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Location attractiveness: is ITS becoming a high-ranked factor?

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Abstract

This paper describes a study on the effects of Intelligent Transportation Systems (ITS) on location preferences of office-keeping organisations. To measure these effects a Stated Preference (SP) experiment has been conducted in the Netherlands. Representatives of office-keeping organisations in selected city regions have been questioned about the attractiveness of pre-specified location profiles which included three ITS attributes. Next a preference model has been estimated in order 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. It appears that all the three ITS attributes, with difference in strength, have a significant contribution to the preference model.

Keywords: ITS, Location preference, Stated Preference, Urban region

1. Introduction

The development of Intelligent Transport Systems (ITS) has taken a leap in the past decade. Under strong influence of new Information and Communication Technology (ICT), industries and scientific institutes have put much effort on developing a range of intelligent applications for vehicles to drive safer, more comfortable, to make more efficient use of infrastructure and to manage fleets more accurately. ITS can be described as 'systems consisting of electronics, communications or information processing used singly or integrated to improve the efficiency or safety of surface transportation'. From a scientific point of view ITS applications seem to hold many keys to innovate the performance of the transport system. Consequently, ITS receives much interest from governmental bodies since ITS could contribute significantly to transport policy goals. However, many uncertainties do exist. One of the uncertainties concerns the spatial impacts of ITS. An interesting question for instance is whether the spatial distribution of office locations will change in case ITS are deployed at a large scale.

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. 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.

To test these hypotheses, a Stated Preference (SP) survey has been conducted. The SP approach uses hypothetical location alternatives, for which respondents are asked to provide preferences or choices. In this paper the set-up and the first results of our experiment is presented. A questionnaire was sent out to 5025 office-keeping organisations of which 345 organisations filled in the questionnaire in such way that it was useful for analysis. The results are used to test the hypothesis mentioned above.

Section 2 focuses on describing the research approach. This section explains the conceptual model on location choices. Further, it explains the theory behind the Hierarchical Information Integration (HII) method, which is a specific variant of the SP method and is used in this research.

Section 3 describes the application of the HII method. Further, it focuses on the selection of attributes and levels, the construction of profiles and the estimation procedure.

Section 4 gives a set out of the questionnaire. Besides the set out, the section explains the test results and how the research population is demarcated.

Section 5 focuses on the results of the HII experiment. 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 respondents' judgements on office location profiles.

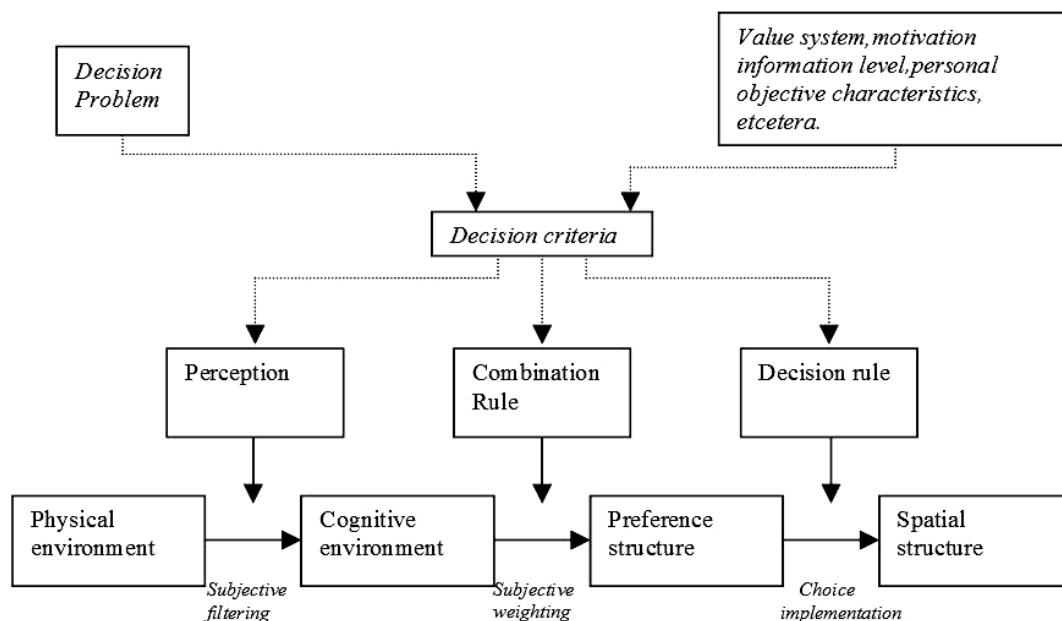
Section 6 finally describes what is to be concluded and what can be said about future research.

2. Conceptual model on location choices

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. 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 fig. 1.

Fig. 1: A general conceptual model for spatial choice

Timmermans (1982)



It illustrates that location choices and other spatial choice behaviour is considered to be the outcome of an individual's decision making process among a set of potential alternatives under consideration¹. 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. This model is based on the assumption that each choice alternative can be characterized by number of attributes, underlying the choice of an individual. The bundles of attributes which

¹ In this research it is not believed that only one person decides upon relocations of an office-keeping organisation. We believe 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 respondent is a very important person in the relocation process. In office-keeping organisations this could be the director or management in an organisation.

describe the available alternatives give a description of the physical space or environment (Molin, 1999). If an organisation would for example be looking for an office, important attributes could be the price, travel distance for employees, 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 so called cognitive constructs. This information has been gathered through search and learning processes and is related to the individual's value system, his motivation and possibly to other more personal characteristics.

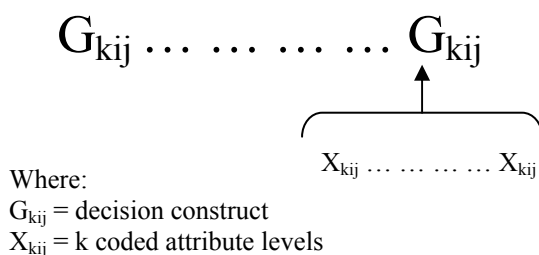
It is next assumed that the decision problem, together with his value system, motivations and so on, defines a set of decision criteria for the individual, conditioning his perceptions of the objective physical environment. This perspective act typically involves a subjective filtering based upon imperfect 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 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.

The SP experiment in our study aims at identifying the relative importance of the different attributes underlying location choices, and especially the role of the three introduced ITS concepts. The results set only focuses on the preference structure. Thus, 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.

In case a large number of potentially influencing attributes need to be evaluated, one typically applies a Hierarchical Information Integration (HII) approach (Louviere, 1984). The HII approach is an extension of the traditional SP approach and is based on the assumption that respondents that are confronted with decisions involving many attributes, they process information in a hierarchical manner (see fig. 2). Individuals are assumed to first group attributes into higher order decision constructs. They then evaluate each construct separately, and finally integrate these evaluations to arrive at an overall preference structure (Bos, 2004). Hence, in our study it is assumed that individuals firstly evaluate the accessibility of an office-location before judging the overall description of the location. Therefore, two experiments were conducted.

Fig. 2: Decision constructs formed by attributes



The theory behind HII approach is that the process of evaluating the preference alternatives involve many potentially influential attributes by grouping the attributes into 1 subsets which define or represent decision constructs, denoted G_i ($i = 1...I$). For each decision construct, there is a subset of K_i attribute levels X_{kij} ($k = 1,2...K_i$) that defines the profile of alternative j on decision construct i .

3. Applying the HII

The research which is described in this paper is a very simple variant of an HII experiment. A more extended HII experiment would focus on a large set of attributes equally corresponding to the number of decision constructs. So, for example, if one would focus on location choice with five decision constructs, it would need another five groups of attributes to evaluate the location preferences (see figure 2). However, we are specifically interested in the role of new ITS concepts in location choices of office-keeping organisations. As such we only select accessibility attributes to form a group representing the accessibility decision construct. The ITS concepts are embedded in that group of attributes. This typical HII variant uses the following steps in setting up an HII experiment:

- selection of attributes and levels
- generate attribute-based profiles
- construct profiles
- estimate models

3.1 Selection of attributes and levels

So, at first we deal with the selection of attributes that can be grouped to decision constructs. In this study, only the attribute ‘accessibility of location’ is seen as a decision construct. Therefore, 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 Argioli *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 (P+R) 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 No available
- Automatic Bus Station: 250 m. or No available
- People Mover stop to P+R facility: 250 m. or No available
- Train station: 250 m. or 3 km.
- Highway on/off ramps: 1,5 km or 6 km.

Secondly, to define the attributes for the general location experiment, a literature study was performed. From that study the following five attributes were 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 ours). 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). In this research, we use closed spaces, flexible spaces and different rooms plus 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 Report²’, 2002) describing fluctuations in amount of office space and corresponding rental prices. The price levels are expressed in m²/year and include: 90 euro, 130 euro and 170 euro.

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

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.

Thus, this means that for the second, bridge, experiment the following attributes and levels were selected:

- Building appearance: *Old mansion in respectable neighbourhood, Functional building in residential area* or *Modern building on office park or boulevard*
- Internal space use: *Closed cells, Different rooms + office garden* or *Flexible use of space*
- Price in m²/year: *90 euro, 130 euro* or *150 euro*
- Parking space in number/employees: *10/100, 30/100* or *50/100*
- Accessibility in school rate: *Accessibility is 4, Accessibility is 6* or *Accessibility is 8*.

3.2 Generate attribute-based profiles






For generating attribute based profiles 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 five attributes with three levels, the respondent has only to judge 18 profiles, instead of the 81 profiles that would be needed in full factorial designs. In this research we use fractional factorial designs.

3.3 Construct profiles

The respondent had to judge eleven profiles constituted by the transport modes. Eight profiles are necessary to estimate the model, one profile is used as an example and two profiles function as so-called 'holdout profiles'. 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 transport 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:

Fig. 3: Example of (1) accessibility and (2) location profile to be judged by respondent

	<u>Accessibility profile</u>	<u>Office location profile</u>
1	 250 m.	<i>Modern building in office park</i>
	 250 m.	<i>Flexible use of space</i>
	 No available	<i>130 euro m²/year</i>
	 6 km.	<i>10 parking places per 100 employees</i>
	 No available	<i>Accessibility is 6</i>
2		

Pictogram one in fig. 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.

3.4 The estimation procedure

Apart from the HII approach 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.

Further, 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 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 focused 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:

Fig. 4: General main effects model (McClave et al. 1997)

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

Where:

V_j = the utility of 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

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 I provides the coding scheme for effect coding for two to three level attributes (Molin, 1999).

Table I: 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

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).

4. Setting up the questionnaire

This section describes three issues that are important before going into detail about the results of the research. At first the set up of the questionnaire, secondly the test results and finally the specification of the research population will be explained.

The questionnaire was built up from 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 it 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. The second part of the questionnaire included an introduction of the three new ITS concepts, supported both by text and two drawings for each ITS concept. 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 included the accessibility profiles. The respondent was asked to react on a series of 11 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 and final part of the questionnaire dealt with the location profiles. In this part the respondent was asked to react on 21 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.

Before the final questionnaire was distributed, the questionnaire was tested on its complexity and length. Six office-keeping organisations were involved in this test 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. These organisations were asked 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 these issues. The test implied that the lay-out needed serious improvement. Concerning the contents it was concluded that organisations seemed very well able to understand the subject discussed and to answer the questions in a logical way.

A last action before conducting the experiment involved a specification of our population. As stated earlier, our research focuses on the influence of ITS concepts on location attractiveness in city regions for office-keeping organisations. In earlier studies (i.e., see Argiolu et al. 2004) it was explored that the three ITS concepts would best be developed in, to Dutch standards, smaller urban regions. The Netherlands has five of such urban regions including 16 cities in total. It includes medium-sized cities like Eindhoven, Maastricht and Groningen. The set excludes bigger cities as Utrecht or Amsterdam. Besides the city-scale-criterion there are also restrictions to the number of employees of organisations. An important decision in our study is that this experiment only focused on organisations that have a minimum size of five employees³. This was decided because of two reasons. The first is that really small organisations (one to three employees) are often located at private home addresses. As such the choice data of these home-based offices are not considered to be valid. Secondly, it is likely that small organisations have small impact on spatial development by relocation preferences. Finally, the office-keeping organisations within the service- and non-profit-sector were selected. Thus, important sectors like the industry, transport or retail were not included in our study as these organisations were not considered to be operating on the real estate market for offices.

5. Results

As we expected we had a rather low percentage of response. We sent the questionnaire to 5025 organisations. It seemed that at least 213 addresses were incorrect. The response was 8%. In total, 388 questionnaires returned, of which 360 seemed completely useful for further analysis.

Table II shows some characteristics of the research population. The average size of company is 42 employees, with a median of 10 employees. These numbers are higher than the national average because only companies were invited with more than five employees for reasons we explained earlier. The explanation for the difference between the company size mean and median can be found in the small number of large organisations. For example, the largest organisation in the dataset had 4400 employees. Further, the influence of the respondent on the decision making process when the organisation should relocate has an average of 5 on a six-scale and a

³ For methodological reasons we made an exception in case of one branch of organizations. For that specific branch we used a minimum of three employees.

median of 6. That means that it is plausible to assume that the organisations' location preferences can be based on only one respondent per organisation.

Table II: Information on organisations' respondents and the stated influence on relocation decision process

N = 345	Mean	Median	Interquartile Range (mid 50%)
Company size (total number of employees working at office)	42	10	Percentile 25 = 6 employees Percentile 75 = 22 employees
Influence of respondent in decision making process relocation*	5	6	Percentile 25 = 5 Percentile 75 = 6

* Note: '1' very little influence and '6' very much influence on relocation decision making

Table III shows the results of the second part of the questionnaire. The respondents were not really convinced that the Automatic Car Lane and the P+R and People Mover are realistic transport concepts. The respondents found that the other ITS concept, the Automatic Bus Lane is some more convincing in terms of being realistic. When asking to the effects of the ITS concepts on the overall accessibility of the area, it is obvious that the automatic bus lane is considered to have the highest impact, although the difference between the means is quite small.

Table III Median and mean on questions about ITS concepts using a six-point scale

N=345	Median	Mean
Automatic Car Lane		
Is this a realistic transport concept?	4	3,77
Improvement of accessibility in region?	4	3,95
Automatic Bus lane		
Is this a realistic transport concept?	5	4,24
Improvement of accessibility in region?	4	4,05
People Mover from P+R		
Is this a realistic transport concept?	4	3,92
Improvement of accessibility in region?	4	3,84

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

The third part of the questionnaire was aimed at exploring to what extent the three new ITS concepts contribute to the overall evaluation of the accessibility of an office location. The second column of Table IV shows the part-worth utilities of the included attribute levels in the SP experiment as well as the average utility. The third column shows whether this contribution is significant or not. The final column indicates the importance of an attribute. It is calculated by the difference between the two part-worth utility numbers of that specific attribute.

Table IV: Results of part-worth utilities five transport concepts.

N=345	Part-worth utility	Sign. Level	Importance (rank order)
Attributes			
Average utility (intercept)	5,799		
Train station			1,084 (2)
250 meter	0,542	0,002	
3 km.	- 0,542		
People Mover from P +R			0,542 (5)
250 meter	0,271	0,009	
None	-0,271		
Automatic Bus stop			0,788 (3)
0) 250 meter	0,394	0,004	
1) None	- 0,394		
Motorway on/off ramp			1,384 (1)
0) 1,5 km	0,692	0,001	
1) 6 km	-0,692		
On/off Ramp Automatic Car lane			0,564 (4)
0) 1,5 km	0,282	0,009	
1) None	- 0,282		
$R^2 = 0,999$			

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 aggregated results. The results show that all levels that correspond to small distances of the transport system to the hypothetical location are contributing positively to the preference model. On the other hand when the system lies farther or no system is present, in case of the three ITS systems, it is contributing negatively to the preference model. The two conventional transport modes are considered to have the largest influence on the accessibility. Their contribution to the model is bigger. The proximity of a motorway on/off ramp is considered to be slightly more important than the proximity of a train station. Nevertheless, the ITS concepts are each considered to have a significant contribution to the accessibility of a new office location. Of the three ITS concepts, the automatic bus lane has the most influence on the preference model.

Table V describes the fourth and final part of the questionnaire-results including the 'location' profiles of the SP experiment. The average is 4,9 and reflects the functions intercept. 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. The part-worth utility of the level 'old mansion' is almost equal to zero and very insignificant. A logical interpretation is that the utility function of the office building is linear. This is also the case with the part-worth utilities of the last three attributes, namely price, parking availability and accessibility rate. The type of internal space use is an exception. There, both the flexible space and the different and office garden have a small but positive contribution and the closed interior spaces have a negative contribution to the utility function.

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

Attributes	N=345	Part-worth utility	Sign. Level	Importance (rank order)
Average utility (intercept)		4,927		
Office building appearance				0,242 (5)
0) Old mansion within respectable neighbourhood		4,509E-0,3	0,932	
1) 'Functional' building in residential neighbourhood		-0,121	0,049	
2) Modern building on office park or boulevard		0,121		
Type of internal space use				0,453(4)
0) Closed interior spaces		-0,278	0,001	
1) Flexible spaces		0,175	0,011	
2) Different rooms + office garden		0,103		
Rental-/purchase cost per m2/ year				1,028(3)
0) 90 euro		0,514	0,000	
1) 130 euro		5,862E-02	0,287	
2) 170 euro		-0,514		
Parking Space (per 100 employees)				1,424(1)
0) 10		-0,712	0,000	
1) 30		4,944E-02	0,364	
2) 50		0,712		
Accessibility judgment (10-scale rating)				1,244(2)
0) 4		-0,622	0,000	
1) 6		2,528E-02	0,634	
2) 8		0,622		
$R^2 = 0,989$				

Interesting observation for this research is that accessibility is the second most important attribute. Its contribution to the utility function is significant. The second accessibility level, accessibility is 6, has an insignificant contribution of nearly zero, which means that this attribute's utility should be interpreted as a linear function. The difference between an accessibility of 4 and 6 is the same as the difference between accessibility is 6 and 8. Further, note that this accessibility attribute was designed as a decision construct and consequently was linked with the first experiment. This means that any conclusions regarding this attribute can be found in table 3, 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 1,5 km, the train station at 250 meters, an automatic bus stop at 250 meters, the automatic car lane at 1,5 km and the People Mover from P+R facility at 250 meters. This would add respectively to the intercept $(5,8) + 0,7 + 0,5 + 0,4 + 0,3 + 0,3 = 8,0$ (see table IV).

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. The parking space attribute is, according to the office-keeping organisations, considered to be of major importance. The importance of the amount of parking space is followed by the accessibility attribute and the

price one has to pay for the location. The type of office building appearance seems rather insignificant compared to the other attributes.

6. Conclusions and further research

The research conducted aimed at exploring the influence of new ITS concepts on the location preference of office-keeping organisations. The strategy of using a HII experiment in which we confronted the organisations with new systems supported by text as well as visuals seemed to be fruitful. In total at least 345 organisations showed interest and filled in the questionnaire, which we found useful for analysis.

A first important conclusion relates to the validity. Most of the attributes were 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 confirm that the accessibility plays an important role in relocations and that this accessibility is mainly found attractive due to conventional transport modes. The hypothesis as stated in the introduction is accepted. The three specified ITS concepts do contribute significantly to the location preference model. In that perspective we can say that they change the location preferences of office-keeping organisations.

Of all three concepts the automatic bus lane had the largest contribution to the preference model. The answer for the difference of importance might be explained by the variables tested in part two of the questionnaire. Namely, it was exactly the automatic bus lane which was considered most realistic, as compared to the other two concepts. This implies that organisations have more believe that this concept will surround their urban environment within the near future.

A more in-depth analysis of our data will likely give more detailed results. For instance, significant differences in preferences might be found by considering different groups of organisations within our population. Groups can be constructed by varying across variables like office branches, the respondent's city region and the company size. Although these questions remain unanswered for now, we can conclude that all three ITS concepts when developed close to office locations contribute to a significant degree to the accessibility of a new location, perceived by office-keeping organisations.

To validate this preference based study, a choice based experiment will be designed, which should indicate whether future choices, when simulated in a case region, match preference structures that are found in this HII experiment. In that future study, organisations are asked to decide which alternative they would choose given their evoked set. We hypothesize that the individual will choose the alternative with the highest preference scale.

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