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Car drivers' knowledge and preferences regarding additional services at parking facilities

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Abstract

The paper presents a study on car drivers' knowledge and preferences regarding additional services at parking facilities. The following eight services are investigated the presence of public toilets, parking spaces for challenged people, lockers, refreshment machines, elevators, charging points for electric vehicles, a free newspaper service, and AED-equipment. The data were collected about the city of 's-Hertogenbosch using an online questionnaire. In total, 435 car drivers completed the questionnaire. Car drivers know the absence/presence of lockers, a free newspaper service, and AED-equipment best. The services they prefer most are restrooms, parking facilities for disabled people, charging points for electric cars, and AED-equipment. The relationship between car drivers' preference and personal and visit characteristics is analyzed using binary logistic regression analysis. A significant relationship is found for the characteristics age, education, visiting day, visit motif, visit party, and visit frequency.

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Keywords: Knowledge, Preferences, Services; Parking facilities

1. Introduction

The average occupancy rates of parking facilities in city centers are decreasing due to various reasons such as financial crisis and local transport policies. Together with the Erasmus University of Rotterdam, Ebbing [1] of Spark Parking Consultancy investigated the occupancy of parking facilities in 19 cities in the Netherlands. It appeared that in the period 2008-2012 the average number of sold parking hours decreased with approximately 10 percent (see

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Figure 1). This decrease influences the profitability of parking facilities negatively. Parking companies compete for business with each other and with publicly operated curbside parking spaces [2]. To attract car drivers to their parking facilities, parking companies continuously look for additional services that can be provided in the parking facility. The main question in this context is what additional services are preferred by car drivers.

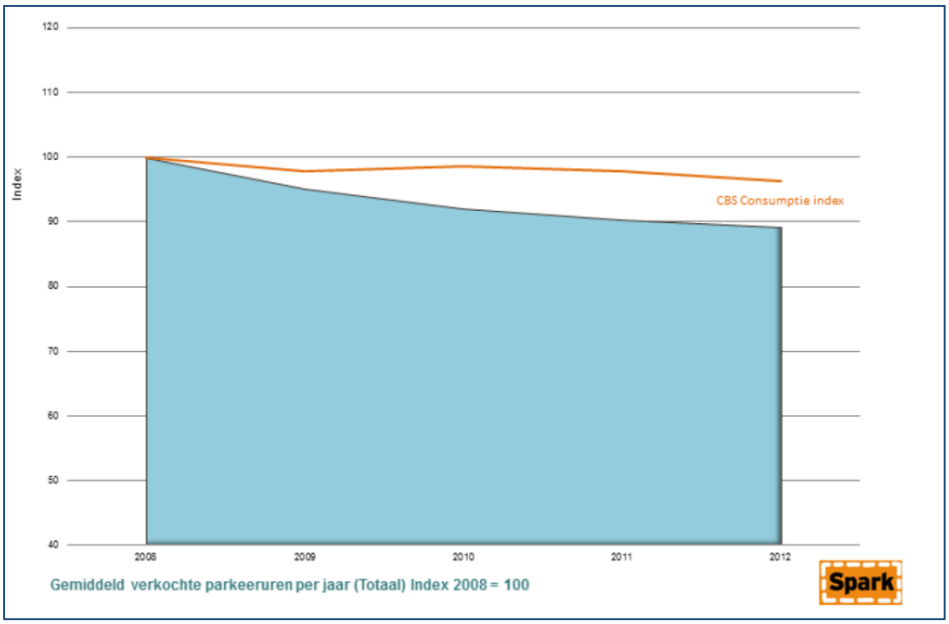

Fig. 1. Average sold parking hours between 2008 and 2012 [1]

Fig. 2. Examples of services in parking garages

In the past, the focus of parking managers was mainly on infrastructural and technical aspects of parking facilities [e.g., 3]. With improvement of entrances, floors, signing, painting, etc. they wanted to attract car drivers to their parking facility. In addition to these aspects, parking companies started to offer extra services such as vending machines, charging points for electric vehicles, and AED equipment (Figure 2). Insights into car drivers' knowledge and preferences regarding this type of services are still limited [e.g., 4, 5].

The aim of this study is to provide more insight into the car drivers' knowledge and preferences regarding additional services in parking garages and at parking lots. The study is part of an extensive study regarding car drivers' preferences regarding parking facilities in the city of 's-Hertogenbosch, the Netherlands. The remainder of the paper is organized as follows. First, some basic insights into parking choice and relevant parking attributes are provided. Next, the adopted research approach is outlined. This section is followed by some details of the data collection. In the following section the analyses are presented. The analyses are subdivided into two parts: descriptive analyses with a focus on knowledge and preferences, and model analyses with a focus on the relationship between preferences and characteristics of the car drivers. The paper ends with the conclusions and recommendations.

2. Parking choice

Car drivers base their choice of a parking facility on various characteristics of all available on- and off-street parking facilities. In the past, various studies have been done regarding car drivers' parking location choices. Two main approaches can be noticed in this context: focus on type of location (on-street, off-street, illegal) and focus on individual parking facilities (each at different location). In almost all studies various parking (tariff, walking distance, etc.), personal (age, gender, etc.), and trip (motif, duration, etc.) related attributes are included. As could be expected, in previous studies a lot of attention has been paid to parking cost and time related attributes. Golias et al. [6] concluded that parking cost has the most important impact on parking choice followed by time related attributes i.e., search time for a parking, duration of parking, and walking time between parking space and final destination. The findings did not depend on driver and trip characteristics. More recently, Ibeas et al. [7] investigated the influence of access time to parking, access time to destination, and parking fee on car drivers' parking type choice. They found that the parking fee is the most important attribute and that the weights placed on the attribute varied across individuals. In the context of tourist travel, Ma et al. [8] concluded that car drivers are more sensitive to walk time between parking and final destination than to the price. Zong & Wang [9] found that trip purpose and number of passengers are more important than parking costs when looking at where car drivers want to park. Parking costs are more important when deciding how long to stay.

However, it appears that the possibilities of parking companies to distinguish themselves from each other are limited. In many cases, municipalities determine the locations of parking facilities (including walking distances), and set the parking tariff regime. Within these restrictions, parking companies have to set up their policy regarding services they want to offer to attract potential customers. Insights into what services have to be provided are still limited.

3. Research approach

To get insight into car drivers' knowledge and preferences regarding additional services at parking facilities, the following research approach is adopted. Based on literature and experts' experiences (including parking facility evaluation lists of professional organizations, e.g. ESPA-checklist of the European Parking Association), a list is composed with interesting services. Eight services are included in the study and investigated in more detail (Figure 3). Investigated services are the presence of public restrooms, parking spaces for disabled people, lockers, refreshment machines, elevators, charging points for electric vehicles, free newspapers service, and AED-equipment. For each service two questions are asked to the car drivers: (i) *Is a special service present at the parking that you have chosen?* and (ii) *Do you prefer a specific service to be provided in that parking?* The questions are included in an extensive online questionnaire covering various aspects of visitors' parking behaviour and some personal characteristics.

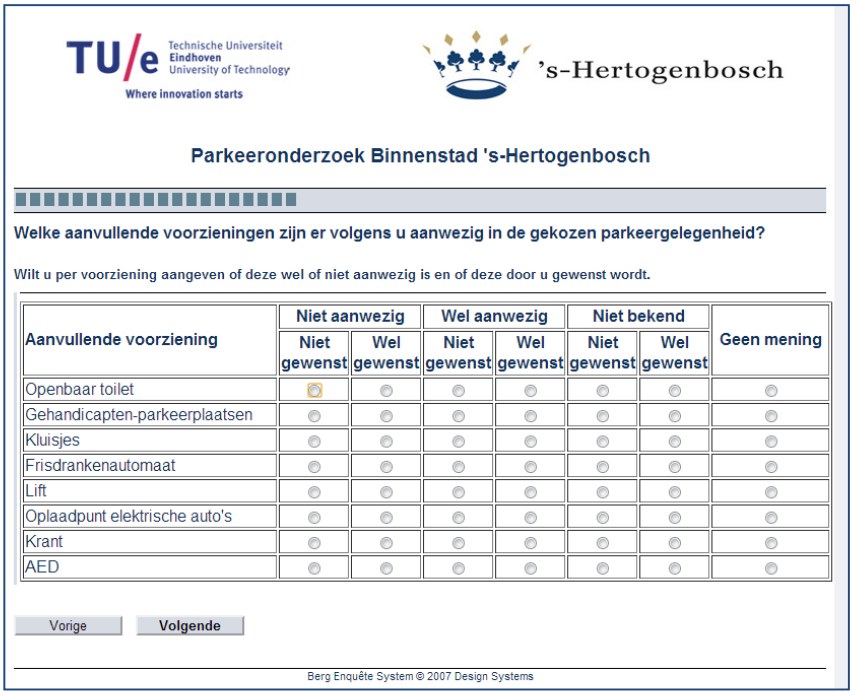

Fig. 3. Part of the online questionnaire

4. Data collection and preparation

The study is set up in the centre of 's-Hertogenbosch, the Netherlands. The city of 's-Hertogenbosch is the capital of the province Noord-Brabant and resides approximately 145,000 inhabitants. The historical city centre includes approximately 500 stores and 250 bars and restaurants. The city centre is surrounded by 6 parking garages and 1 parking lot (Figure 4, blue). In addition, at some distance from the centre there are three Park & Ride facilities available to transfer from car to use public transport (Figure 4, red).

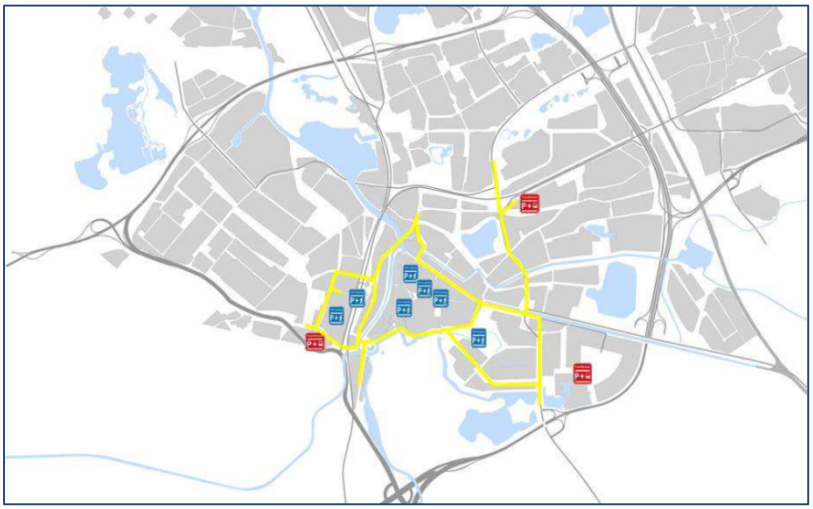

Fig. 4. Parking facilities in the city of 's-Hertogenbosch

The actual situation in the parking garages is collected using the websites of the municipality, parking information organization, and a private company that manages some parking facilities. This website provides information regarding location, number of spaces, opening hours, tariff structure, payment policy, and presence of special parking spaces and available facilities (Figure 5).

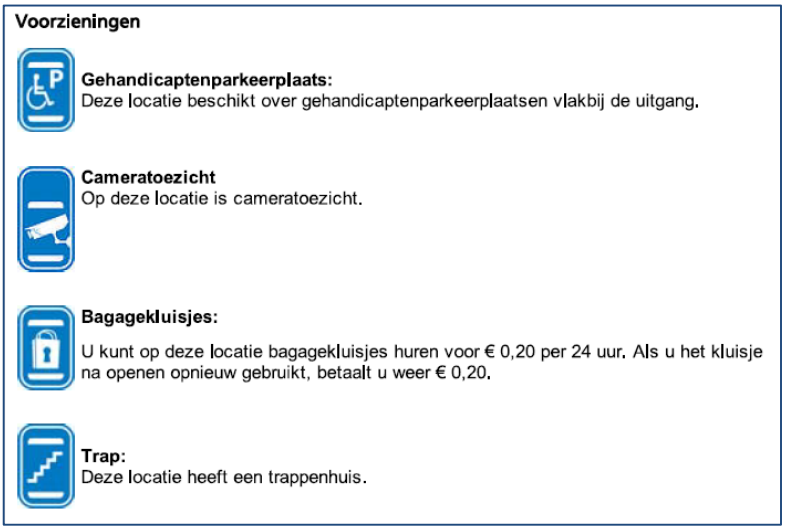

Fig. 5. Available facilities in parking garage 'Sint Josephstraat'

Figure 6 shows an overview of available services (indicated with '1') per parking facility as provided by the consulted websites. As can be seen, five parking facilities offer a public toilet, only one parking facility offers lockers, and none of the parking facilities offers a free newspaper service.

	A	B	C	D	E	F	G	H	I	J
1	**Parking Facility**	**Restrooms**	**Disabled**	**Lockers**	**Refreshments**	**Elevator**	**E_charge**	**Newspaper**	**AED**	**Spaces**
2	Parking garage Wolvenhoek	0	1	0	0	0	0	0	0	467
3	Parking garage Stationsplein	1	1	0	0	1	0	0	0	161
4	Parking garage Paleiskwartier	1	1	0	0	1	1	0	0	1059
5	Parking garage Sint Josephstraat	0	1	1	0	0	0	0	0	175
6	Parking garage Tolbrug	0	0	0	1	1	0	0	0	324
7	Parking garage Arena	0	0	0	1	1	1	0	1	475
8	Parking lot Bernardsstraat	0	0	0	0	0	0	0	0	60
9	Transfer parking Willemspoort	1	0	0	1	0	1	0	0	500
10	Transfer parking De Vliert	1	1	0	0	0	1	0	0	450
11	Transfer parking Pettelaarpark	1	1	0	0	0	1	0	0	341
12	P+R Maijweg	0	0	0	0	0	0	0	0	370
13										4382

Fig. 6. Overview of available services per parking facility

Approximately 8000 invitation cards for the online questionnaire were distributed at the various parking facilities in the spring of 2013. In total, 502 car drivers filled out the questionnaire. The data of 435 car drivers could be used for the analyses. Some details of the respondents are presented in Table 1. It appears that the sample is not representative for the Dutch population. The sample includes more males, older respondents, and higher educated respondents than could be expected for the Netherlands. The number of observations per characteristic level is enough to be included in the suggested analyses.

Table 1. Personal and visiting characteristics of the respondents

Characteristic	*Levels*	*Frequencies*	*Percentages*	*Coding**
Gender	Female	179	41.1	-1
	Male	256	58.9	+1
Age	Younger than 55 years	246	54.6	-1
	Older than 55 years	189	43.4	+1
Education	Medium	152	35.0	-1
	High	283	65.1	+1
Home location	's-Hertogenbosch region	209	48.0	-1
	Other	226	52.0	+1
Visiting day	Thursday	273	62.8	-1
	Saturday	162	37.2	+1
Visit frequency	Once per month or more	274	63.0	-1
	Less than once per month	161	37.0	+1
Visit duration	3 hours or less	190	43.7	-1
	More than 3 hours	245	56.3	+1
Visiting motif	Shopping	213	49.0	-1
	Other	222	51.0	+1
Travel party	1 person	229	52.6	-1
	More than 1 person	206	47.4	+1
Total		435	100.0	

* Coding for the model analysis

5. Car drivers' knowledge

The first question of this paper concerns the car drivers' knowledge of the absence/presence of services at the parking facility they used. Because of the limited number of observations for some parking facilities, it was not possible to detail the analyses per parking facility. The overall results are presented in Figure 7. The percentages represent the number of car drivers who know the absence or presence of a service correctly divided by the total number of car drivers included in the study. The figure shows that the percentage of car drivers who indicate the absence/presence of services correctly ranges between approximately 57 (absence/presence of parking space for disabled people) and 98 (absence/presence of lockers). Car drivers are also aware of the absence of a free newspaper service (95 percent) and AED equipment.

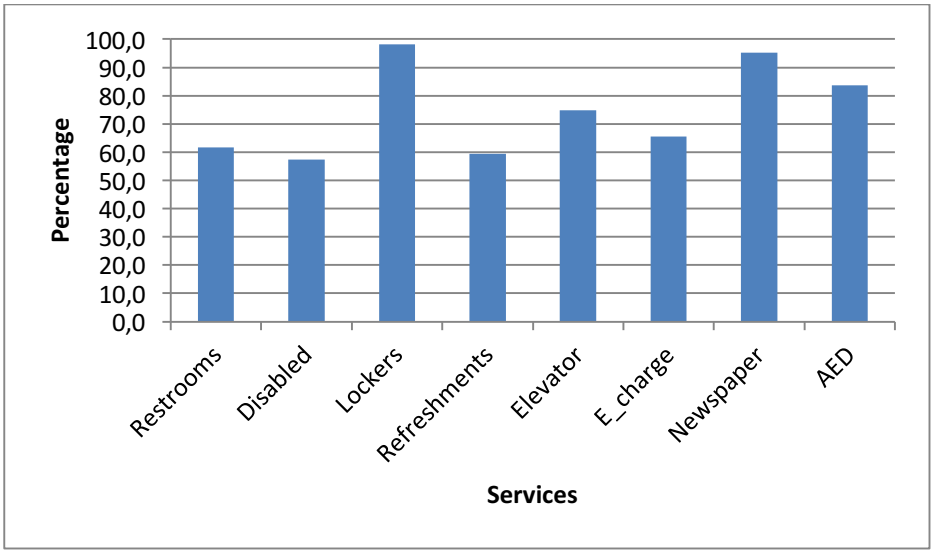

Fig. 7. Percentage of car drivers' knowing the absence/presence of services correctly

In addition to the overall scores, it is interesting to look at the separate scores in the case that a service is absent and a service is present (Figure 8). The percentages show that car drivers are more aware of the absence of services, than they are aware of the presence of services. For example, 80 percent of the car drivers know when there are no restrooms at the parking facility, while 40 percent knows when there is a restroom available.

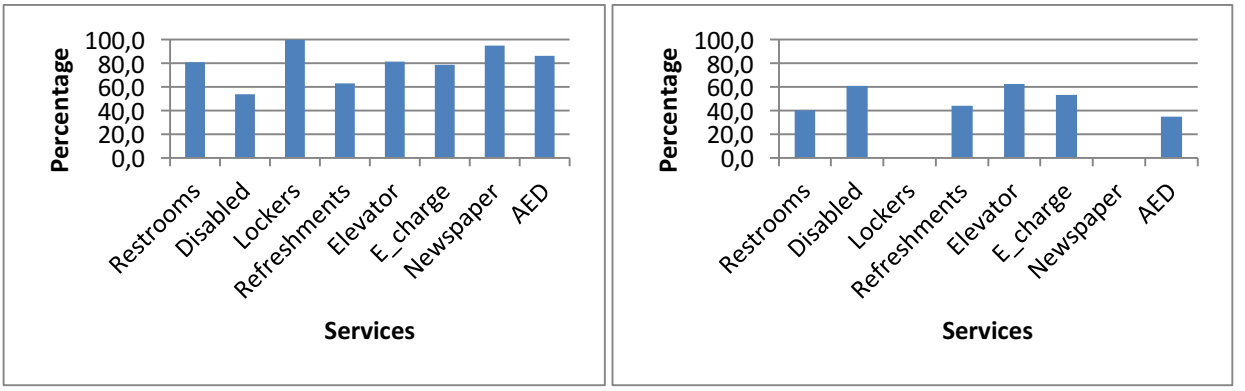

Fig. 8. Car drivers' knowledge separated in absence (left) and presence (right)

6. Car drivers' preferences

The second question of this study deals with the car drivers' preferences regarding availability of services. Figure 9 shows the percentages of car drivers who prefer certain services. For example, approximately 55 percent of the car drivers prefer a public toilet in a parking facility. The Figure shows that parking spaces for disabled people, a public restroom, and a charging point for electric vehicles are most preferred.

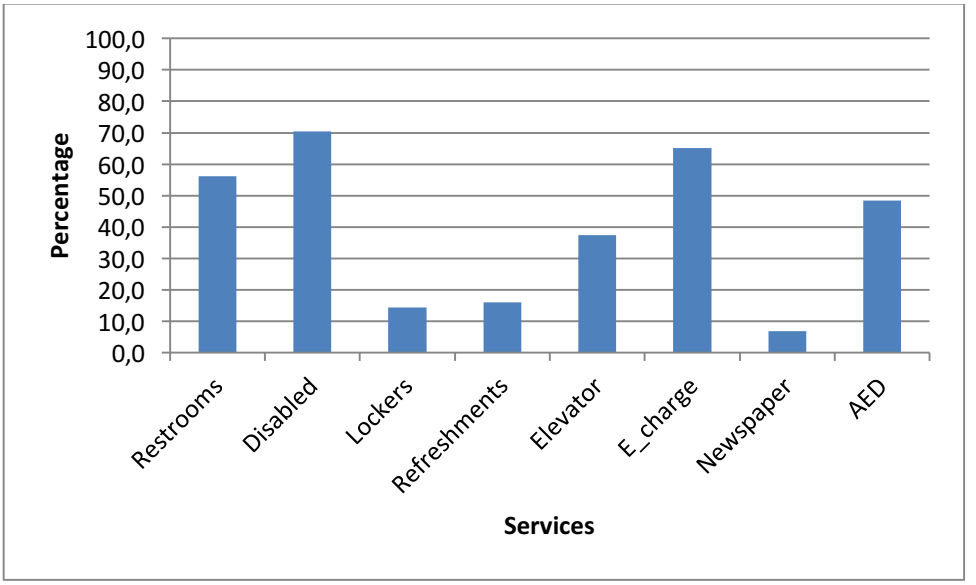

Fig. 9. Car drivers' preferences regarding parking facility services

To look in more detail at the preferences of car drivers, a binary logistic regression analysis is used as included in the statistical package SPSS (IBM Corporation, 2013). In this analysis, the preferences are related to the personal and visit characteristics of the car drivers. With binary regression, the probability of Y occurring given known values of independent X's is predicted [10]. The logistic regression equation from which the probability of Y in the case of two categories is predicted is shown below.

$$P(Y) = \frac{1}{1 + e^{-(b_0 + b_1 X_{1i} + b_2 X_{2i} + \ldots + b_n X_{mi})}} \quad (1)$$

Where,

P(Y) is the probability of Y occurring;
e is the base of natural logarithms;
X_{1i} is first predictor variable of answers category *i*;
b_i is a coefficient or weight of a predictor variable.

The significant estimation results of the binary logistic regression analyses are presented in Table 2. For each service, one model is estimated. Based on the values of the constants, the following can be concluded. In advance, car drivers prefer the following services: restrooms, parking spaces for disabled people, and charging points for electric cars. Car drivers do not prefer lockers, refreshment machines, elevators, or a free newspaper service. Most of these effects are expected, except the one for presence of elevators. It might be that car drivers feel uncomfortable when using elevators in parking garages or think elevators are not necessary in multi-storey parking garages. In addition, it appears that only a few characteristics are significantly influencing the car drivers' preferences. The negative sign of the characteristic 'education' shows that car drivers with a higher educational level do not prefer the presence of restrooms and refreshment machines. The positive sign of 'age' shows that older car drivers prefer the presence of restrooms, parking spaces for disabled people, and lockers.

Table 2. Estimation results binary regression analyses (significant only, p<0.05)

		Services							
Character	Level	Restroom	Disabled	Lockers	Refresh	Elevator	E-charge	Newspaper	AED
Gender	Male	-	-	-	-	-	-	-	-
Education	High	-0.221	-	-	-0.291	-	-	-	-
Home	Other	-	-	-	-	-	-	-	-
Age	> 55 yrs	0.325	0.223	0.338	-	-	-	-	-
Day	Saturday	-	-	-	-	-0.490	-	-0.562	-
Duration	> 3 hours	-	-	-	-	-	-	-	-
Motif	Other	-	-	-	-	-	-0.277	-	0.314
Party	> 1 pers	-	-	-	-	-	-0.267	-	-
Frequency	< 1/mth	-	-	-0.308	-	-	-	-0.663	-
Constant		0.388	1.005	-1.955	-1.686	-0.583	0.663	-3.177	-
Model fit		61.1%	70.3%	85.5%	83.9%	63.7%	65.7%	93.1%	60.7%

7. Conclusions

The study's goal was to provide some insights into car drivers' knowledge and preferences regarding additional services provided at parking facilities. It appears that for all investigated services the knowledge level is above 50 percent. This means that more than 50 percent of the car drivers know that a specific service is absent or present. The highest knowledge level is observed for the absence/presence of lockers, a free newspaper service, and AED-equipment. These services are mostly absent. When looking at services that are present at a parking facility, it appears that car drivers know the presence of restrooms and elevators the best. Car drivers prefer the services restrooms, parking facilities for disabled people, charging points for electric cars, and AED-equipment the most.

The preferences are significantly related to by the personal characteristics age and education. Also, some visit characteristics are related to the car drivers' preferences: visiting day, visit motif, visit party, and visit frequency.

The results of this study can be used by parking companies to optimize the services of their parking facilities. When optimizing their services, the companies have to take notice of the characteristics of the users and their visiting behaviour. To increase the insights into car drivers' knowledge and preferences, more data per (type of) parking facility is needed. Additionally some other services can be investigated in the near future such as CCTV, payment options and points, and mobile phone coverage.

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