

Door-to-door service or fare?

Analyzing travelers' choice for ridepooling services
with the help of Conjoint Analysis

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Knowledge for Tomorrow



The urban transport system is changing!



flexibilization

personalization

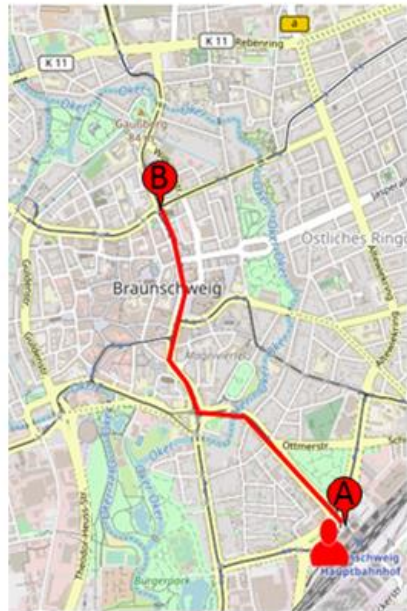
digitalization

References: [1-10]

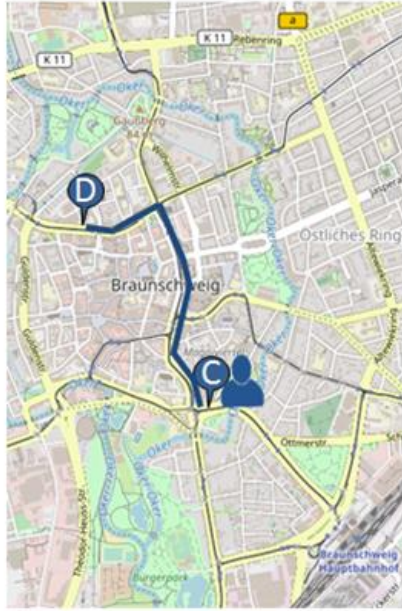


Ridehailing, Ridesharing, Ridepooling?

Ride request of traveler 1



Ride request of traveler 2



Matched ride requests



Ridepooling

- Demand-responsive transport based on matching of rides
- Pooling algorithm determines route
- p.e. *Via, Kutsuplus*



The benefits of ridepooling

Alonso-Mora et al. (2017):

- 2,000 ridepooling vehicles (15% of nowadays Manhattan's taxi fleet) with capacity of 10 passengers can serve 98% of the demand within a mean waiting time of under 3 min

International Transport Forum (2015):

Table 6. Summary of main indicators with the variation of the presence of private cars

Aggregate Indicators	0% private cars	20% private cars	40% private cars	60% private cars
Active fleet size (Sh. Taxis + priv. cars)	2.80%	2.6% + (20%)	2.4% + (40%)	2.2% + (60%)
Prices rel. to current (Sh Taxi / Taxi-Bus)	26% / 39%	28% / 41%	30% / 42%	33% / 45%
VKM (weighted) peak-hour	63%	75%	87%	98%
CO2 emissions	66%	75%	86%	97%
% parking space released	97%	77%	58%	38%

Source: ITF - International Transport Forum (2015), p. 50



Research questions

Which service characteristics affect the **travellers' perception of attractiveness** of a ridepooling system?

- Recurring factors that affect bus service quality from the passengers' perspective like reliability and frequency (Jianrong, Wei & Bing, 2011: De

Which service characteristics are **most important to the users**: short walking distances to pick-up point or fare?

ease and speed of booking, easy access, accessibility of information (Ambrosino, Nelson & Romanazzo, 2003) are based on phone-booking services in rural areas and thus are less flexible and dynamic

How do **sociodemographic characteristics** affect appraisal of the ridepooling's service characteristics?



Methods

Choice-based Conjoint Analysis

- Conjoint Analysis is a stated preference method to examine the importance of product characteristics based on the decomposition of the overall utility to part-worths
- Relevant attributes and levels were elicited through a qualitative process based on a literature review and a focus group

Attributes	Levels			
	<i>Level 1</i>	<i>Level 2</i>	<i>Level 3</i>	<i>Level 4</i>
Time of booking	5 min	10 min	30 min	
Walking distance	0 m	300 m	500 m	
Shift of departure	+ 0 min	+ 10 min	+ 20 min	
Travel time	10 min	20 min	30 min	
Information provision	none	few	many	
Fare	2.50 €	3.00 €	3.50 €	4.00 €



Methods

Choice sets and scenarios

- Creation of 24 choice sets based on orthogonal design
- Scenario of 5 km ride to the city center

Alternative 1	Alternative 2	
Walking distance: 300m Fare: 2,50€ Shift of departure: +20min Travel time: 10 min Information: many Time of booking: 30 min	Walking distance: 0m Fare: 3,50€ Shift of departure: +0min Travel time: 20 min Information: many Time of booking: 30 min	None of these
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Example of a choice set

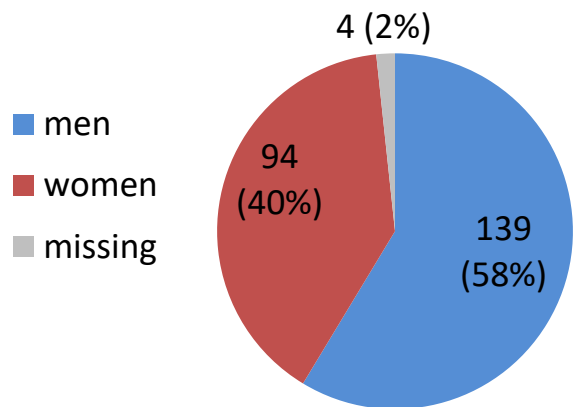


Methods

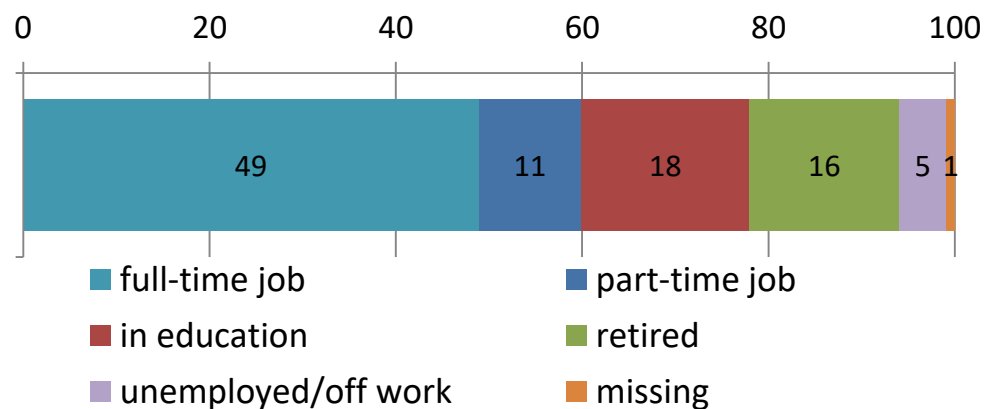
Sample description

- Original dataset with $N = 521$
- Target group: adult city dwellers ($N = 237$) living in cities > 100.000 inhabitants
- Mean age of 43.5 years ($SD = 16.5$ years)

Gender



Employment status



Results

Analysis of part-worth utilities

1) Estimating part-worths

- Data analysis with Cox-regression in SPSS (Backhaus, Erichson & Weiber, 2015)

$$U_{nsj}$$

$$= ASC + \beta \text{Fare} + \beta \text{Walking distance} + \beta \text{Time of Booking} + \beta \text{Shift of departure} + \beta \text{Travel time} + \beta \text{Information} + e_{nsj}$$

Attribute	Attribute level	Regression coefficient	p-value
Fare	Fare_2.50€	1.581	.000
	Fare_3.00€	0.979	.000
	Fare_3.50€	0.651	.000
	Fare_4.00€	0.000	
Walking distance	Walking distance_0m	1.114	.000
	Walking distance_300m	0.700	.000
	Walking distance_500m	0.000	
Time of booking	Time of booking_5min	0.069	.294*
	Time of booking_10min	0.078	.164*
	Time of booking_30min	0.000	
Shift of departure	Shift of departure_+0min	1.022	.000
	Shift of departure_+10min	0.078	.000
	Shift of departure_+20min	0.000	
Travel time	Travel time_10min	1.151	.000
	Travel time_20min	0.604	.000
	Travel time_30min	0.000	
Information	Information_none	-0.925	.000
	Information_few	-0.402	.000
	Information_many	0.000	
	None-of-these	-1.645	.000

* Not significant



Results

Analyzing probabilities of choice

Alternative 1	Alternative 2	None of these
Walking distance: 300m Fare: 2,50€ Shift of departure: +20min Travel time: 10 min Information: many Time of booking: 30 min	Walking distance: 0m Fare: 3,50€ Shift of departure: +0min Travel time: 20 min Information: many Time of booking: 30 min	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

<35 Jahre $\text{prob}(1|2,3) = 59,0\%$

$\text{prob}(2|1,3) = 40,6\%$

$\text{prob}(3|1,2) = 0,3\%$

>60 Jahre $\text{prob}(1|2,3) = 35,8\%$

$\text{prob}(2|1,3) = 63,8\%$

$\text{prob}(3|1,2) = 0,4\%$



Results

Analysis of part-worth utilities

1) Estimating part-worths

- Data analysis with Cox-regression in SPSS (Backhaus, Erichson & Weiber, 2015)

$$\begin{aligned}
 U_{nsj} &= ASC + \beta \text{Fare} + \beta \text{Walking distance} \\
 &+ \beta \text{Time of Booking} + \beta \text{Shift of departure} \\
 &+ \beta \text{Travel time} + \beta \text{Information} + e_{nsj}
 \end{aligned}$$

2) Determining attribute importance

- Importance represented by range of levels divided by sum of ranges across attributes (Hair et al., 2010)

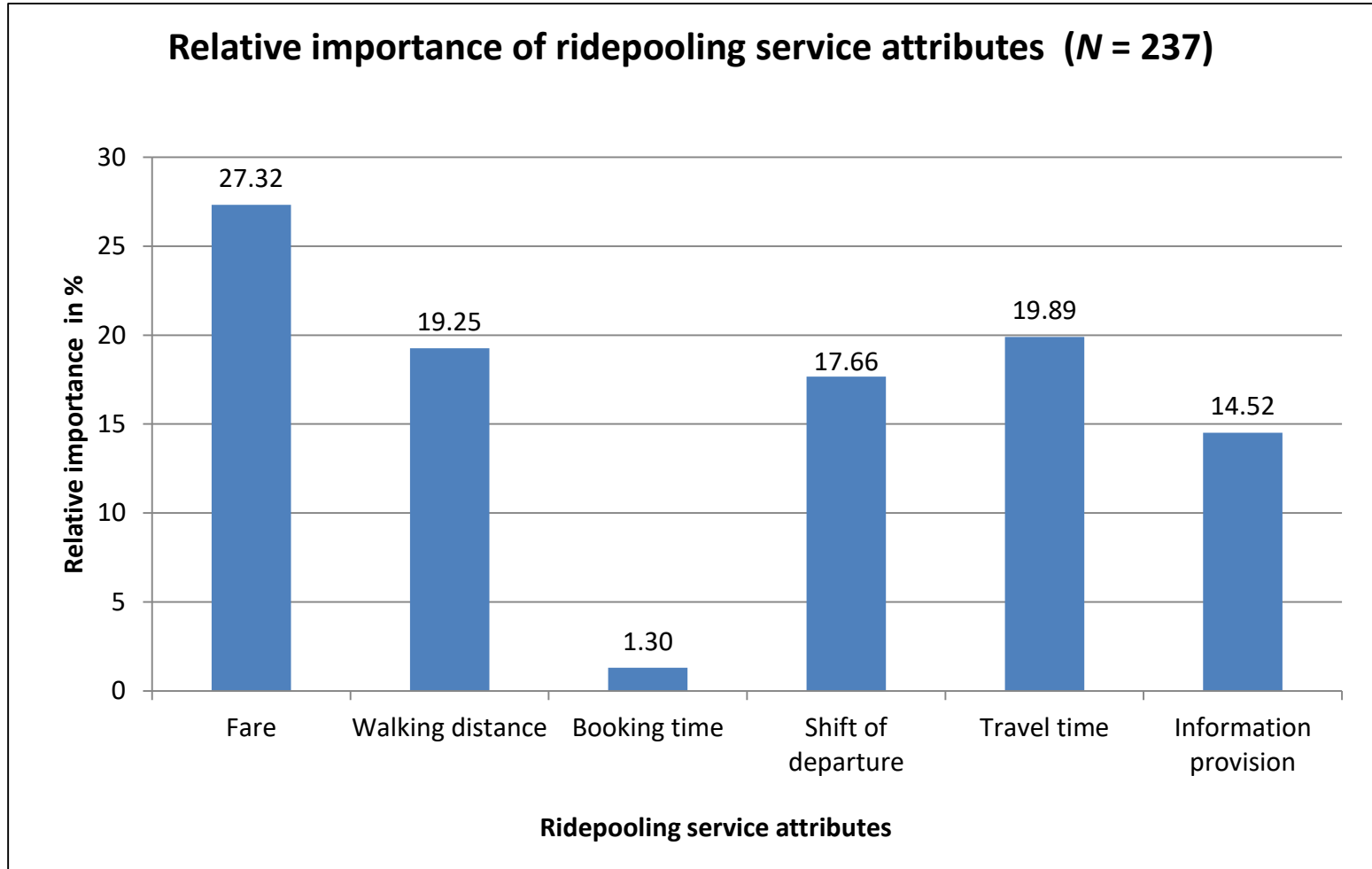
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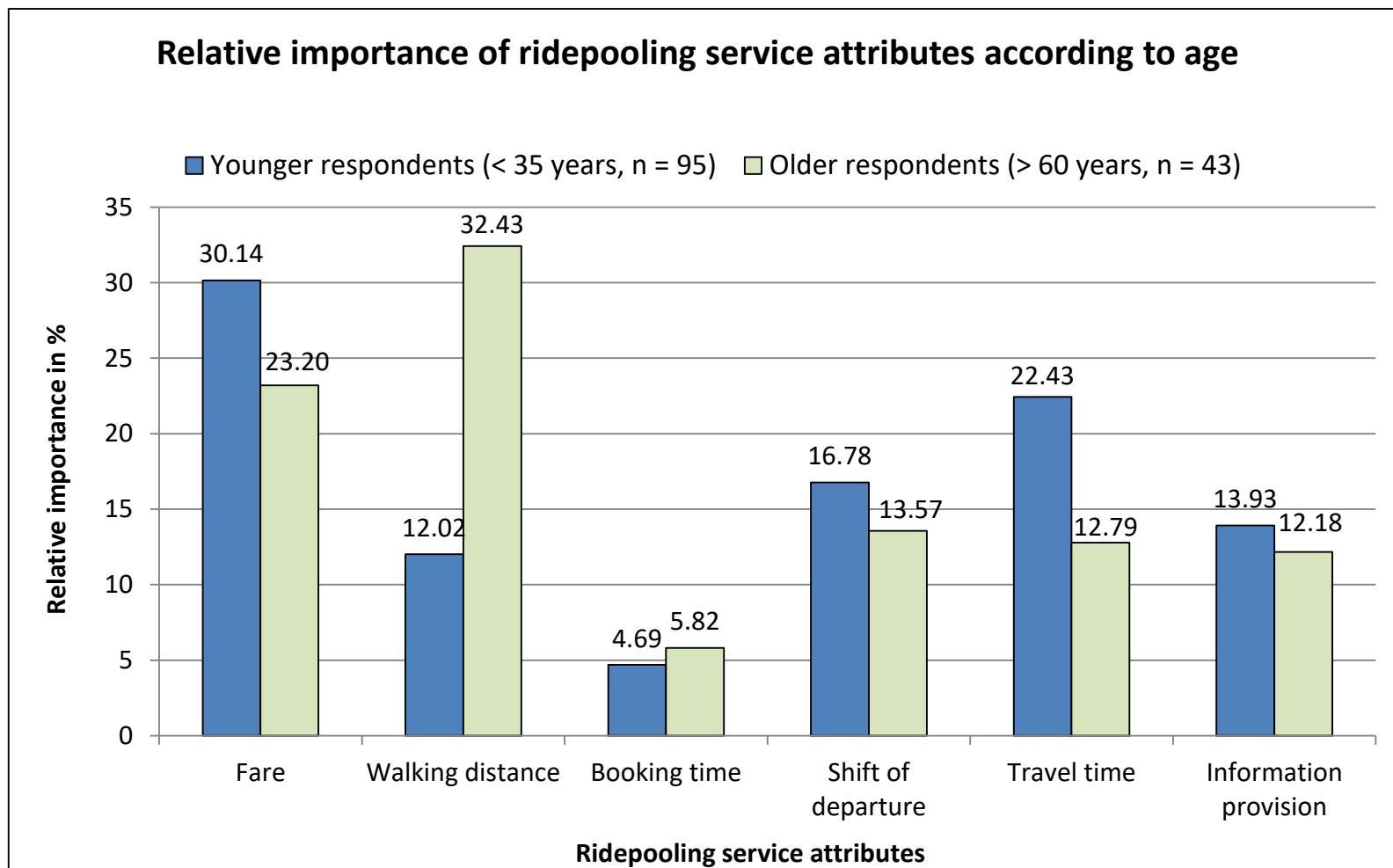
Results

Relative importance of service characteristics



Results

Relative importance of service characteristics according to age



Derived recommendations for policy, city planning and transport authorities (1/2)

- Walking distance to the pick-up points of the ridepooling service should be as short as possible, especially in city districts with high average age. If possible, a door-to-door service should be offered.
- In order to secure small shifts of departure, transport agencies should aim to provide a high availability of vehicles, especially in areas with high demand.
- Avoid excessive travel times by limiting the maximum detour to an acceptable level



Derived recommendations for policy, city planning and transport authorities (2/2)

- It should be possible to use monthly tickets and student tickets for the ridepooling system. In this way, the integration of the ridepooling service in the fixed-scheduled transport could be facilitated.
- Provide clear and comprehensive information in real time on departure and arrival time as well as route.
- Inform prospective users about the service concept and system inherent operational aspects like the shift of departure and the prolongation of travel time that represent a usual state and should be communicated as such.



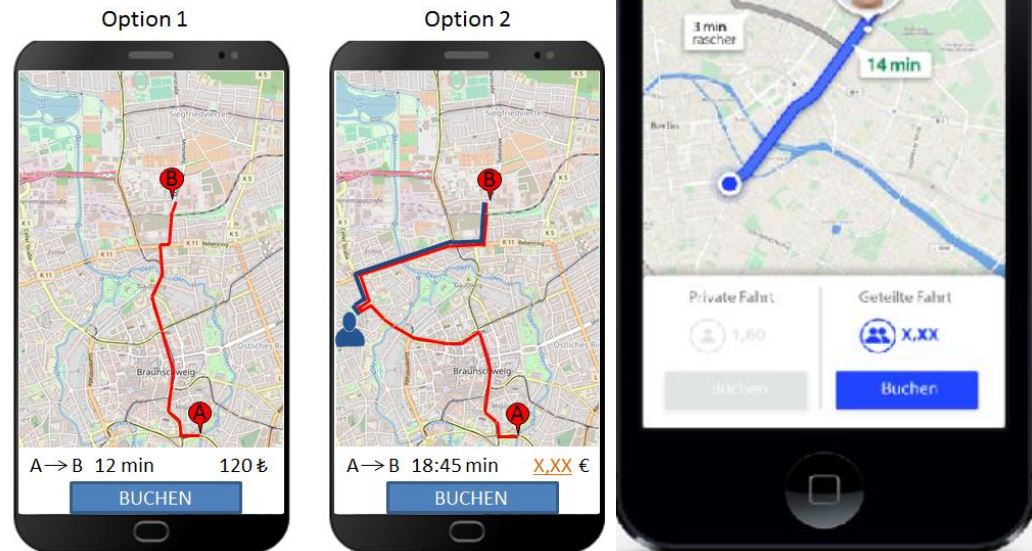
Summary and outlook

Door-to-door-service or fare?

Elderly prefer door-to-door service while younger users are more attentive to low prices

Further research needs:

- Maximum detour accepted by travelers
- Incentives for increasing travelers willingness to share rides, like monetary incentives (p.e. *MyTaxi*; Betzholz, 2017) or gamification
- Quality and quantity of information necessary to increase travelers' feeling of control over the system



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Images

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Thank you for your attention!
Muchas gracias por su atención!

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