Location attractiveness: is ITS becoming a high-ranked factor?
Using the test results for a first glance

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Abstract

This paper focuses on the developing process of a Stated Preference (SP) questionnaire to gain insight into the effects of ITS concepts on location preferences of office keeping organisations. To measure these effects an SP experiment is conducted in the Netherlands and involves office keeping organisations in selected city regions. The paper describes the first (test) results of a model describing the attractiveness of location profiles, which are based on location preference attributes, and the role of ITS in these profiles. Three ITS concepts, which are selected and based on previous research are introduced as 'new' attributes within the location profiles. The estimated model was used to test two hypotheses. The first hypothesis is that the introduction of these ITS attributes will change the preferences of office keeping organisations regarding locations. The second hypothesis is that if preferences will change, the ITS attributes have a significant contribution to the preference model. Finally, some conclusions are drawn on the role of ITS in location attractiveness and the validation tools which are available to validate the preference model.

Keywords: ITS, Location preference, Stated Preference, Urban region
Topic area: Stated Preference, ITS, relocation

1. Introduction

The long-term effect of Intelligent Transport Systems (ITS) on spatial dynamics is uncertain. Despite this uncertainty, it is plausible that ITS concepts, in the long term, significantly affect location choices of firms. This paper explores the hypothesis that the implementation and proximity of three theoretically constructed ITS concepts, an Automatic Car Lane, an Automatic Bus Lane and a People Mover system from a Park & Ride facility, will change the location preferences of office keeping organisations. To that end, a Stated Preference (SP) survey is conducted as Revealed Preference approaches are not the most convenient methods to determine the effects of future concepts. The SP approach uses hypothetical choice alternatives, for which respondents are asked to provide preferences or choices.

The aim of this paper is to give insight into the procedure of developing such an experiment. In addition, the resulting questionnaire was tested by asking office-keeping organisations to fill in the concept questionnaire in order to determine lacks in an early phase. These test results are used in this paper to gain insight into the face validity of the outcomes of the questionnaire and to give a first try exploring the hypothesis mentioned above. Of course, the number of test respondents does not allow us to do any judgment whether to reject or accept the hypothesis stated.

The questionnaire was built up from four parts. Part one consisted of eight questions related to general organisation features such as the number of employees, the four digit zip code and the respondent's influence on the relocation decision making process. Part two introduced the three new ITS concepts. This introduction included both a textual description and two drawings of the three concepts. About each ITS concept two questions were formulated. Respondents were asked, firstly, to what extent the concept seems to be realistic and secondly, to what extent the concept would contribute to a better accessibility within a city region. As a large number of attributes seemed to be important in location choices and the influence of three new ITS concepts should be measured, it was decided to split up the SP experiment in two parts. The first part of the SP experiment, including a series of accessibility profiles, was conducted in part three of the questionnaire. Part four of the questionnaire includes the series of 'location' profiles derived from the second SP experiment. The 'location' profiles include an overall evaluation of accessibility (being described by more attributes in the first experiment) in such a way that it was possible to link the first experiment with the second one in a hierarchical way.

Section 2 focuses on describing the research approach. What method is used and why? What models are used to estimate the preference structure? And what does the research population look like? And finally, what respondents' features are important for this research as they might include variables that distort the specific nature of the research results?

Section 3 focuses on the test results and statements of what we can expect from the SP survey. This section will focus on the three main parts of the survey questionnaire: questions about the test respondents' attitude towards the three ITS concepts, judgement of accessibility profiles and finally the test respondents' judgements on office location profiles.

Section 4 finally describes what is to be concluded and what can be said about future research.

2 Research approach

2.1 Conceptual model for spatial choices

The choice for the SP approach to determine the effects of future ITS concepts implies some assumptions underlying to the general conceptual model for spatial choices (Timmermans, 1982), visualised in Figure 1.

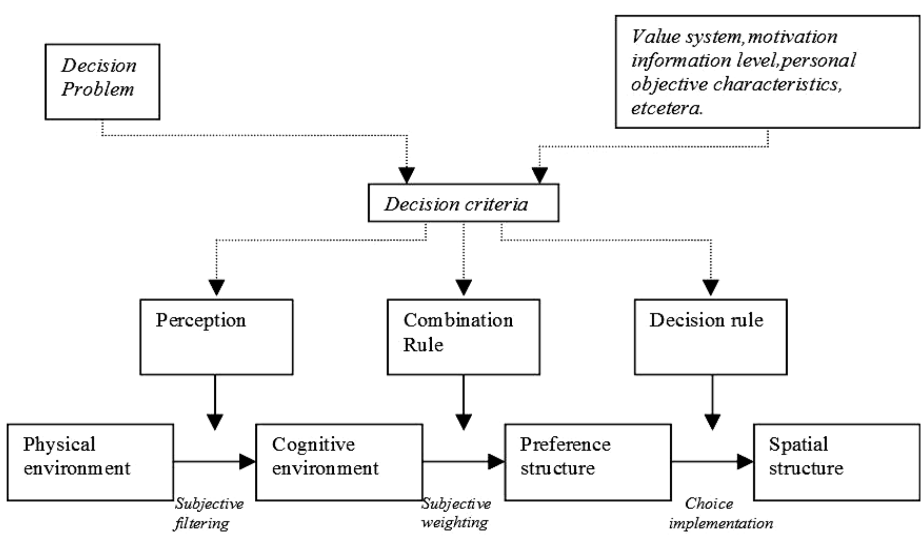

Figure 1. A general conceptual model for spatial choice Timmermans (1982)

This section explains the conceptual model and explores to what extent the underlying assumptions are consistent with the literature about location choices of office-keeping organisations. Figure 1 illustrates that location choices and other spatial choice behaviour is considered to be the outcome of an individual decision-making process. Location choices are considered to be the outcome of an individual's act of choosing a particular alternative from among the set of potential alternatives under consideration[1]. In case of relocation of organisations this set of potential alternatives includes the available office locations in the choice set of an office-keeping organisation. In the model of Timmermans (1982) it is believed that each choice alternative is characterized by a large but finite number of objective attributes. The bundles of attributes which describe the available alternatives give a description of the objective *physical space* or environment (Molin, 1999). If an organisation would for example be looking for an office important attributes could be the price, distance to employees and transport, number of rooms and parking availability. The physical space or environment is then dependent on the alternatives matching these attributes. Further, it is assumed that individuals, in our case organisations, have built up a personal information system about the physical space, stored in cognitive constructs. This information has been gathered trough search and learning processes and is related to the individual's value system, his motivation and possibly to other more objective personal characteristics.

It is assumed that the decision problem, together with his value system, motivations and so on, defines a set of decision criteria for the individual, conditioning his perceptions of the objective physical environment. This perspective act typically involves a subjective filtering based upon imperfect information, the result of which is a *cognitive space*. It is assumed that this cognitive space, rather than the objective physical space itself determines individual choice behaviour (Molin, 1999). For example, when deciding about the choice for an office location one might have some neighbourhoods in mind with a good reputation matching the ideal attributes.

Individuals are assumed to discriminate between the limited numbers of choice alternatives in their cognitive space on the basis of a limited set of attributes. They are assumed to combine their evaluations of the values or levels of these attributes according to some combination rule which they use to form an overall evaluation of each spatial choice alternative. This cognitive process involves a subjective weighing in light of the derived decision criteria, the result of which is the formation of a subjective preference scale. A preference scale may be conceived of as some composite of the subjectively weighted attributes, where the weights indicate the relative importance an individual assigns to that attribute. It consists of an ordering of the choice alternatives on the basis of their utility in satisfying the particular needs underlying spatial search (Molin, 1999). In case of our organisation searching a new office that could entail that although the price is too high (according to their value system) they still decide to buy or rent the office because the other attributes, as for example square meters, small distance to employees or clients and a nice neighbourhood, are highly satisfied.

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[1] In this research it is not believed that only one person decides upon relocations of an office keeping organisation. It is not believed that households' relocations reflect an individual choice either. Molin (1999) developed a specific methodology to model group preferences. However, in this study it is simplified and believed that it is plausible that one person's preference structure reflects the preference of an office keeping organisation as a whole (See for example Muilerman (2001: 126/127) who interviewed managers in the food industry and the service industry). An important criterion is that the person who is functioning as communicator (in research respondent or the interviewed) to the researcher is a very important person in the relocation process. In households this would be the financial head of the family (the father for example) and in office keeping organisations this could be the director or management in an organisation.

The test study of the SP survey which is described in this document aims exactly at describing the relative importance of the different attributes, and especially the role of the three introduced ITS concepts, that are assigned to office location preferences. The test results set (and as a logical consequence the SP Survey) only focuses on the preference structure.

Although a strong preference for a specific set of location attributes gives some indication on actual spatial choices, this study only aims at exploring the relative importance of ITS-related attributes within location attractiveness. No conclusions will be drawn on actual spatial behaviour.

To validate this preference based study, a choice based experiment is designed, that should indicate whether future choices, when simulated in a case region, match preference structures that are found in the SP experiment. In that future study, organisations are asked to decide which alternative they would choose given their evoked set. A reasonable assumption is that overt choice behaviour bears some systematic relation with the positioning of the choice alternatives on the preference scale. It is assumed that the individual will choose the alternative with the highest preference scale (Molin, 1999).

2.2 The model

After having explained the theory behind our SP approach, we want to take a closer look to the model(s) we are trying to estimate. In this section we will deal with some important decisions upon the type of model we want to estimate and the assumptions related to these decisions. We will use the following sequence: first the focus on the hierarchical approach of the experiment and the model(s), secondly the choice between an additive and a compensatory model, further the difference between the estimation of main effects and/or interaction effects and finally we focus on the experiment design regarding the amount of profiles to be presented to the respondents.

Because of the large number of potentially influencing attributes, the Hierarchical Information Integration (HII) approach, originally proposed by Louviere (1984), was applied. The HII approach is an extension of the traditional SP approach and allows one to handle a large number of attributes. In this case it is assumed that respondents firstly evaluate the accessibility of an office-location before judging the overall description of the location. Therefore, two experiments were conducted.

The first experiment focuses on the accessibility of an office-location. Respondents are asked in the second experiment to evaluate the overall location in which one of the attributes included involves the overall accessibility of the location. When knowing the influence of the overall accessibility on location choices from the results of the second model, it is possible to gain more insight into the effects of the three new ITS concepts and the conventional modes of transport on overall location choices as the HII approach enables a link between the two separate models.

Secondly, we choose to estimate additive models instead of multiplicative models. This decision involved the composition rule. That rule describes how the respondent combines the part-worth utilities of the attributes to obtain overall worth (Hair *et al.*, 1998). According to Timmermans, '*the choice between an additive and a multiplicative specification is influenced by somewhat contrasting considerations*' (1984: 193). In the additive model, the respondent simply "adds up" the part-worth utilities for each attribute to get the total value for a combination of attributes. The multiplicative model is similar but it differs in that it allows for certain combinations of levels to be more or less than just their sum. The assumption of the additive model is that the relative unimportance of any attribute-level can be compensated by the importance of any other attribute-level.

Thirdly, we estimate main effects models. Basically, the reason not to use the interaction model is that including interaction requires more profiles to be evaluated. A design that allows estimating all possible interaction effects is referred to as a full factorial design (Kroes & Sheldon, 1988). That would entail that for instance if one wants to measure the SP profiles that are constructed by four attributes with three levels each, one must present the respondent 3^4 (81!) profiles. It can be imagined that a respondent are not likely to fill in the whole experiment in that case or at least will get tired or annoyed. This would have serious consequences for the reliability of the research as we focus on about 500 organisations. Decreasing the number of attributes and attribute levels is unwanted because it would present an unrealistic simplified set of treatments to the respondent. Marchau (2000) explains the main effects model as follows: the overall utility is the sum of the separate part-worth utilities, assuming that the part-worth-utility of an attribute-level is level is independent from the levels of other attributes. No interactions are taken into account. The general main effects model takes the general form of:

$$V_j = \beta_0 + \Sigma_k \beta_k X_{kj} + \varepsilon_j$$

Where:
V_j = the utility or a particular profile *j* (the dependent variable)
β_0 = the regression intercept
β_k = the regression coefficients to be estimated for the
X_k = k coded indicator variables
ε_j = error component

Figure 2 General main effects model (McClave *et al.* 1997)

Besides the full factorial designs, comprise and fractional factorial designs can be distinguished (Steenkamp, 1985). Comprise designs allow the estimation of some interaction effects, but if applied need more profiles to be evaluated than in case of fractional factorial designs. In case of fractional factorial designs allowing only the estimation of main effects the set of profiles is limited by the use of so-called Addelman's schemes. In case of the mentioned five attributes with three levels, the respondent has only to judge 18 profiles, instead of 81 profiles.

Thus, this research estimates an additive main effects model using fractional factorial designs. The next subsection describes effect coding required to estimate the effects of the attribute levels to overall preferences.

2.3 The estimation procedure

The dependent variable in this analysis is the profile rating, and the independent variables are formed by the parameters required to calculate the influence of the attribute levels on overall preferences. The estimated regression coefficients are then interpreted as the part-worth utility contributions to the overall ratings of the profiles.

To include categorical attributes, for example building characteristics, into the analysis, the attribute levels need to be coded. An additional advantage of coding for continuous variables is that the estimated effects can be more easily compared across attributes. In this study effect coding is used. Table 1 provides the coding scheme for effect coding for two to three level attributes (Molin, 1999).

Levels	Two-levels	Three levels	
0	1	1	0
1	-1	0	1
2		-1	-1
	⇩	⇩	⇩
Parameters to be estimated	β_1	β_1	β_2

Table 1 Effect coding for two- to three-level attributes (Molin, 1999).

In case of a three level attribute, the parameters β_1 and β_2 are estimated. The part worth utility of each attribute level is calculated by multiplying the estimated parameter with its code and summing the results across indicator variables (coded columns). For example, the part-worth utility of the first level of a three level attribute is calculated by: $\beta_1 *1 + \beta_2 * 0 = \beta_1$. Likewise, the part-worth utility for the second level is equal to β_2. The part-worth utility for level two is calculated as: $\beta_1 * -1 + \beta_2 * -1 = -(\beta_1 + \beta_2)$. It may be clear that if effect coding is used, the sum of the part-worth utilities across the levels of a particular attribute is zero by definition. Furthermore, the estimated regression intercept is equal to the mean observed overall utility of the profiles. Therefore, the estimated regression coefficients can be interpreted as the contribution of the attribute levels to the overall utility expressed as the deviation from the regression intercept, this from the mean observed overall utility (Molin, 1999).

3 The SP experiment design

Two important steps in setting up an SP experiment that are relevant to describe in this paper are described in this section: the selection of attributes and the determination of attribute levels.

Before dealing with the attribute choice and their levels we need to explain some key features of the experiment design used which is described in this paper. For two reasons we decided to split the experiment. The first reason to do so was that a large number of attributes influences location choices of office-keeping organisations and a standard SP approach can only handle a limited number of attributes, as too many profiles would had to be judged and the danger of fatigue effects and aversion to the questionnaire by the respondents. The second reason to split the relevant attributes in this way was that we assume that the contribution of ITS variants to the preference model is embedded within the accessibility attributes. As ITS concepts are rather new, it was very unlikely that they would become a ranked player between conventional attributes. The danger of underestimation would be logical as the other attributes have already proven themselves and ITS probably needs already some imagination.

The experiment was split into two parts within one questionnaire: 1) the first experiment focusing on the introduction of the three ITS concepts into accessibility profiles; 2) the second experiment dealing with general location characteristics including an accessibility judgement attribute referring to the first experiment. In the next subsections we explore the relevant set of attributes for experiment 1 and 2 derived from exploration of future ITS and location theory literature respectively.

3.1 Selecting attributes and levels for accessibility profiles: experiment 1

The focus of the first experiment is the judgement of the organisations on accessibility. This accessibility is defined as the proximity to five different transport modes. Besides two conventional modes, car and train, three new ITS concepts are introduced. The ITS concepts were the result of an exploration of relevant and plausible ITS concepts which was conducted in earlier studies and focused on a morphological analysis of the future ITS concepts. For more specific information about the definition of the future ITS concepts we refer to Argiolu *et al.* (2004). The defined transport modes were used as attributes in the research.

The following concepts were derived from the exploration in the morphological analysis: 1) A dedicated lane on highways for automatic car driving (car driving); 2) A dedicated lane for automatic buses (public transport); 3) A multimodal concept using a Park&Ride and a People Mover system (car driving + public transport). This means that for the first experiment the following attributes and levels were selected:

* Automatic Car Lane on/off ramps: 1,5 km or Not available
* Automatic Bus Station: 500 m. or Not available
* People Mover stop to P+R facility: 500 m. or Not available
* Train station: 500 m. or 3 km.
* Highway on/off ramps: 1,5 km or 6 km.

The respondent had to judge eleven profiles constituted by these transport modes. Eight profiles are necessary to estimate the model, one profile is used as an example and two profiles functions as so-called ‘holdout profiles’. These were constructed in order to gain insight into the criterion validity. These holdout profiles are not used to estimate the model but serve as additional measurements to enable comparison of the actual ratings for the holdout profiles with the ratings predicted by the estimated model.

An important assumption in this first experiment was that the closer the system lies to the hypothetical location, the higher the respondent would judge the accessibility profile. An example of a profile the respondent has to judge is visualised as follows:

Figure 3 Example of accessibility profile to be judged by respondent

Pictogram one in figure 3 refers to a train station (it is the logo of the Dutch Railway company), the second one refers to the automatic bus station, the third pictogram to the People Mover from P+R, the fourth refers to a normal motorway on/off ramp and the fifth pictogram refers to the automatic car lane off and onramp. The (ITS) concept behind the pictograms was explained (using both text and visuals) in part two of the questionnaire, using a textual description, two drawings and the corresponding pictograms. During the questionnaire-tests it seemed that respondents were good at matching the concept characteristics to the pictograms used.

3.2 Selecting attributes and levels for location profiles: experiment 2

To define the attributes for the general location experiment, a literature study was performed. From that study the following five attributes where found to be important factors for the relocation of office-keeping organisations: *building type, floor use, price, parking availability and accessibility*.

Several studies reveal that the *building type* influences location choices of office-keeping organisations to a large degree (Van der Velde, 1992; Korteweg, 1994; Van Dijk et al., 1999; Pen, 2002). Van der Velde (1992) uses a threefold. '*A notary belongs to be located in a respectable mansion on a shady and leafy canal. An organisation with a clear public function needs a well accessible office, with sufficient parking availability. An innovative high-tech company will be mainly located in a modern high-tech looking office'* (Van der Velde, 1992: 63, *Translation and parenthesis mine*). Korteweg (1994: 9) uses the following distinction of office milieus: office boulevards, other centre locations, peripheral nodes, other nodes, residential areas and business sites (for industry and transport, need more space). Based on these studies we selected three levels: an old mansion in a respectable neighbourhood, a functional building in a residential area and a modern building on an office-boulevard or in an office-park.

The second important attribute is *floor use***.** Van der Velde (1992) describes a spectrum with 'closed spaces', which are rather conventional on one edge and the 'open offices' on the other edge. The closed space (also called 'structured' or 'conventional' plan) consists of several cellular office spaces. In between the two edges there are more office lay-outs, for example the 'modified plan' in which the user has the opportunity to what extent he uses walls to mark his 'territory' (Van der Velde, 1992). We use closed spaces, flexible spaces and different rooms + office garden.

The third attribute is *rental purchase cost***.** The levels for the purchase and rental cost are based on multiple documents (e.g. the 'KAN Real Estate Report[2]', 2002) describing fluctuations in amount of office space and corresponding rental prices. The price levels are expressed in m^2/year and include: 90 euro, 130 euro and 170 euro.

The fourth attribute is *parking space*. The levels for this attribute were also derived from multiple studies and policy-documents. It includes 10, 30 and 50 parking places per 100 employees.

The fifth and final attribute is *accessibility.* The levels used in the experiment are accessibility is 4, accessibility is 6 or accessibility is 8. These numbers refer to a ten point school report scale, which is widely used in The Netherlands. It also refers to the ten point scale which is used in the first experiment where the respondent is judging (on a ten point scale) the accessibility profiles.

The respondent had to judge 21 profiles constituted by these transport modes. Again, eighteen profiles are necessary to estimate the model, one profile is used as an example and two function as holdout profiles.

3.3 Research Population

As explained earlier, the research focuses on the influence of ITS concepts on location attractiveness in city regions. This paper describes the test results of the research part that focuses on the preferences of office keeping organisations. In future the results from a larger data set (hopefully between 300 -500 organisations) will be validated by a choice experiment conducted among organisations in the Arnhem – Nijmegen region, the so-called KAN-region.

Although the *scales* of implementation between these concepts vary, this research mainly focuses on the most appropriate scale, which is the small regional scale. The regional scale covers both lower and higher scaled improvements of services in transport. Investments

[2] In Dutch this is the *KAN-Vastgoedrapportage*.

in for example automation technology for buses are more of interest for cities like Eindhoven and Groningen (both over 200.000 residents) than for example for Amsterdam or Rotterdam (nearly 800.000 residents). These larger cities focus more on light rail and subway systems, as they are populated more densely. A first exploration of investment strategies in urban regions of the defined scales is described in Argiolu *et al*. (2004).

The criteria and specification of city regions similar to the KAN-region is described in the last four reports on Spatial Planning in The Netherlands. The only deviation from that set of regions is the exclusion of the Randstad region, for reasons mentioned above.

National City Network	*Cities included*
Brabantstad	Breda, Tilburg, Den Bosch, Eindhoven, Helmond
Zuid-Limburg	Maastricht, Heerlen, Sittard, Geleen
Twente	Enschede, Hengelo, Almelo
Groningen/Assen	Groningen and Assen

Table 2 Research Population

Table 2 shows the total amount of cities and the corresponding city network name, which is derived from the national reports used. The set contains 14 cities from the far north (Groningen and Assen) to the far south (Sittard-Geleen, Maastricht and Heerlen).

Besides the city-scale-criterion there are also restrictions to the number of employees of organisations. An important decision in research is that this experiment only focuses on organisations that have a minimum size of three employees. This was decided because of two reasons. The first is that really small organisations (one to three employees) are often taking place at home addresses. As such the data would not concern office keeping real estates data provided by that kind of organisations are not considered to be valid. Secondly, although large in quantity (there is a lot of small organisations), it is really questionable whether the preference of small organisations really influences spatial development by location preference, as the impact of their relocation on spatial development is very small.

Finally, the office keeping organisations were selected using line of business coding, based on literature features. Basically, the research focuses on the service- and non-profit-sector. Thus, important sectors like the industry, transport or retail were excluded. These organisations were not considered operating on the real estate market for offices. The test results described in the next section are derived from six respondents, representing three companies and one non-profit organisation from Nijmegen, one from Wageningen (a city which is not included in the research population) and one company from Maastricht.

4. Test results

In order to establish the final questionnaire sent out to 5025 office-keeping organisations, the questionnaire was tested by asking six office-keeping organisations to fill in the questionnaire and react on several aspects as the answering categories, the lay-out and length of the questionnaire and the explanations of the included questions. Additionally, a few colleague scientists were asked to react on the mentioned aspects. The questionnaire was built up in four parts.

The first part consisted of general questions about office-keeping organisation features, mainly focussing at revealing possible explanatory variables and gaining insight into reasons for non-response (for example in literature is was stated that the office-keeping organisations that were looking for new locations might be more interested in filling in the questionnaire.) To gain insight into the reliability of the provided answers an additional question was included to what extent the respondent has influence on location decisions. Further, office-keeping organisations' four digit zip code was asked, assuming that organisations in some regions (e.g. the Eindhoven region, which has more experience in ITS concepts) would respond differently from organisations from other regions.

The second part included an introduction of the three new ITS concepts, supported both by text and two drawings for each ITS concept. Further, the respondent was asked if they found the concept realistic and contributing to a better accessibility within, or in case of the automatic car lane of, the city region. The answers to these questions might give us more understanding why certain organisations might give low scores on the rank orders in the experiment.

The third part of the questionnaire includes the accessibility profiles. The respondent was asked to react on accessibility profiles (constituted by varying two-level distances to the five different transport concepts) given the fact that he/she would have to relocate the organisation.

The fourth part of the questionnaire deals with the location profiles. In this part the respondent was asked to react on location profiles (constructed by five three level location factors) given both facts that he/she would have to relocate the organisation and that the location factor accessibility judgment referred to the respondent's judgement earlier given in the accessibility profiles.

By giving some insight into the test results of part 2, 3 and 4 of the questionnaire, we try to give a first glance of what is to be expected from the real experiment focussing on a research population of, hopefully, about 300 – 500 respondents.

N=6 (!)	**Median**	**Average**	**Inter-quartile range (mid 50%)**
Automatic Car Lane			
Is this a realistic transport concept?	3,5	3,33	(1 – 5,25) range = 5,25
Improvement of accessibility in region?	5,5	5,33	(4,75 – 6) range = 1,25
Automatic Bus lane			
Is this a realistic transport concept?	5,5	4,83	(4 – 6) range = 2
Improvement of accessibility in region?	5	4,67	(3,5 – 6) range = 2,5
People Mover from P+R			
Is this a realistic transport concept?	4,5	4,33	(3,25 – 6) range = 2,75
Improvement of accessibility in region?	4,5	4,67	(3,75 – 6) range = 2,25

Table 3 Descriptive statistics on questions about ITS concepts using a six-point scale

** Note: '1' was really unrealistic or sure no improvement and '6' was really realistic and sure of improvement*

It is clear from table 3 that the respondents were not convinced that the Automatic Car Lane would be a realistic transport concept. However, the variety of answers about this case is quite large. All the other responses have rather small ranges. The respondents found that the other ITS concepts would be realistic concepts, especially the Automatic Bus Lane. Note that this answer also has the one but smallest inter-quartile range, which means that respondents' answers do not vary in a large extent. When asking to the effects of the ITS concepts on the overall accessibility of the area, it is obvious that the automatic car line is considered to have the highest impact. The answers did not diverge in a large extent. Also the impact of the other ITS concepts was considered to be high but the answers varied in a larger degree. The third part was aimed at exploring to what extent the three new ITS concepts contribute to the overall evaluation of the accessibility of an office location. Table 4 shows the part-worth utilities of the included attribute levels in the SP experiment. The second column shows whether and to which extent a specific attribute level is contributing to the function positively or negatively. The third column shows whether this contribution is significant or not.

N=6 (!) Attributes	Part-worth utility	Sign. Level	Importance (rank order)
Average utility (intercept)	5,625		
Train station			**1,416 (2)**
0) 250 meter	,708	,007	
1) 3 km.	-,708		
People Mover from P +R			**0,084 (5)**
0) 250 meter	,042	,553	
1) None	-,042		
Automatic Bus stop			**0,750 (3)**
0) 250 meter	,375	,024	
1) None	-,375		
Motorway on/off ramp			**1,666 (1)**
0) 1,5 km	,833	,005	
1) 6 km	,-833		
On/off Ramp Automatic Car lane			**0,666 (4)**
0) 1,5 km	,333	,030	
1) None	-,333		
R^2 = 0,995			

Table 4 Test results of part-worth utilities five transport concepts.

Further, the fourth column includes the importance of the whole attribute and is calculated by the difference between the two part-worth utility numbers of that specific attribute. As effect coding was used, the intercept denotes the average rating, whereas the regression coefficients denote the contribution to the overall utility in terms of deviation from this average rating. Finally, the R square indicates the predictive power of the model, which normally is quite high as this number is calculated by using the profile means.

As it is clear from table 4 the two conventional transport modes have the largest influence on accessibility evaluations although the proximity of a motorway on/off ramp is considered to be slightly more important than the proximity of a train station. Further it is clear that both the automatic bus stop as well as the automatic car lane have a significant contribution to the overall evaluation of a new location although to a lower degree than the two conventional transport modes. Finally, the contribution of the people mover from P+R is insignificantly and very small.

Table 5 describes the fourth and final part of the questionnaire-results including the 'location' profiles of the SP experiment. It is clear from the table that the respondents favoured modern office buildings over old mansions within respectable neighbourhoods. The functional building had a negative contribution to the overall evaluation of the entire office location. Concerning the internal space use of office buildings, flexible space use had a positive contribution to the overall evaluation, whereas both the closed fixed spaces as well as the different rooms + office garden had a negative contribution. However, the influence of this attribute was insignificant.

The part-worth utilities of the last three attributes reveal that the utility functions of those attributes are non-linear. For example, an increase in rental-costs from 90 to 130 euros influences the overall preference of a location in a larger degree than an increase in costs from 130 to 170 euros. The price of the building has a significant contribution to the overall evaluation. The amount of parking space also contributes in a large, significant way. The third column shows the importance of the attribute as a whole. From table 5 it is clear that when organisations should relocate to a new office location the accessibility level is the most important feature. This accessibility was linked with the first experiment. This means that any conclusions regarding this attribute can be found in table 4, which refers to the first experiment. For example, the attribute level 'accessibility is 8' from the second experiment would match in a high degree with the following accessibility profile from the first experiment: motorway on/off ramp at 1,5km, the train station at 250 meters, an automatic bus stop at 250 meters and the automatic car lane at 1,5 km. This would add respectively to the intercept (5,625) + 0,833 + 0,708 + 0,375 + 0,333 = 7,874 (see table 4).

N=6 (!) Attributes	Part-worth utility	Sign. Level	Importance (rank order)
Average utility (intercept)	5,426		
Office building appearance			**1,333 (3)**
0) Old mansion within respectable neighbourhood	,241	,207	
1) ‘Functional’ building in residential neighbourhood	-,787	,003	
2) Modern building on office park or boulevard	,546		
Type of internal space use			**0,361 (5)**
0) Closed interior spaces	-,065	,719	
1) Flexible spaces	,213	,258	
2) Different rooms + office garden	-,148		
Rental-/purchase cost per m2/ year			**1,084 (4)**
0) 90 euro	,491	,025	
1) 130 euro	,102	,575	
2) 170 euro	-,593		
Parking Space (per 100 employees)			**1,445 (2)**
0) 10	-,843	,002	
1) 30	,241	,207	
2) 50	,602		
Accessibility judgment (10-scale rating)			**2,528 (1)**
0) 4	-1,176	,000	
1) 6	-,176	,343	
2) 8	1,352		
R^2 = 0, 950			

Table 5 Test results of part-worth utilities related to the general location attributes

Even the attribute level ‘accessibility is 6’ (which is formally used as a sufficient accessibility) has a negative value. The eight has a strong positive contribution to the model. The importance of the accessibility attribute is followed by the amount of parking space, the building appearance and the price one has to pay for the location. The type of internal space use seems rather insignificant compared to the other attributes.

5. Conclusions and further research

A first important conclusion relates to the face validity. That concerns the validity of the questionnaire as a tool to gain answers on questions about preferences of accessibility and location. The respondents seemed to have no problems with filling in the questionnaire. Most of the attributes where found to contribute significantly and in the directions as expected to the overall evaluation of the accessibility of the office location respectively the overall evaluation as the office location as a whole. The two conducted experiments also show that the accessibility plays an important role in relocations and that this accessibility is mainly found attractive due to conventional transport modes.

Given the results of the evaluations of the attractiveness and the realism of the three ITS concepts one might conclude that the ITS concepts that are not found realistic are not considered to be an important aspect in evaluating the accessibility profiles. However, as respondents believe that the automatic car lane would have a large contribution in improving the accessibility of a region but consider this concept not being realistic at this moment, it might be assumed that organisations will trade-off the existence of the automatic car lane against the other ‘more conventional’ concepts in a larger degree when the development of those newer concepts is further and thus more realistic. In fact this is already visible when considering the automatic bus lane, which was found most realistic of the three concepts and had the most significant contribution. The poor position of the P+R and people mover stop might be explained that it is not convincingly contributing to a better accessibility within a city region (as for example to other two do) and that it is even not considered as realistic as the automatic bus lane.

The future research might probably show interesting outcomes, differentiated among variables like office branches, size of organisation and perhaps specified by city region.

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