majority of the comments were positive feedback about the research and the application (28 %).

> "It's really good that this kind of questionnaires exist. The influence of living environment to the quality of life must be essential. Thank you! "

20 % of the comments were general observations concerning the city of Järvenpää. 24 % reported technical problems using the application. The complaints concerned most often about the use of the map tool, which was found to be difficult to use or the map hard to orientate. Another type of negative comments (10 %) was the criticism towards the use of QHG-scale at the end of the questionnaire. Many subjects were suspicious about the data security concerning this part of the application or wondered how these questions related to the themes of the rest of the questionnaire. For this reason, information concerning data security was added in the application already during the data collection.

> "I am suspicious of the data security. Where is the data saved? Are they saved in the original form or as coded? Who has a right to look at the data after the study is done?"
> "The map tool was somewhat hard to understand. I wanted to mark whole areas instead of individual places. Open questions, or questions concerning districts could work better."

About 40 % of the respondents did not fill the whole web survey. During the first four phases of the application we lost a steady number of respondents. Those who did reach the 5. phase did fulfil the task. See Figure 5.
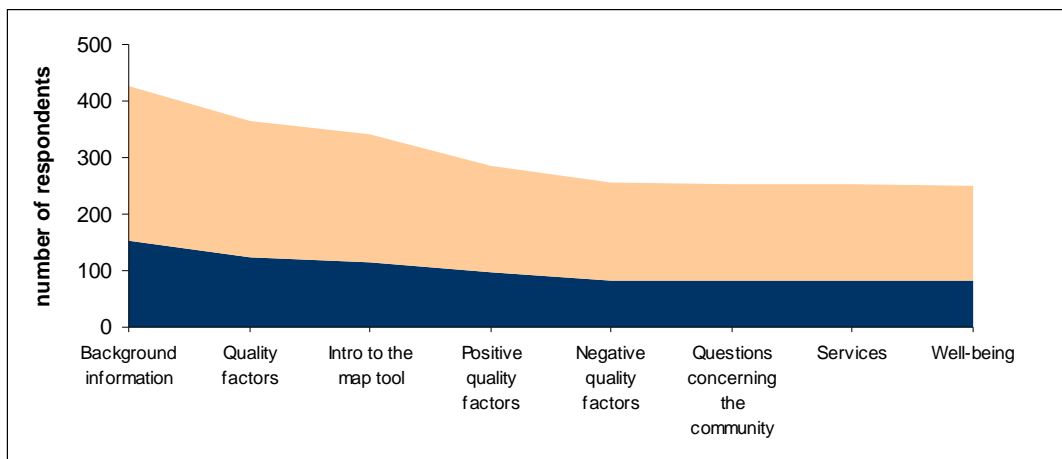

Figure 5 The number of respondents according to the progress of the application.

Preliminary results

The contents of the quality factors

The contents of the named positive and negative quality factors are presented in Table 2. Most often mentioned positive quality factors were peacefulness, security, tidiness and closeness to the nature. In the negative factors, the opposite qualities dominated: restlessness, density, insecurity and untidiness.

Table 2 The contents of the quality factors.

Positive factors	n	Negative factors	n
peaceful	220	restless, noisy	230
secure	199	dense	154
tidy	144	insecure	121
close to nature	116	untidy	121
cozy	80	bad location	83
good services	75	crowded	74
good connections	43	uncozy	72
spacious	30	polluted	46
child friendly	22	ugly	18

The meanings of these quality factors were studied more closely by looking at the physical places where these quality factors were located and how these settings were described. Peaceful places were most commonly natural settings without much traffic or noise. Forests, parks and private yards were mentioned often as peaceful settings. Sometimes also buildings were perceived peaceful. Then home, summer cottage and church were mentioned. Secure places were often recreational settings and routes that were used for outdoor exercise or for daily activities. Children's safe mobility was often mentioned too. Another type of secure settings was home environment where subjects felt free from the demands of the work life. Clean settings were both home settings and public settings like parks, recreational areas or shopping centres. Good maintenance and (again) perceived security and peacefulness were among the reasons given to explain the clean environment.

The location of the quality factors

The quality factors were marked to the areal GIS map of the town. A general finding of the location of positive and negative quality factors was that positive spots were more scattered around the town than the negative ones, which were more clustered. (See Figure 6).

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Figure 6 The location of the positive and negative quality factors.

The localized data base will allow us to look more closely at the 'hot spots' of different quality factors ie. places where the markings were concentrated. An example of these hot spots is the park area by the lake that attracted many inhabitants. Another example of a negative hot spot is the central area of the town especially during the evenings at dark. (Figures 7 and 8). It is often perceived restless and unattractive. Later, we will analyse more closely the relationship between the different types of quality factors and the settings where they are located. GIS-based localized database will allow us to combine the information concerning land use with the experiential information.

Figure 7 An example of a positive hot spot: the park area by the lake.

Figure 8 An example of a negative hot spot: the centre of the town.

The accessibility of quality factors

First, the distance of the quality factors from home was calculated to evaluate the accessibility of quality spots. The average distance of positive quality factors was 760 m and that of negative factors 1221 m. Within 20 metres from home (at home or in the yard) were 17 % of the positive quality factors and 2 % of the negative ones. Within walking distance (< 1 km) were 50 % of both the positive and negative factors. Within cycling and driving distance (< 3 km and < 10 km) were 19 % and 5 % of the positive factors and 31 % and 8 % of the negative factors. Few quality factors were located outside the town: only 9 % of the positive and 8 % of the negative factors.

The accessibility of the quality factors and the 'quality net' can also be evaluated in individual level. In Figure 9 are presented two examples of these individual quality nets. Both these individuals have rather large quality net but it is possible that some individuals rely even more on the immediate surroundings when localising their quality spots. Later, we will analyze more closely the varying sizes of the nets of respondents belonging to different age groups, living in different parts of the town etc.

The most often mentioned obstacle to the actualization of the quality factors was the lack of time (28 %). Other reasons were mentioned seldom: lack of company (5 %), too long journey to the quality spot (5 %) or lack of money (4 %).
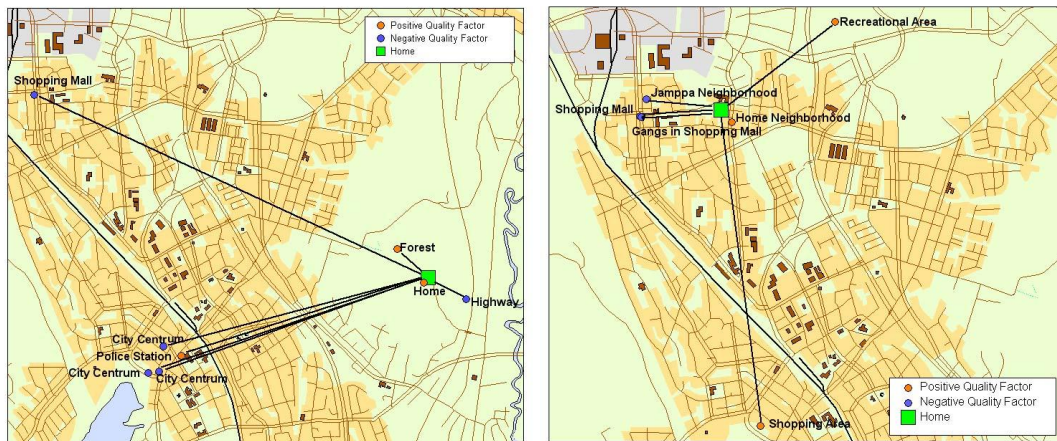
Figure 9 Two examples of individual quality network.

The actualization, the personal importance, and the perceived control on quality factors

The impact of background variables to the actualization, the personal importance and the perceived control of quality factors is presented in Table 3. The quality factors actualized on average more often to inhabitants who were employees, experts or in leading positions than to retired, students or unemployed. Tenure was connected with the matter so that inhabitants living in co-operative housing found the actualization of quality factors highest and renters lowest. According to housing type the actualization was best for single family and worst for high rise dwellers. The stage of the families with children was connected to the actualization as shown in Figure 10: the actualization was most likely if the youngest child was between 7 and 17 years of age. There was also a positive correlation between actualization and the size of the household, the number of rooms and the size of floor area.

The personal importance of quality factors was higher for women than for men. The importance of quality factors was also connected to the quality of childhood environment: the quality factors were on average more important to people with rural than urban background. The age of the respondent correlated positively with the personal importance of quality factors.

The families with youngest children perceived most control on quality factors. Childhood environment in urban environment was more likely to be connected with confidence of control than childhood in rural setting or in abroad. The number of children and the size of the household were positively correlated and the age negatively correlated with the perception of control over the existence of quality factors.

Table 3 ANOVAs and Spearman's correlation coefficients for testing the importance of different background variables on the actualization, the personal importance and the perceived control of quality factors.

	The actualization of positive quality factors	The personal importance of positive quality factors	The perceived control
ANOVA			
Gender	ns.	F=16,7 df=1 p=.000***	ns.
Occupation	F=2,1 df=9 p=.030**	ns.	ns.
Tenure	F=4,4 df=3 p=.004**	ns.	ns.
Housing type	F=4,8 df=3 p=.003**	ns.	ns.
Family stage	F=6,6 df=2 p=.002**	ns.	F=4,1 df=2 p=.018*
Childhood environment	ns.	F=4,7 df=6 p=.000***	F=2,6 df=6 p=.018*
Correlation			
Age	ns.	.183**	−.179**
Total number of children	ns.	ns.	.132*
The size of the household	.122*	ns.	.138*
Number of rooms	.198**	ns.	ns.
The floor area per dwelling	.193**	ns.	ns.
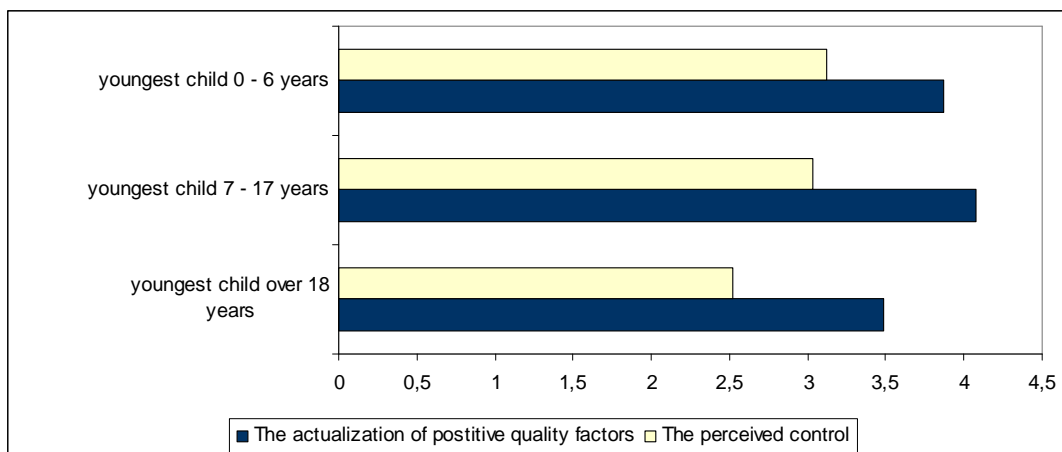
Figure 10 The actualization and the perceived control of quality factors for families with children.

The quality factors and the perceived well-being

The relationship between the actualization, personal importance and perceived control of quality factors and the perceived well-being was first estimated by looking at the correlations between these variables. Well-being was measured with three variables: the GHQ score and the scores of perceived health and perceived quality of life. Table 4 shows that the actualization of quality factors and the perceived quality of life were positively correlated with all other variables.

Table 4 The Pearson's correlation coefficients between the perception of quality factors and the perceived well-being.

	Actualization of positive quality factors	Personal importance of quality factors	Perceived control	GHQ score	Perceived quality of life	Perceived health
Actualization of positive quality factors	1					
Personal importance of quality factors	.166**	1				
Perceived control	.530**	ns.	1			
GHQ score	.177**	.129*	ns.	1		
Perceived quality of life	.267**	.151*	.154*	.604**	1	
Perceived health	.194**	.228**	ns.	.505**	.659**	1

Linear regression analyses were performed to examine the relations between the six variables more closely. Inspection of the beta coefficients in Table 5 reveals that in predicting the actualization of positive quality factors the perceived control and the personal importance of quality factors accounted for 30 % of the variance. In predicting the perceived quality of life, perceived health and the GHQ score, the actualization and the personal importance of quality factors accounted for 9 %, 8 % and 5 % of the accounted variance, respectively.

Table 5 Regression of actualization of quality factors and the perceived well-being.

Outcome variable	Beta
Dependent variable: actualization of positive quality factors	
The perceived control	.53***
The personal importance of quality factors	.14**
R^2	.30***
Dependent variable: perceived quality of life	
The actualization of quality factors	.26***
The personal importance of quality factors	.13*
R^2	.09***
Dependent variable: perceived health	
The actualization of quality factors	.22***
The personal importance of quality factors	.18**
R^2	.08***
Dependent variable: GHQ score	
The actualization of quality factors	.17**
The personal importance of quality factors	.12
R^2	.05**

Discussion

The research reported in this paper is still going on and we will analyze the results further. Already these preliminary results show that the prototype of the web-based softGIS method was able to bring about interesting results concerning the perceived quality factors (affordances) of the living environment and especially the location of them. By localizing the experiences of inhabitants we believe that we can produce more usable information for planners and urban designers than the traditional P-E-studies.

Many kind of web-based methods for the participation in urban planning and for the evaluation of existing environments already are developed that interest researchers and practitioners around the world. Still, few applications with true two-way interaction have been realised. In our on-going multidisciplinary research project OPUS – Urban planning and everyday life: a learning process, we will develop the softGIS method further as well as other types of web-based tools for participatory planning.

A self-evident methodological problem while using web questionnaires is the representativeness of the sample. In the near future we will realise a parallel questionnaire where we will approach the inhabitants first by traditional mail letters. The comparison of results of the two parallel studies will make the evaluation of representativeness possible.

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