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ScienceDirect
Journal of Transport Geography 14 (2006) 451–462
JOURNAL OF TRANSPORT GEOGRAPHY
www.elsevier.com/locate/jtrangeo

Destination choice and the identity of places: A disaggregated analysis for different types of visitor population environment in the Netherlands

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Abstract

Individual behaviour relates to the ecological structure or identity of places. In this study, we investigated the relationship between the space–time ecologies of different types of visitor population environment in the Netherlands and destination choice. Multinomial logistic regression modelling for car users was applied to determine the relative importance of various personal and household attributes on choosing for a particular purpose a particular type of visitor population environment during a particular time period of the day. The attributes with the strongest link to the space–time ecologies of destination environments proved to be age, educational level, car ownership, and household income and type.

Keywords: Visitor populations; Space–time ecology; Destination choice; The Netherlands

1. Introduction

Advanced transportation and communication infrastructures have released many activities from the need for spatial propinquity and metropolitan concentration (Amin and Graham, 1997). As a result, the opportunities for participation in activities and travel in contemporary society have become highly fragmented in space and time. At the same time, triggered by numerous economic, cultural, and social developments (Giuliano and Gillespie, 2002; Musterd and Van Zelm, 2001), which offered both expanded opportunities and new constraints, the heterogeneity in household types and life styles has increased markedly. As a result, activity and travel patterns have diversified in a temporal as well as a spatial sense.

There is, however, enough evidence to show that *co-presence* in space and time is still essential for many activities (see for example Couclelis, 2004; Storper and Venables, 2004). What is changing is that, as a result of the dynamics operating in society, places are in a constant state of flux, so that the characteristics of the populations present show marked variations throughout the day, week, month, and year. Both individual characteristics and the supply of transportation and communication systems in combination with the opportunities to participate in activities offered at a given location have an impact on the composition of these *visitor populations* (as opposed to the 'permanent' *inhabitants* of an area; see Martinotti, 1996). Transport-policy related issues such as congestion and parking as well as the functioning of public transport systems are related to the size of these temporary populations, their characteristics, and their use of different transport modes in particular periods and places.

Visitor populations are constituted by the coupling together of individual paths through space and time at specific temporal and spatial locations as a result of needs and constraints (Pred, 1984). Correspondingly, individuals'

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0966-6923/$ - see front matter
doi:10.1016/j.jtrangeo.2005.10.009

attributes and activities contribute to the *socioecological structure* or *identity* of places. Conversely, temporal variations within these structures are "one of many factors that might, also, influence decisions on individual activity and travel behaviour (Janelle et al., 1998, p. 131)." Whereas 'traditional' urban socioecology usually employed the sociodemographic attributes of individuals and households at fixed residential addresses to describe the spatial patterns of the urban social structure, the behaviour of individuals can only be fully understood if it is also related to the short-term temporal shifts in activities, travel, and sociodemographics that occur within any given spatial context.

In this study, we have investigated the relationship between the space–time ecological structures of different types of visitor population environment in the Netherlands and destination choice, thereby taking into account various individual and household characteristics. Although earlier studies have considered the relationship between these structures and the presence of subpopulations (Janelle et al., 1998), the analysis of disaggregate destination choice in this respect is new. In this study, *visitor population* is defined as *an aggregate of persons, including those active within their residential municipality, performing out-of-home activities in a particular municipality during a particular time period*. The term includes commuters and other frequent and infrequent users of rural, suburban, and urban areas, but disregards foreign visitors. A type of visitor population environment describes similarities in diurnal weekday patterns of visitor populations for a certain range of municipalities.

For this analysis, we used the 1998 Netherlands National Travel Survey (NTS), which has allowed us to link the spatiotemporal characteristics of trips (arrivals in particular) to personal attributes and destination environments. The next section provides an overview of the relevant theoretical and empirical literature. Section 3 provides a description of the dataset and research design. Section 4 contains an overview of the typology of visitor population environments used in the analysis. In Sections 5 and 6, we discuss the results of a descriptive and a multivariate analysis respectively. Our conclusions are reported in Section 7.

2. Space–time social ecology

Originating in the work of Robert Park and Ernest Burgess in the 1920s and 1930s and Shevky and Bell's Social Area Analysis halfway through the 1950s, socioecology analyses individual behaviour in the context of the environment's social structural properties and functional relationships. Most socioecological studies, which had their heyday in the 1960s and 1970s, employed factor-analytical techniques, focused on the residential differentiation within an area, and identified underlying dimensions that referred to economic, family, and ethnic status (Janson, 1980). Very few studies have paid attention to the daytime population (as opposed to the nighttime or residential population) in analysing the segregation of people over urban space. Janson (1971) included variables defining the daytime population in his analysis of the urban spatial structure of Swedish cities and found a dimension indicating a dwelling area versus workplace area differentiation (*residentialism*). More recently, Blumen and Zamir (2001) and Ellis and colleagues (2004) have examined changes in sociospatial segregation as a result of the daily spatial mobility between home and work location. However, these empirical studies focus on working and pay no explicit attention to the time dimension of the use of places.

To date, Taylor and Parkes (1975) and Goodchild and colleagues (Goodchild and Janelle, 1984; Goodchild et al., 1993; Janelle et al., 1998) are the only researchers who have examined empirically diurnal changes in the socioecology of urban life. They describe space–time factorial ecologies for a hypothetical, medium-sized British city and the metropolitan area of Halifax-Dartmouth, Canada respectively. Based on activity, transport, and sociodemographic variables, they identified certain factors that underlie aggregate space–time patterns of populations, which can be categorized along activity and sociodemographic dimensions. Of the activity dimensions, home–work differentiation seems to provide the strongest dimension of the urban space–time structure, followed by leisure, shopping, and education. The relevant sociodemographic dimensions of visitor populations are primarily related to income, educational/occupational status, and age. Projecting these dimensions onto locations and times indicates that different areas in the city, such as the CBD, shopping centres, and suburban areas, yield particular patterns of *temporal specialization*.

These patterns are linked to the movements and activities of individuals. Studies of population role groups, defined by the combined attributes of gender, marital status, job, childcare, residence tenure, and car ownership (Janelle et al., 1998), show that these subpopulations can be characterized by specific temporal patterns of scores on the various dimensions. For example, employed, unmarried respondents are above the norm on the work dimension the whole day. Furthermore, female homemakers clearly dominate shopping behaviour in mid-afternoon, while single female workers have the lowest scores on the shopping dimension.

However, analysing the space–time ecological structure in relation to subpopulations does not provide the necessary insight into how individuals influence and anticipate this structure in programming their daily activities. In this study, we expand on the work of Goodchild and colleagues in this direction as we investigate destination choice. Furthermore, whereas Goodchild and colleagues concentrate on one metropolitan area, we have included different types of visitor population environment, ranging from rural areas to large cities, which differ in their space–time ecological characteristics. Finally, recognizing that these characteristics are increasingly determined by the functional relationships between locations, we add to our character-

ization of these types of visitor population environment *network position* as an expression of the intensity and direction of visitor flows between locations.

Our review of empirical studies suggests that certain personal and household attributes might be relevant for exploring the link between destination choice behaviour and the space–time ecological structure of place, such as employment status, educational and income level, household type, and age. A rationale for including these variables can also be found in the few studies that have analysed destination choice for work and non-work activities (Bhat et al., 1998; Pozsgay and Bhat, 2001). Correspondingly, drawing a distinction between travel purposes is important since work, leisure, and shopping show large variations in their expressions in space and time. Since the choice of a destination environment closely interrelates with the decisions an individual makes with regard to participation in activities and their timing, and mode choice (Timmermans et al., 2002), we also take into account these choice dimensions of travel.

3. Research design

The aim of this paper is to describe and explain how individual destination choice behaviour relates to the space–time ecological structure of different types of visitor population environment, thereby taking into account individual and household characteristics. We used the 1998 Netherlands National Travel Survey (NTS), which yields data on the travel behaviour of some 130,000 individuals in a single-day diary format (Statistics Netherlands, 1999). From this dataset, we used a subsample of 217,716 out-of-home activities carried out by 85,596 persons.

Our dependent variable comprises five types of visitor population environment based on certain dimensions that underlie diurnal weekday variations in the presence of visitor populations in Dutch municipalities: a *central-place* type, which includes both local visitors and people who reside in municipalities with lower levels of urbanization; a *contemporary-node* type, which contains a relatively large proportion of visitors who have their homes in more urbanized areas; a *self-contained* type, which comprises people at work, learning, and in recreation locally; a *mobile-children* type, which combines the presence of children active locally with inter-local visitors; a *local-children* type in which young children active in their local environment are overrepresented. The dimensions and the typology have been described extensively in earlier work by the authors (Zandvliet and Dijst, in press-a, in press-b). In the current study, we confine ourselves to providing a brief description of the dimensions and the typology in Section 4.

The explanatory variables include three personal variables (*gender*, *age*, and *educational level*), three household variables (*car ownership*, *household income*, and *household type*), a *workday* variable, a *day-of-the-week* variable, and a *location* variable. The workday variable indicates whether the respondent carried out a working activity on the survey day and the location variable indicates whether an activity was performed inside or outside the residential municipality. Our typology of households is based on the combination of three dimensions: presence of children (<12 yr), employment status, and household size. Our main focus is on examining destination choice; hence, in our analysis we control for other travel-related choices that people make. These include type of activity, mode choice, and time-of-day.

We applied multinomial logistic regression to analyse the joint effect of personal and household attributes on visiting a particular type of visitor population environment. Because visits to destinations were only observed for those people in the sample who actually travel for a given trip purpose by a certain mode during a certain time, the issue of selectivity bias relates to the results of the regression analyses we performed. The selectivity bias stems from the fact that the decision to travel for a trip purpose by a given mode during a certain time is not unrelated to the decision regarding destination. To correct for this bias, we applied Heckman's two-step procedure (Heckman, 1979). First, a *participation model* is used to estimate the probability that someone travels for a trip purpose by a given mode during a certain time period. This likelihood is then transformed and incorporated as the independent variable λ in the *substantial model* for destination visits; λ represents the inverse of the predicted probabilities of travelling for a trip purpose by a given mode during a certain time period. The sets of independent variables in the two models should be sufficiently different to avoid multicollinearity between λ and the independent variables in the substantial model. For this reason, one or more variables used in the participation model were not incorporated in the substantial models.

Following the introduction of our typology of visitor population environments in the next section, in Section 5 (in line with the descriptive analyses carried out by Janelle and colleagues (1998)), we examine the associations between the presence of *population role groups* and the dimensions underlying the ecological structures of urban, suburban, and rural areas in the Netherlands. In Section 6, we describe our application of multinomial logistic regression modelling, which has provided us with insights into the effects of the characteristics of a person pursuing a certain out-of-home activity on the choice of the type of visitor population environment where the activity is performed, given a certain time period and mode choice. For our modelling endeavours, data limitations compelled us to concentrate on car travel. We composed a three-period temporal segmentation for weekdays based on a peak/off-peak differentiation: 6 a.m.–10 a.m., 10 a.m.–4 p.m., and 4 p.m.–8 p.m. The activities considered in the regression analyses include working, shopping, and leisure. In this stage of the analysis we have only used heads of household and partners, if present, since these individuals are the most likely to be in regular employment and carry out most of

the household maintenance tasks, and are thereby most likely to consider the car as a transport alternative.

4. Typology of visitor population environments

In this section we elaborate briefly on the dimensions underlying diurnal weekday variations in the presence of visitor populations in Dutch municipalities and our typology of visitor population environments that we constructed on the basis of these dimensions. The dimensions were retrieved by applying principal factor analysis on the basis of the presence of subpopulations in municipalities during six representative one-hour time periods of the day (8 a.m.–9 a.m., 10 a.m.–11 a.m., 12 a.m.–1 p.m., 2 p.m.–3 p.m., 5 p.m.–6 p.m., and 8 p.m.–9 p.m.). These subpopulations were defined by a selection of categories of individual and household characteristics, activity characteristics, and trip characteristics, and were expressed as a proportion of the total visitor population.

We weighted by activity duration to reflect the 'presence' of each individual within each municipality during each of the one-hour time periods. To aggregate to the total Dutch population, we multiplied the weighted presence of a person by weight factors from the NTS. Subsequently, on the basis of the dimensions identified, we applied a two-step cluster analysis to develop a typology of visitor population environments. Fig. 1 is a map of the Netherlands showing the spatial distribution of the various types.

The first and most important dimension underlying aggregate space–time patterns of visitor populations in the Netherlands is a leisure dimension oriented towards different degrees of participation in leisure activities. Accordingly, two dimensions relate to the size of the territory on which visitor populations operate combined with the use of different transport modes (inter-local and local dimensions), one dimension expresses the direction in which inter-local movement occurs (central place dimension), and three dimensions capture different life stages within the visitor population (children, high-income family, and senior dimensions). The typology of visitor population environments that we composed on the basis of these dimensions thus depends not so much on the (static) spatial characteristics of places—although important linkages

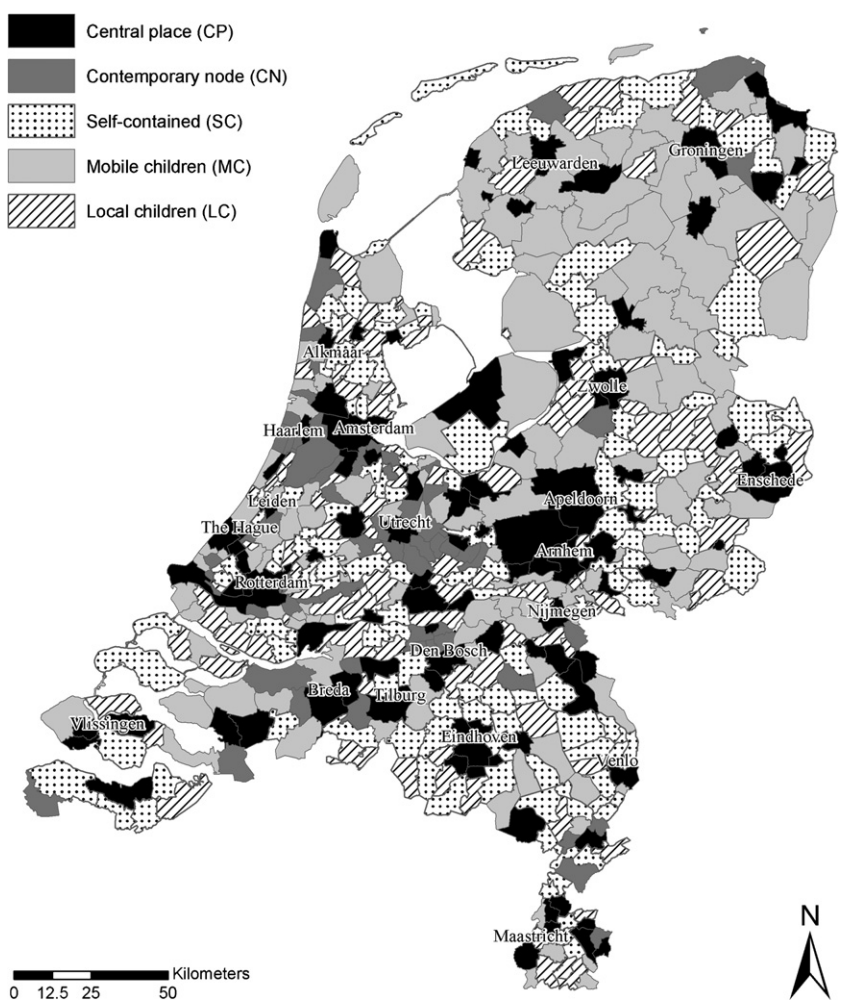

Fig. 1. Typology of visitor population environments in the Netherlands.

certainly exist (see below)—but rather on their changing identities throughout the day.

The first type of visitor population environment is a *central-place* type in which local and inter-local visitor flows come together, with the latter mainly originating from areas with lower levels of urbanization. This type has a strong orientation towards non-leisure activities (work, education) during daytime and a strong orientation towards leisure in the evening. The social structure is highly diversified, including both 'traditional' and 'new' household types such as singles and dual-earners. Many of the larger cities in the Netherlands belong to this type (Fig. 1).

The second type is a *contemporary-node* type, which receives large flows of working visitors from other municipalities, including a relatively large share of visitors from the more urbanized areas. This work-oriented type is a product of the deconcentration of economic land uses (jobs) from the city centres to locations readily accessible by car. Contemporary nodes concentrate at the fringes of large cities in the Netherlands such as Amsterdam and Utrecht (Fig. 1), but are also prevalent in the more peripheral regions. 'New' household types such as single workers and dual-earners determine the space–time socioecological structure.

The third type mainly encompasses work-oriented rural municipalities and is referred to as *self-contained*, since not many people from other municipalities visit these areas. Some self-contained municipalities are old industrial towns or farming communities, while others take up a position within the regional business networks of larger companies residing in cities. The family and senior life-stage dimensions have relatively strong expressions within this type. Large concentrations of this type can be found around Eindhoven, Venlo, and east of Arnhem (Fig. 1).

The fourth type has been termed *mobile-children* as it relates positively to the first life-stage dimension (children) and to local participation in activities during school hours, but also yields reasonably strong associations with the inter-local dimension at several times of the day. Working activities take place, but they are not a distinctive feature. Next to youth, non-family-based household composition (including senior households) is also a distinctive feature of its space–time socioecology. The largest concentration of this type can be found in the (rural) north of the Netherlands, but the mobile-children type is also prevalent in the more urbanized western part of the Netherlands (Fig. 1).

The fifth and final type is termed *local-children* since it combines the presence of (young) children with a focus on the local environment. Compared with the other types, working activities are least apparent in this type. Its ecological character can be described as that of local family life. There is no clear spatial pattern.

The fivefold typology described in this section was used as the dependent variable in the multinomial logistic regression analyses (Section 6). In the next section, we first explain by means of descriptive statistics how the presence of different types of subpopulation links to the dimensions defining the space–time ecological structure of Dutch municipalities.

5. Population role groups and dimensions

In this section, we describe the associations between the dimensions underlying the space–time ecological structure of municipalities and population role groups. A positive association indicates the (relative) presence of a group in locations showing certain ecological characteristics, whereas a negative association indicates the (relative) absence of a group. Unfortunately, because of space restrictions, we can only show a limited number of dimensions: we have chosen the inter-local, children, and high-income family dimensions (Fig. 2). The scores in Fig. 2 express factor scores that have been standardized across space for each time period. Five population role groups have been composed on the basis of some of the explanatory variables also used for the multinomial logistic regression analysis: gender, age, educational level, and household type. Each group has a link with the roles individuals are presumed or expected to fulfil in society on the basis of their sociodemographic characteristics.

The first group ('full-time workers') comprises males aged 30–65 with a medium-to-high or high educational level belonging to two-worker couples or single-worker households. The second group ('part-time workers') captures females aged 30–65 with a low-to-medium or medium-to-high educational level belonging to a family with two working adults. The third group ('housewives') contains females aged 40–65 with a low or low-to-medium educational level belonging to a family with one adult worker. The fourth group ('pensioners') includes people aged 65 or more belonging to a couple or single household with no workers present. The fifth and final group ('schoolchildren') consists of people aged less than 18 with no or a low educational level belonging to a one-worker family.

Fig. 2a shows standardized scores on the inter-local dimension by the time of day for the five role groups distinguished. Group 1 (full-timers) has strong associations with this dimension throughout the entire day. Apparently, visitors from group 1 need to visit other municipalities in order to carry out their daily activities. At the other end of the spectrum are schoolchildren (group 5) and housewives (group 3), since these groups are unable to move to other locations because of capability constraints (schoolchildren) and coupling constraints (housewives). Fig. 2a also shows that pensioners (group 4) are quite mobile, particularly around noon and in the evening.

Group 5 (schoolchildren) and the dimension expressing the prevalence of the first life stage display the expected association (Fig. 2b). The contrast between group 1 (full-timers) and group 5 on this dimension is marked; however, in the morning and evening, and at noon, these groups tend to 'grow' towards each other. In general, the structuring

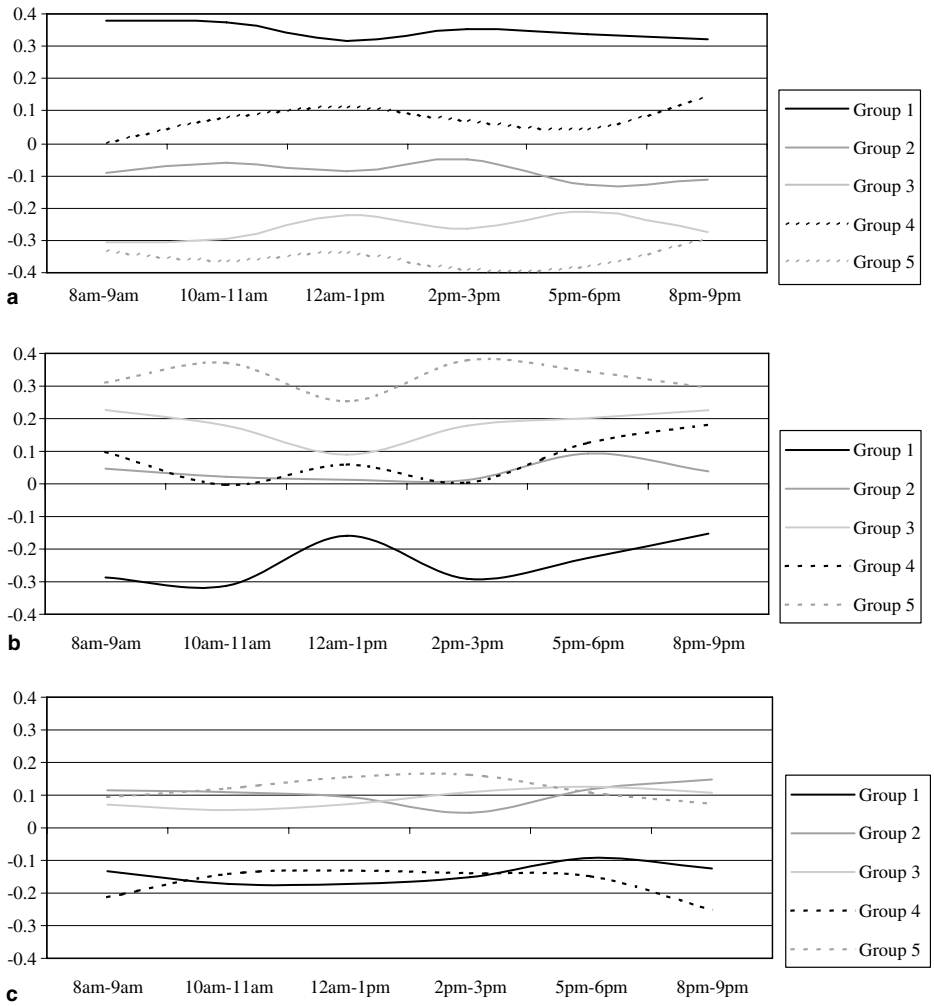

Fig. 2. Association of population role groups with dimensions underlying the ecological structure: (a) inter-local dimension; (b) children dimension; (c) high-income family dimension. Group 1: Males aged 30–65; medium-to-high or high educational level; two-worker couple or single worker. Group 2: Females aged 30–65; low-to-medium or medium-to-high educational level; two-worker family. Group 3: Females aged 40–65; low or low-to-medium educational level; one-worker family. Group 4: People aged 65 or more; single or couple household without workers. Group 5: People aged less than 18; no or low educational level; one-worker family.

effect of the children dimension on the whereabouts of the five groups is relatively low around noon, since the lines lie close together at that particular time. Housewives (group 3) have a positive association with schoolchildren (group 5), particularly in the morning and evening.

Fig. 2c indicates that full-time workers from a single or couple household (group 1) and pensioners (group 4) have negative associations with *familism* throughout the entire day. Presumably, these groups 'avoid' locations where many visitors from family households are active. In contrast, part-timers (group 2), housewives (group 3), and schoolchildren (group 5) have positive associations. Apparently, female part-timers work at locations in which the second life stage (family association) is overrepresented in the space–time ecological structure; that is to say, they work relatively close to their home location, possibly because of household tasks.

All in all, Fig. 2 gives a good impression of how people contribute to or anticipate the space–time ecological structure. On the basis of the three dimensions examined, the sharpest contrast in the use of time and space appears to be between workers from non-family-based households and schoolchildren. Fig. 2 provides a preliminary exploration of how people respond to the space–time ecological structure in choosing their destination environment. However, our focus here is still on groups and separate dimensions. In the next section, using multivariate analysis, we investigate destination choice behaviour in the light of all the dimensions combined into a typology of visitor population environments, thereby taking into account crucial personal and household features and the relationships between these variables.

6. Multivariate analysis for destination environments

In this section, we present the results of a multivariate analysis, in which we analysed the joint effects of personal and household attributes on visiting by car a particular

type of visitor population environment for the purposes of work between 6 p.m. and 10 p.m., shopping between 10 p.m. and 4 p.m., and leisure between 4 p.m. and 8 p.m. For this part of the analysis, we only used heads of household and partners, if present. The results are shown in Tables 1–3. In this section, in addition to presenting our main results, we also say something about possible explanations.

Table 1
Multinomial logistic regression analysis for destination environment for working by car (driver and passenger) between 6 a.m. and 10 a.m. with correction for selectivity bias

	Participation *B*	CP *B*	CN *B*	SC *B*	MC *B*
Gender					
Male (ref)	0.000	0.000	0.000	0.000	0.000
Female	−0.821**	0.142	0.516**	0.003	−0.012
Age					
18 to <30 (ref)	0.000	0.000	0.000	0.000	0.000
30 to <40	−0.267**	0.139	−0.052	−0.164	−0.005
40 to <65	−0.361**	0.287**	0.102	−0.289*	0.026
Education					
Low (ref)	0.000	0.000	0.000	0.000	0.000
Low–medium	−0.023	0.239	−0.102	0.112	0.308
Medium–high	−0.113*	0.437**	0.067	0.020	0.227
High	−0.260**	0.889**	0.320	0.057	0.424*
Car ownership					
No cars (ref)	0.000	0.000	0.000	0.000	0.000
1 car	1.822**	−0.578	−1.007*	−0.455	−0.114
2+ cars	2.218**	−0.834*	−1.373**	−0.515	−0.180
Household income (in Euros)					
<15,500 (ref)	0.000	0.000	0.000	0.000	0.000
15,500 to <26,300	0.058	0.064	0.171	0.218	−0.226
>26,300	0.073	0.412*	0.705**	0.226	−0.106
Household type					
Family, two workers (ref)	0.000	0.000	0.000	0.000	0.000
Family, one worker	−0.281**	0.071	0.301*	0.296*	0.083
Couple, two workers	0.121**	0.076	0.075	0.155	0.127
Couple, one worker	−0.273**	1.221**	1.688**	0.679	1.092*
Single, worker with children	0.666**	−0.220	−0.056	−0.901	−0.068
Single, worker	0.455**	0.583**	0.791**	−0.144	0.606**
Workday					
No (ref)					
Yes					
Weekday					
Monday (ref)	0.000				
Tuesday	−0.085**				
Wednesday	−0.124**				
Thursday	−0.109**				
Friday	−0.258**				
Location of activity					
Outside residence (ref)	0.000				
Inside residence	−1.519**				
Lambda		−0.548**	−1.366**	−0.319*	−0.005
Constant	−2.329**	2.661**	2.569**	1.350*	0.948*
	Nagelkerke $\rho^2 = 0.239$	Nagelkerke $\rho^2 = 0.049$			
	No. cases = 150,520	No. cases = 15,258			
	Dependent variable =1, working by car between 6 a.m. and 10 a.m.; = 0, no working by car between 6 a.m. and 10 a.m.	Dependent variable = Local children (LC) CP = Central place CN = Contemporary node SC = Self-contained MC = Mobile children			

* Significant at $\alpha = 0.05$.
** Significant at $\alpha = 0.01$.

Table 2
Multinomial logistic regression analysis for destination environment for shopping by car (driver and passenger) between 10 a.m. and 4 p.m. with correction for selectivity bias

	Participation *B*	CP *B*	CN *B*	SC *B*	MC *B*
Gender					
Male (ref)	0.000				
Female	0.131**				
Age					
18 to <30 (ref)	0.000				
30 to <40	−0.075				
40 to <65	0.164**				
>65	0.345**				
Education					
Low (ref)	0.000	0.000	0.000	0.000	0.000
Low–medium	0.069	0.097	0.051	0.096	−0.090
Medium–high	0.008	0.292*	0.171	0.142	−0.079
High	−0.121**	0.396**	0.158	−0.182	−0.174
Car ownership					
No cars (ref)	0.000	0.000	0.000	0.000	0.000
1 car	1.940**	−1.813**	−2.318**	−0.125	−0.028
2+ cars	2.240**	−2.299**	−2.492**	0.059	0.000
Household income (in Euros)					
<15,500 (ref)	0.000	0.000	0.000	0.000	0.000
15,500 to <26,300	0.103**	0.127	0.299	0.181	0.162
>26,300	0.173**	0.334*	0.578**	0.446**	0.390**
Household type					
Family, two workers (ref)	0.000	0.000	0.000	0.000	0.000
Family, one worker	−0.167**	0.037	0.175	0.191	0.347**
Family, no worker	0.171	−0.142	0.109	0.045	0.435
Couple, two workers	0.085*	0.292*	0.217	0.022	0.282*
Couple, one worker	−0.086	0.204	−0.265	−0.205	0.068
Couple, no worker	0.240**	0.178	0.449*	0.353	0.521**
Single, worker with children	0.410**	0.276	0.176	1.109*	0.622
Single, worker	0.117	0.989**	1.464**	0.441	0.835**
Single, no worker	0.144*	0.157	0.640*	0.197	0.285
Workday					
No (ref)	0.000	0.000	0.000	0.000	0.000
Yes	−1.594**	1.032**	1.482**	−0.347	−0.168
Weekday					
Monday (ref)	0.000	0.000	0.000	0.000	0.000
Tuesday	0.105**	0.027	−0.043	0.112	0.052
Wednesday	0.188**	−0.284*	−0.265	−0.126	0.024
Thursday	0.142**	−0.124	0.167	−0.015	−0.064
Friday	0.439**	−0.326*	−0.341	−0.083	0.032
Location of activity					
Outside residence (ref)	0.000				
Inside residence	−0.267**				
Lambda		−1.634**	−2.188**	0.357	0.249
Constant	−4.355**	5.850**	5.092**	−0.818	0.007
	Nagelkerke $\rho^2 = 0.119$	Nagelkerke $\rho^2 = 0.040$			
	No. cases = 150,520	No. cases = 10,614			
	Dependent variable = 1, shopping by car between 10 a.m. and 4 p.m.; = 0, no shopping by car between 10 a.m. and 4 p.m.	Dependent variable = Local children (LC) CP = Central place CN = Contemporary node SC = Self-contained MC = Mobile children			

* Significant at $\alpha = 0.05$.
** Significant at $\alpha = 0.01$.

Table 3
Multinomial logistic regression analysis for destination environment for leisure by car (driver and passenger) between 4 p.m. and 8 p.m. with correction for selectivity bias

	Participation *B*	CP *B*	CN *B*	SC *B*	MC *B*
Gender					
Male (ref)	0.000				
Female	−0.013				
Age					
18 to <30 (ref)	0.000	0.000	0.000	0.000	0.000
30 to <40	−0.281**	0.098	0.455*	0.158	−0.151
40 to <65	−0.361**	0.145	0.534**	0.076	−0.059
>65	−0.259**	−0.094	0.341	−0.184	−0.400
Education					
Low (ref)	0.000	0.000	0.000	0.000	0.000
Low–medium	0.052	−0.044	0.076	−0.284	0.011
Medium–high	−0.002	0.214	0.400	−0.194	0.119
High	−0.041	0.602**	0.429	−0.060	0.175
Car ownership					
No cars (ref)	0.000	0.000	0.000	0.000	0.000
1 car	1.204**	0.359	−0.675	0.063	0.524
2+ cars	1.302**	0.261	−0.712	0.241	0.601*
Household income (in Euros)					
<15,500 (ref)	0.000	0.000	0.000	0.000	0.000
15,500 to <26,300	0.075	0.185	0.241	0.161	0.220
>26,300	0.090	0.449**	0.774**	0.200	0.377*
Household type					
Family, two workers (ref)	0.000	0.000	0.000	0.000	0.000
Family, one worker	−0.030	0.279*	0.167	0.270	0.458**
Family, no worker	−0.096	−0.947*	−0.455	−0.027	−0.118
Couple, two workers	0.242**	0.593**	0.630**	0.123	0.457**
Couple, one worker	0.348**	0.292	0.523	0.110	0.229
Couple, no worker	0.287**	0.975**	0.861**	0.557*	0.931**
Single, worker with children	0.411**	0.708	0.247	−0.438	0.859
Single, worker	0.707**	1.014**	0.962**	−0.062	0.834**
Single, no worker	0.435**	1.249**	0.358	0.614	0.897**
Workday					
No (ref)	0.000	0.000	0.000	0.000	0.000
Yes	−0.215**	0.067	0.100	0.250*	−0.049
Weekday					
Monday (ref)	0.000	0.000	0.000	0.000	0.000
Tuesday	0.102**	−0.005	−0.418*	0.127	−0.019
Wednesday	0.085*	0.087	0.112	0.097	0.192
Thursday	0.039	−0.141	−0.043	−0.005	−0.236
Friday	0.026	−0.083	−0.176	−0.077	−0.275*
Location of activity					
Outside residence (ref)	0.000				
Inside residence	−0.638**				
Lambda		1.190**	−0.589	−0.110	1.584**
Constant	−3.732**	−2.378**	−0.008	−0.130	−3.697**
	Nagelkerke $\rho^2 = 0.031$	Nagelkerke $\rho^2 = 0.054$			
	No. cases = 150,520	No. cases = 6908			
	Dependent variable = 1, leisure by car between 4 p.m. and 8 p.m.; = 0, no leisure by car between 4 p.m. and 8 p.m.	Dependent variable = Local children (LC) CP = Central place CN = Contemporary node SC = Self-contained MC = Mobile children			

* Significant at $\alpha = 0.05$.
** Significant at $\alpha = 0.01$.

As reported in Section 3, we corrected our logistic regression analyses for selectivity bias by drawing a distinction between participation models and substantial models. In the tables for the participation models, unstandardized coefficients (B) are given. The multinomial logistic regression models (the substantial models) express the likelihood of a visit to an environment of a particular type relative to visiting an environment of the local-children type. For example, in the first model for contemporary-node environments, the parameter B of 0.516 indicates an increase in the likelihood of women visiting this type of environment relative to local-children environments. Insignificant variables were left out of the discrete choice models to increase the significance of other variables in the models. Nagelkerke ρ^2 indicates the model fit.

As indicated by this pseudo R-square statistic, all three models—with the exception of leisure—explain a fair share of the variation in mode choice during particular time periods, but only a small share of the variation in destination choice. This finding indicates that visits to types of visitor population environment vary unsystematically with personal and household attributes. Presumably, other factors are more important for the explanation of observed differences. The low ρ^2 might also be caused by the fact that our dependent variable contains no less than five categories.

Nevertheless, the estimations offer some interesting insights. Table 1 shows the results for visiting destinations for work purposes during the morning. The use of the private car between 6 p.m. and 10 p.m. is very much reduced for those who work in their residential environment, even when the effects of personal and household attributes are controlled for (the participation model). Gender, age, educational level, and car ownership all have the expected impact on travel to work by car in the morning. The results with regard to educational level are in line with earlier research (Schwanen et al., 2002), which shows that the highly educated in particular travel to work by train rather than private car. In addition, the propensity of single workers to use the private car is higher than for individuals from households with two workers. The time pressure these single workers experience in daily life is capable of explaining this result.

The travel to a certain type of visitor population environment is analysed in the substantial model. The fact that the model coefficient for educational level in the participation model is negative whereas the coefficient in the substantial model is positive indicates that the decision to use a certain mode during a certain time period and destination choice by that mode in that time period are related: the highly educated are disinclined to use the car frequently, because they visit destinations which are relatively easy to reach by other means of transportation than the car.

The results indicate that women are more inclined to visit work places in contemporary-node environments in the morning than local-children environments. Had λ not been included in the analysis, gender would not have had significant coefficients. Thus, when participation is controlled for, women are more likely to choose a contemporary node as a destination, which might indicate a current constraint for women to visit contemporary nodes for work since these nodes are mainly car-oriented environments. People aged between 40 and 65 years visit central-place type environments for work more often than people aged 18–30 do. Presumably, the work opportunities offered in these environments are better suited to more experienced workers. In contrast, young workers are more likely to visit work-based rural or suburban communities. With rising levels of education, the probability that commuters visit local-children environments decreases. The results also suggest that jobs for the more highly educated are mostly available in central-place environments. With regard to income, we see that, particularly in the contemporary nodes, the likelihood of visiting destinations in the morning increases with income level, which illustrates that this type of environment offers better-paid jobs than local-children environments. The results for household type indicate that workers from non-family-based households are more likely to visit central-place, contemporary-node, and mobile-children environments.

Table 2 shows the results for travelling by car for shopping between 10 p.m. and 4 p.m. The use of the car for shopping as either a driver or a passenger is relatively heavy for women, increases with age, car ownership, and income level and decreases with educational level (the participation model). Single workers with children are most likely to engage in shopping activities by car, possibly because of the time pressure these individuals experience in daily life. These visits for shopping are mostly carried out on non-working days; especially on Fridays. The use of the private car is reduced for destinations located in the residential environment.

In the substantial model, neither gender nor age have a significant impact on visiting shopping destinations in this period and have therefore been omitted. The inclination to visit shops in central places increases with rising levels of education and income. These results indicate that the supply of high-level products in these shopping centres attracts the more highly educated. As for working between 6 p.m. and 10 p.m., the likelihood of contemporary nodes being chosen as a shopping destination is relatively sensitive to increasing income levels.

As the negative signs for car ownership indicate, the probability of visiting shops located in central places and contemporary nodes is strongly reduced for visitors from households owning a car. This is a result of Dutch retail planning which has severely curtailed the development of shopping centres on greenfield sites at the edges of cities (Evers, 2002). Severe parking problems in most central places limit the use of the car to visit these shopping destinations. Presumably, there is a strong bias in having a car available in the household and choosing a destination for shopping between 10 p.m. and 4 p.m. The likelihood of visiting shops in local-children environments increases with

household size and the presence of children. Mobile-children environments are attractive as shopping destinations for both family-based households and singles. On working days, shopping visits are most likely to occur in central places and contemporary nodes, possibly on the way home from work or at lunchtime.

The results for leisure visits by car are shown in Table 3. With increasing car ownership, and decreasing age and household size, the propensity to use the private car for leisure visits between 4 p.m. and 8 p.m. increases. The likelihood of these visits is higher on non-working days, particularly on Tuesdays. The car is mostly used for leisure visits to destinations outside the residential environment.

The substantial model shows that the middle-aged are more likely to visit contemporary nodes for leisure. A lack of leisure facilities aiming at younger people in these environments may explain this result. Also, since contemporary nodes are mainly accessible by car, younger people might be unable to visit them. People with a high educational level are more likely to visit central places for leisure. The concentration of cultural activities and events in these areas probably makes them more attractive for the highly educated. For leisure, local-children type environments tend to be avoided by people on high incomes; they mainly visit the contemporary nodes. The results for household type are more difficult to interpret, but obviously central places and mobile-children type environments are attractive for leisure to a wide variety of household types. Single households focus mostly on the type of leisure facility offered in central places, which offer them many opportunities to meet other people. The coefficients for workday and day of the week show only a few significant values, but these are nevertheless significant according to the likelihood ratio test.

To correct for selectivity bias, we included the variable λ in the substantial models; λ has proved to be highly significant for working and shopping in central places and contemporary nodes, and for leisure in central places and mobile-children environments. The coefficients are negative for commuting and shopping by car in central places and particularly the contemporary nodes, indicating that people with a low chance of engaging in these trip purposes by car between 6 p.m. and 10 p.m. and 10 p.m. and 4 p.m. respectively are less likely to visit these environments. Although not shown here, λ is positive and significant for shopping by car between 4 p.m. and 8 p.m. in central places, which means that at this time people with a low chance of using the car for shopping are in fact more likely to visit these environments for that purpose. For leisure visits, λ is positive for central-place and mobile-children environments, implying that people with a low probability of using a car for leisure activities between 4 p.m. and 8 p.m. would have chosen those environments. That λ is significant in most cases shows the prevalence of selectivity bias and justifies our inclusion of this variable. That λ has different signs during different times of the day indicates the time-dependency of selectivity bias and supports the time-specific analysis that we have carried out.

7. Discussion and conclusion

In this study, the aim was to examine how individual destination choice relates to the space–time ecological structure of urban, suburban, and rural municipalities in the Netherlands, taking into account individual and household characteristics. For that purpose, we employed a typology of visitor population environments. The analysis has shown that individuals significantly anticipate or are affected by the space–time ecological character of destination environments; that is, different types of visitor population environment attract different kinds of visitor at different times of the day.

We have analysed the joint effects of personal and household attributes on visiting by car destination environments with particular space–time ecological characteristics for work, shopping, and leisure. The results show that the knowledge-intensity, diversity, and cultural richness of *central places* mainly attracts the highly educated, high income, and non-family-based households; not only for working, but also for shopping and leisure. As the emerging pillars of the economy, *contemporary nodes* are even more attractive to people with high incomes for working, shopping, and leisure than are central places. Also, contemporary nodes seem to be biased as a destination environment towards people with a high chance of using the car. In contrast, the relative peace and tranquillity of *self-contained*, *mobile-children*, and *local-children* environments clearly appeals more to visitors from family-based households.

Insight into how individuals with their activity and travel behaviour co-determine and anticipate diurnal variations in the ecological structure of cities, suburbs, and rural communities could be of great value in designing more effective and efficient policies for providing commercial and non-commercial (transportation) services. Moreover, examining the effects of personal and household attributes on visiting destination environments facilitates the modelling of the impact of changes in the sociodemographic or economic structure on the demands placed upon, for example, road networks, public transportation services, and shopping facilities. One may think in this respect of the rapid increase in the number of senior citizens and households with only working-age adults. Considering the 'economic growth potential' of the contemporary nodes and their current attraction for car users, a sustainability-oriented policy should concentrate on enhancing the accessibility of these environments by public transport. In more general terms, this study echoes the plea of Musterd and Van Zelm (2001) to acknowledge the special local identities of places when developing new environments. In doing so, policymakers should be aware that individuals' preferred identities of destination environments might differ markedly from those of residential environments.

Because of the limitations of the data, this paper should be perceived as a first exploration into the relationship between individual behaviour and aggregate space–time human ecological structures. To conclude, we put forward

some directions for further research to develop a more complete understanding of this relationship. First, although we took into account different space–time ecological characteristics in urban, suburban, and rural contexts, we concentrated on differences at the municipal level. However, place identity does not allow itself to be captured by administrative boundaries. The study of space–time human ecology could benefit from GPS-based activity-travel data to provide insight into how, where, and when places form and dissolve as a construct of human interaction. Second, because this analysis was concentrated on weekday patterns, a future research design should be concerned with weekends, so that comparisons can be made. Third, future research should analyse datasets from years other than 1998, so that the effects of variations in space–time behaviour in time could be identified. Finally, the Netherlands was the focal point of this analysis. It would be interesting to put the results in an international perspective in order to determine the effects of cultural, institutional, and spatial variations on space–time behaviour.

Acknowledgement

This research was sponsored by the Dutch National Science Foundation (NWO), grant 490-24-006 to the Urban and Regional research centre Utrecht (URU), Utrecht University.

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