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"For me it is always like half an hour": Exploring the acceptable travel time concept in the US and European contexts

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ABSTRACT

Milakis et al. (2015b) explored the acceptable travel time concept as a possible factor in the travel and destination decision-making process. These researchers employed both theory and methods triangulation to assess the validity of this concept. Results from interviews with 20 subjects in Berkeley, CA supported the acceptable travel time concept. In this paper, the US study is replicated in Europe (Delft, The Netherlands) to further explore the validity of the acceptable travel time concept, compare results between Delft and Berkeley, and to identify possible factors influencing the acceptable travel time. Results of this study offer support for the validity of the acceptable travel time concept. The subjects in Delft appeared to be less satisfied with longer commute times than the subjects in Berkeley. Urban, transport as well as sociocultural factors might explain this variation in acceptable travel times.

1. Introduction

In 2015, the concept of acceptable travel time was published in Milakis et al. (2015b). This concept suggested that people likely consider an acceptable travel time in their travel and destination decision-making process. It was assumed that acceptable travel time is a behavioural threshold defined by utilitarian processes (i.e. intrinsic and derived utility, see Fig. 1). Intrinsic utility reflects travel-related benefits (or disbenefits). Derived utility reflects the activity-related benefits at the destination of a trip. According to the acceptable travel time concept the trip timeline can be divided into three periods: (a) the growth period, where total utility increases, because both intrinsic and derived utility increase as well, (b) the tolerance period where total utility still increases, but at a slower rate until it reaches a maximum level (acceptable travel time). In the tolerance period intrinsic utility decreases and derived utility increases but at a slower rate compared to the growth period, and (c) the decay period, where total utility decreases because intrinsic utility increases at a higher rate and derived utility decreases at even lower rate.

Milakis et al. (2015b) employed both theory and methods triangulation to assess the validity of this concept. First, the concept was connected to other established theoretical constructs in transport and decision-making, i.e. travel time budget (Zahavi and Ryan, 1980; Zahavi and Talvitie, 1980), ideal travel time (Hupkes, 1982; Mokhtarian and Salomon, 2001), satisficing (Simon, 1956, 1955) and consideration sets (Wright and Barbour, 1977). The theory of constant travel time budgets suggest that at the aggregate level, for example all people in a state or country, have a stable travel time budget, generally on average about 60–75 min per person per day (e.g. Mokhtarian and Chen, 2004). The idea of the ideal travel time explains that there is an optimum travel time that includes both the intrinsic positive utility of travel (travel for the fun of it, it provides a transition between activities such as home and work – see Redmond and Mokhtarian, 2001; Jain and Lyons, 2008) and the derived utility (due to being able to participate in activities. The concept of satisficing (Simon, 1955, 1956) explains that individuals do not strive for maximizing their choice benefit from but stop searching for alternatives once that is good enough. The concept of the consideration set (Wright and Barbour, 1977) tells that people make decisions in two stages. They first select the consideration set, a limited set of alternatives, and next they choose one of the options in that set of alternatives. Milakis et al. (2015b) discuss these concepts in more detail. Second, a mixed method approach was applied to explore acceptable commute time based on interviews with 20 subjects in the case of Berkeley, CA.

In this paper, the original study of Berkeley, CA is replicated in Delft, The Netherlands. The new study offers (a) further exploration of the validity of the acceptable travel time concept through data triangulation, (b) comparison of results between Delft and Berkeley to gain more insights into this theoretical concept, and (c) enrichment of the discussion

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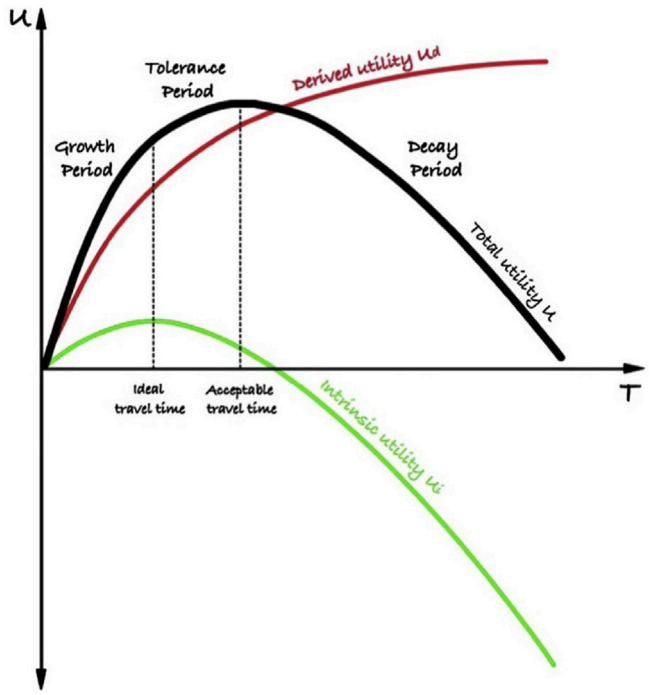

Fig. 1. The variation of intrinsic, derived and total utility with travel time, and the three main periods of a one-way trip (growth, tolerance, decay) in terms of total utility changes according to the acceptable travel time concept (X-axis: Time – T; Y-axis: Utility – U). Source: Milakis et al., 2015a.

on acceptable travel times by providing a conceptual framework for possible factors influencing it, based on the findings from both cities, and our analytical thinking. The replication logic is used in qualitative research to explore theoretical validity (or even build theory through different case studies, see Eisenhardt and Graebner, 2007) as well as generalizability of a concept (Johnson, 1997). According to the replication logic, support for a theory grows with the times this theory is replicated with different people, in different places and times (Johnson, 1997). This qualitative study applies the replication logic to further explore the theoretical validity and generalizability of the acceptable travel time concept by interviewing different people, in different places, at different times. Due to this logic we interviewed people and did not send a questionnaire to a larger number. We nevertheless see a larger quantitative study as a useful next step.

In the following sections, we present the research design (section 2), results for both satisfaction with hypothetical commute times and identification of acceptable travel times (section 3) and finally the conclusions about the validity of the concept, the differences in acceptable travel time between Berkeley and Delft, a conceptual framework for factors influencing acceptable travel time and directions for future research (section 4).

2. Research design

A mixed method approach with concurrent triangulation was employed to explore acceptable commute time in Berkeley, CA and Delft, The Netherlands (for more details about the methodology see Milakis et al., 2015b). This method combines both quantitative and qualitative data, thus enhancing the validity of the results, while allowing to deal with complex real world phenomena, such as travel (Robson, 2011). Data were collected through semi-structured in-depth interviews that involved both open and close-ended questions (see Fig. 2). The subjects were asked to respond first on a 5-point unipolar scale about their satisfaction with their actual commute time and with a range of hypothetical times and then to elaborate upon their choice. Subjective well-being measures, such as overall satisfaction with life, have been used as proxy for utility (Stutzer and Frey, 2008; see also De Vos et al., 2013 for a review on subjective well-being and travel). Thus, in this study, we expected the question about commuting satisfaction to offer evidence about variation of intrinsic utility with travel time. The subjects were also asked to identify and then describe, if possible, what acceptable travel time means to them. Information about participants' travel mode and socio demographic characteristics was also collected. We started discussion with all subjects asking them to describe the most important commuting problems in their area, aiming to become familiar with their language and respond accordingly. All interviews lasted between 30 and 60 min and conducted during August 2013 in Berkeley, CA and May-June 2014 in Delft, The Netherlands.

A stratified, based on the commuting mode (car, public transport, bicycle, walking), random sample of 32 subjects in total (16 in each case study, four subjects for each of the four commuting modes included in each case study) was recruited. The reason for stratifying our sample based on equal number of subjects for each commuting mode was that important variation among travel modes usage existed in both case studies, which could lead to oversampling of subjects using specific modes (e.g. car over walking). Four car-poolers that were interviewed in the Berkeley study were excluded from the current analysis, because we did not manage to recruit a respective sample of car-poolers in the Delft case. The subjects were invited in both areas through local newspapers, local news website, social media and flyers offering a 20$ gift card (15€ in the case of Delft) as an incentive. The subjects in both surveys were relatively younger and more highly educated in comparison to the general population in the two cities. Males were oversampled in Berkeley, CA while more women participated in the sample in Delft, The Netherlands, compared to the general population. Given the exploratory nature of this study we think that these differences between the sample and the population are not a problem (see Onwuegbuzie and Collins, 2007).

The analysis of close-ended questions focused on the relationship between positive and negative satisfaction for a range of hypothetical commute times and on the average acceptable travel time per case study and per travel mode. Due to the small, non-normal sample, Mann–Whitney *U* test was applied to identify possible statistical significant differences of ideal and acceptable commute times between Berkeley and Delft. Content analysis of the open-ended questions about a range of

IQ 1: Satisfaction with the actual commute time.	**IQ 2**: Satisfaction with a range of hypothetical commute times (assuming use of the current travel mode).	**IQ 3:** Identification (and definition) of the acceptable commute time (by the current travel mode).	**IQ 4:** Information about the travel mode and participants' sociodemographic characteristics.
"How satisfied are you with your current commute time?" (1-not at all satisfied to 5-extremelly satified)	"How satisfied you would be with the following commute times? (0', 15', 30', 45', 60', 60'+)" (1-not at all satisfied to 5-extremelly satified)	"Is there a commute time that you would consider as closer to your sense of ideal/acceptable?"	

Fig. 2. The interview questions (IQ).

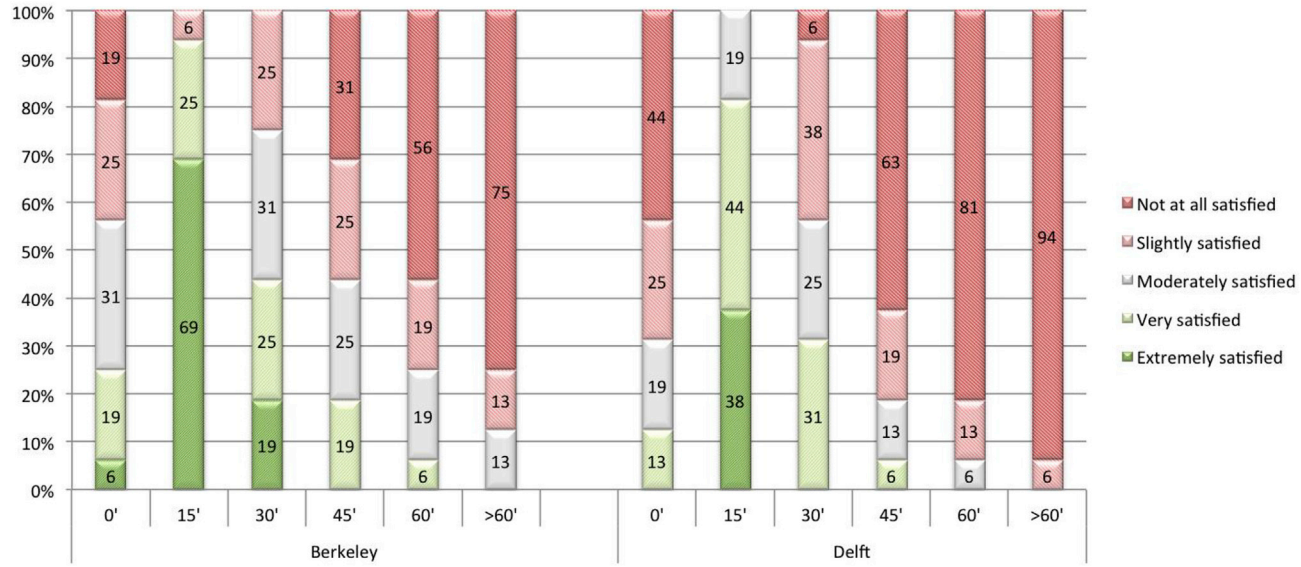

Fig. 3. Levels of satisfaction (%) for a range of hypothetical commute times.

hypothetical commute times and the definition of acceptable travel time was performed by one judge in two stages. First, four themes (positive and negative perceptions, feelings, attitudes and experiences) were identified based on thorough reading of the transcripts. The definition of the themes was based on the Oxford English Dictionary (http://www.oxforddictionaries.com, accessed 31.1.14). Then, the transcripts were inductively coded using the actual language of the participants (in vivo coding) and the codes were assigned to the four themes.

3. Results

3.1. Hypothetical commute times

3.1.1. Closed-ended questions

The results for subject's satisfaction with a range of hypothetical commute times are presented in Fig. 3. Outcomes in both case studies follow a similar pattern. Satisfaction with commute time starts low at 0 min (working at home). Only 6% of the subjects in Berkeley and none in Delft were 'extremely satisfied' with working at home, while 19% and 44% responded 'not at all satisfied' respectively. At 15 min commute time both Berkeley and Delft subjects were 'extremely satisfied' (69% and 38% respectively). At 30 min commute time 19% of the subjects in Berkeley appeared to be still 'extremely satisfied' while none of the subjects in Delft were 'extremely satisfied'. At 45, 60 and over 60 min commute time Berkeley subjects stated that they would be 'not at all satisfied' at a rate of 31%, 56% and 75% respectively. Delft subjects seem to show smaller tolerance to longer commute times as 63%, 81% and 94% stated 'not at all satisfied' with 45, 60 and over 60 min commute time. Fig. 4 presents the variation of positive satisfaction ('very satisfied' and 'extremely satisfied') and negative satisfaction ('slightly satisfied' and 'not at all satisfied') for a range of commute times. In both case studies positive satisfaction starts low at 0 min commute time, takes its maximum value at 15 min and then gradually decreases until it reaches a minimum value at 60 and over 60 min in Delft and Berkeley respectively.

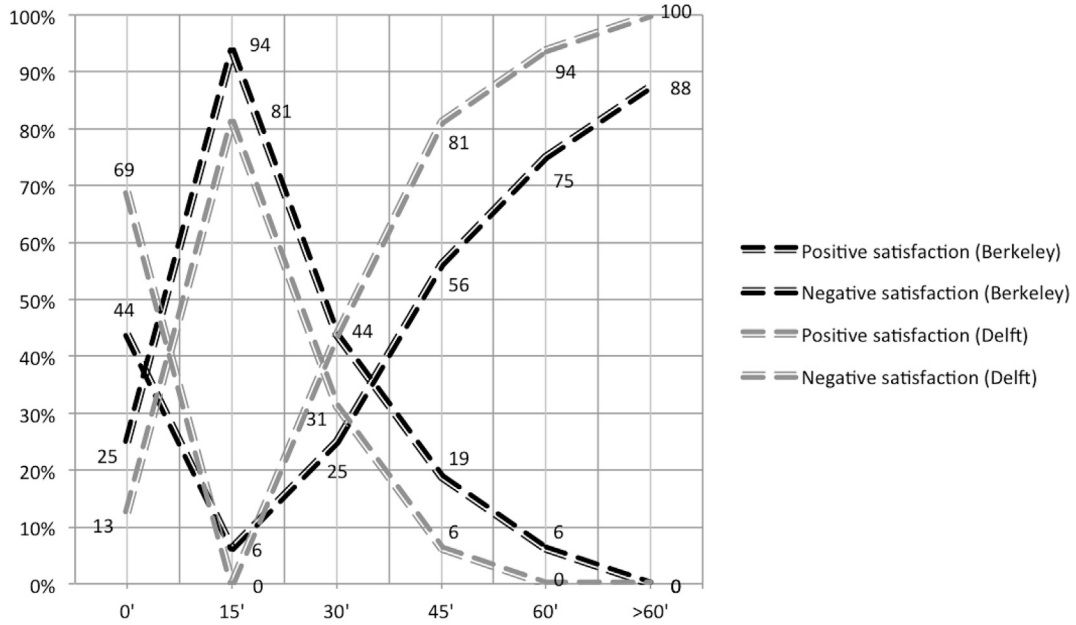

Fig. 4. Positive and negative levels of satisfaction (%) for a range of hypothetical commute times.

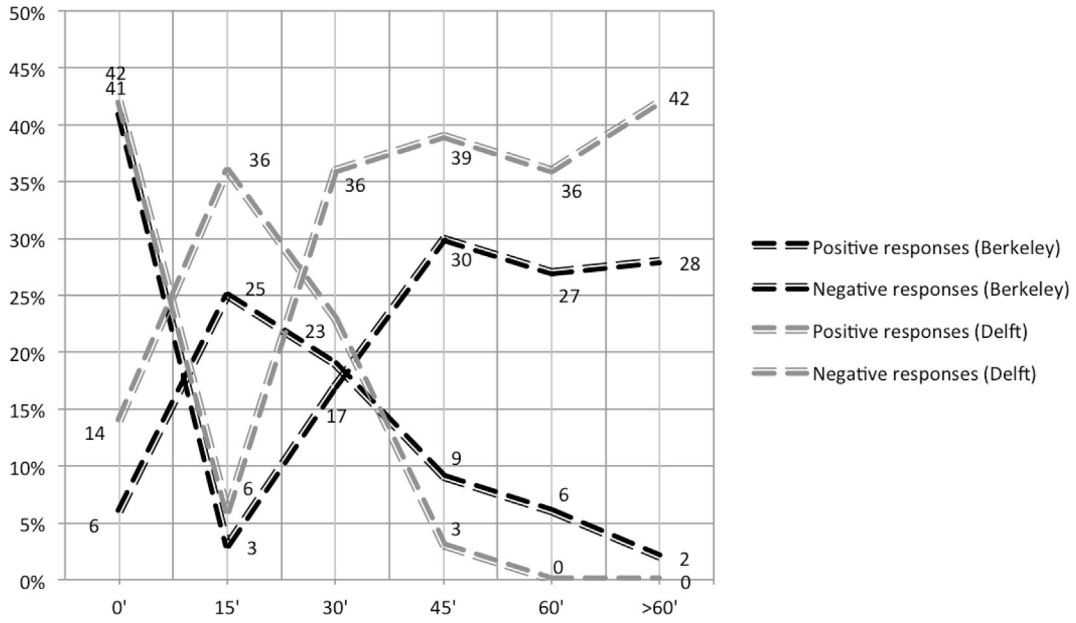

Fig. 5. The average proportion of subjects with positive and negative responses (perceptions, feelings, attitudes, and experiences) for a range of hypothetical commute times.

On the other hand, negative satisfaction starts high (much higher in Delft than Berkeley), takes its minimum value at 15 min (0% in the case of Delft) and then gradually increases until it reaches its maximum value at over 60 min commute time in both cases studies. In the case of Delft, negative satisfaction was already pretty high at 45 min of commute time (81%) and increased to even higher levels at 60 (94%) and over 60 min of commute time (100%). We can identify two balancing points where positive equals negative satisfaction rates in both case studies. In Berkeley, the first balancing point is quite close to 0 min and the second one is slightly over 30 min of commute time. In the case of Delft, the first balancing point is identified quite close to 10 min and the second one slightly below 30 min of commute time.

3.1.2. Open-ended questions

Fig. 5 presents the results of content analysis of responses about a range of hypothetical commute times. Similarly to the results of the close-ended questions, the proportion of subjects with positive responses started low at the 0-min commute time, took its maximum value at the 15-min commute time and then gradually decreased until it reached a minimum value at the 60- and over 60-min commute time for Delft and Berkeley respectively. The proportion of the subjects with negative responses started almost equally high in both case cities, took its minimum value at the 15-min commute time and then gradually increased. The increase of negative responses after the 15-min commute time was steeper in the case of Delft where 36% of the subjects gave negative responses already for the 30-min commute time, while the respective rate for Berkeley was 17%. Two balancing points can be identified in this figure as well. In both case studies the proportion of the subjects with positive responses equaled the proportion of the subjects with negative responses at about 10 min of commute time. The second balancing point for Berkeley is slightly over 30 min and for Delft slightly below 30 min of commute time.

Table 1 deconstructs the results presented in Fig. 5 providing an in-depth picture of subjects' responses about a range of hypothetical commute times. The subjects in both case studies were more negative than positive for 0-min commute time (working at home). They contended that commute helps them clear their mind, invigorate and plan their day. They also stated that the commute offers them the opportunity to get out of their house and that they like to have a separation between home and work. This finding is in line with previous findings suggesting that people highly value the transition time between home and work (see Redmond and Mokhtarian, 2001; Jain and Lyons, 2008). The subjects referred also to some derived utility aspects related to 0-min commute time. More specifically, they perceived working at home as unproductive, associated with many distractions and difficult to keep their schedule. They also highly valued the interaction with colleagues at their workplace: *"It's collaboration. It's development. You learn by imitating others' behavior so you look at your role models and then you become better yourself. But from my perspective, we also need a different environment. You need to be able to split time in different chunks"* (Delft, female, 25–29, public transport user, 80 min). On the other hand, some subjects were relatively positive about a 0-min commute time. They claimed that working at home is more convenient and provides the opportunity to spend more time with the family, while saving cost and time from traveling. Long (negative) commuting experience in the past was also brought into the discussion as a reason for preferring to work at home.

Responses about 15 min commute time were predominantly positive. The subjects, both in Berkeley and Delft, found this commute time quick, convenient and nice. They stated that a 15-min commute time gives them flexibility, allowing them to return home whenever they would need to but also providing adequate separation between home and work: *"15 min isn't too long that you're not wasting a lot of time in the commute but I think 15 min is enough time to provide that mental and geographic delineation between home and work"* (Berkeley, female, 20–24, car, 20 min). They were though some subjects in both case studies that they would like to have a longer commute time than 15 min: *"[15 min] is like maybe moderately satisfying because it means that the scenes that I enjoy during my way is reduced. I have less time to see people, to think about myself"* (Delft, female, 25–29, walker, 30 min).

The subjects in Berkeley gave almost equally positive and negative responses for the 30-min commute time, while the subjects in Delft were predominantly negative for this commute time. For subjects in Berkeley, 30 min of commute can offer time to think, to relax and to exercise, but it might also be considered as too long, inconvenient, stressful and tiring. The subjects in Delft on average consider such a commute time as not effective use of time, too long and tiring. For walkers in Delft a 30-min commute is also associated with sweating and for public transport users it is associated with more transfers to reach their destination.

Negative responses sharply increased for the 45-min commute time and remained at very high levels for the 60- and over 60-min commute

Table 1
The perceptions, feelings, attitudes and experiences of subjects with a range of hypothetical commute times in Berkeley, CA and in Delft, The Netherlands. Percentage refers to the share of subjects that expressed positive or negative perceptions, feelings (both emotional and physical sensations), attitudes and experiences (for example 56% of the subjects in Berkeley expressed negative perception about the hypothetical commute time of 60 min). The number of codes per theme is given in parentheses. The codes are presented hierarchically based on the number of times they are identified in each theme and bolded if this number is higher than one.

			Hypothetical commute time					
			0 min		15 min		30 min	
Perceptions	*Berkeley*	(+)	0%		44% (8)	**Quick, be able to return home,** convenient, time to think	6% (1)	Time to think
		(-)	38% (19)	**Unproductive at home, distractions at home,** commute clears my mind, commute invigorates me, commute allows me to plan my day, commute wakes me up, commute gives me time to think, harder to collaborate at home, less motivation at home	0%		44% (15)	**The commute is too long, the commute breaks into my personal time, inconvenient,** need to adjust my daily schedule, long time to cycle in the dark, long time to cycle in the rain, not effective use of time, too far to walk, look for other commute mode
	Delft	(+)	31% (10)	**More productive at home, more convenient at home, spend time with family at home,** travel wastes energy	81% (26)	**Quick, dependable, flexible, convenient, be able to return home, long enough to be away from work, not too far away,** cost less energy, ideal, increase productivity in work, long enough to relax, plan my day	44% (8)	**Not too far away,** dependable, time to think
		(-)	38% (13)	**Nonstop work at home, unproductive at home,** commute clears my mind, distractions at home, no technical support at home	13% (3)	Too short commute, too long commute, too far to walk	63% (14)	**Not effective use of time, too long commute, undependable, waste of time,** need to adjust my daily schedule, inefficient, long time to ride in the rain, look for other commute mode
Feelings	*Berkeley*	(+)	0%		13% (2)	Nice	31% (5)	**Relax,** happy, not tiring, nice
		(-)	25% (7)	**Get out of the house, hate to work from home**, feel caged at home, feel home is like a vacuum, enjoy short commute	0%		19% (3)	Frustration, stressful, tiring
	Delft	(+)	0%		31% (7)	**Nice**, less stressful, relax	19% (4)	**Enjoy,** relax, nice
		(-)	38% (9)	**Boring, get out of the house,** feel caged home, feel alive when walking, feel freaked out at home, feel lonely at home, feel relaxed when walking	0%		31% (6)	**Carsick, tiring,** be in a hurry, not comfortable
Attitudes	*Berkeley*	(+)	25% (5)	**Like work at home, like to work at home occasionally,** like saving cost/time	31% (6)	**Like home/work separation,** like shops between home/work, like short commutes	0%	
		(-)	81% (17)	**Like home/work separation, like interaction, dislike work at home**, like driving, prone to move	13% (2)	**Like longer commute**	6% (1)	My maximum commute time
	Delft	(+)	19% (3)	**Like saving cost/time,** like work at home	13% (3)	**Like home/work separation,** like short commutes	13% (2)	Like riding my bike, like short commutes
		(-)	81% (42)	**Like interaction, like go out of home, dislike work at home daily, dislike work at home, like home/work separation, like to move**	6% (1)	Like longer commute	25% (5)	**Do not like long commute,** my maximum commute time
Experiences	*Berkeley*	(+)	0%		13% (5)	**Being outside,** exercise	38% (8)	**Exercise, read,** being outside, knit, watching activity inside the bus
		(-)	19% (5)	**Being outside, childhood experiences**, exercise	0%		0%	
	Delft	(+)	6% (1)	Long commuting in the past	19% (4)	**Exercise,** reliable public transport, scenic route	19% (3)	**Exercise**
		(-)	13% (3)	**Get fresh air,** be outside	6% (1)	Bad weather	25% (5)	**Sweating, more transfers public transport,** unreliable public transport

			Hypothetical commute time					
			45 min		60 min		>60 min	
Perceptions	*Berkeley*	(+)	6% (1)	Time to think	0%		0%	
		(-)	63% (16)	**The commute is too long,** the commute breaks into my personal time, need to adjust my daily schedule, need to change driving lifestyle, commute would be hassle, look for other commute mode, low commute quality, no flexibility, safety issues, too far to walk, too much driving	56% (12)	**The commute is too long,** the commute breaks into my personal time, move closer to work, need to adjust my daily schedule, commute is a black hole, need to change driving lifestyle, too far to walk, too much driving, look for a new job	69% (18)	**The commute is too long, the commute breaks into my personal time, cannot imagine, safety issues,** move closer to work, commute is a black hole, expensive, too far to walk
	Delft	(+)	0%		0%		0%	
		(-)						

(*continued on next page*)

Table 1 (*continued*)

			Hypothetical commute time					
			45 min		60 min		>60 min	
			81% (34)	**The commute is too long, the commute breaks into my personal time, need to adjust my daily schedule, commute time undependable, not effective use of time, too far to walk, too much driving, waste of time,** inconvenient, look for other commute mode, no flexibility, too far from home (unsafe), too far to cycle, unhealthy	81% (40)	**The commute is too long, the commute breaks into my personal time, cannot imagine, commute time undependable, look for other commute mode, too far to walk, not effective use of time, waste of time,** need to adjust my daily schedule, inconvenient, move closer to work, ridiculous, too far from home (unsafe), too much driving, too much exercise, commute transition becomes state, unhealthy	70% (35)	**The commute breaks into my personal time, the commute is too long, cannot imagine, commute time undependable, move closer to work, too much driving, waste of time, need to adjust my daily schedule,** expensive, will impact my work, look for a new job, look for other commute mode, not an option, not effective use of time, ridiculous, too far from home (unsafe), commute transition becomes state
Feelings	*Berkeley*	(+)	19% (4)	Nice, fun, relax, not tiring	6% (2)	Enjoy, not tiring	0%	
		(-)	25% (7)	**Tiring, boring,** carsick, stressful, unpleasant	31% (5)	**Tiring,** daunting, spoiled	19% (4)	**Scared,** frustration, tiring
	Delft	(+)	6% (1)	Enjoy	0%		0%	
		(-)	31% (7)	**Tiring,** exhausting, carsick, sleepy	25% (6)	**Tiring,** exhausting, carsick, faint	35% (10)	**Tiring,** carsick, exhausting, faint, horrible, hungry, irritating, stressful
Attitudes	*Berkeley*	(+)	0%		6% (1)	Like transfers	0%	
		(-)	6% (1)	My maximum commute time	13% (2)	**My maximum commute time**	6% (1)	Not ecological
	Delft	(+)	0%		0%		0%	
		(-)	6% (1)	My maximum commute time	6% (1)	My maximum commute time	10% (2)	Do not like long commute
Experiences	*Berkeley*	(+)	13% (2)	Work while commuting, read	13% (4)	**Watching activity inside the bus,** talk with people on the bus, work while commuting	6% (1)	Work while commute
		(-)	25% (8)	**Sweating,** change clothes and shower, commuting consumes too much energy, cannot listen to music (ADD), cannot read (ADD), not interesting, uncomfortable bus	6% (1)	Sweating	19% (3)	Traffic, uncomfortable bus, childhood experiences
	Delft	(+)	6% (4)	Scenic route, interesting route, watch activity around me, exercise	0%		0%	
		(-)	31% (7)	**Unreliable public transport,** sweating, bad weather, cannot work during commute, more transfers public transport, negative experience with this commute in the past	31% (5)	**Unreliable public transport, sweating,** traffic	20% (5)	Unreliable public transport, sweating, traffic, cannot listen to music, cannot read

time in both case studies. Moreover, for commute times over 45 min negative response rates in Delft were much higher than in Berkeley. The subjects in both cities reported that commute times over 45 min are too long and would break into their personal time: *"I play music, so I won't have the time for music and stuff, so it will just not fit. It will just not fit"* (Delft, male, 30–34, car, 20–25 min). The subjects in Delft added that such commute times would be undependable and would waste their time. The subjects in both case studies also felt that commute times over 45 min would be tiring or even exhausting: *"Well, it will be difficult to require that [to bike for 60 min] everyday rain or shine no matter how you're feeling, well or sick* " (Berkeley, male, 45–49, bicycle, 15–20 min). Some subjects stated that 45 or 60 min would be the maximum commute time they would tolerate to travel. Sweating for walkers and bicycle users in both case studies and unreliable public transport in Delft were also negatively associated with long commute times. Finally, earlier experiences with long commute were also identified as reasons for a negative response: *"I always felt like [45 min commute time] is a waste of time. I worked there for 10 years. There is something in my mind, that when I'm going to my next job, I'll try to have a shorter commute time"* (Delft, female, 40–44, car, 30 min).

3.2. Acceptable commute time

3.2.1. Closed-ended questions

The subjects were asked to identify their ideal (see Mokhtarian and Salomon, 2001; Redmond and Mokhtarian, 2001) and acceptable commute times. Table 2 presents the results. The average ideal commute time in Berkeley and in Delft was 20.0 min and 14.7 min respectively, while the average acceptable commute time was 42.5 min and 36.4 min respectively. Car users reported on average 36.3 min acceptable commute time in Berkeley and 33.1 min in Delft. Public transport users identified an average acceptable commute time of 60.0 min in Berkeley and 42.5 min in Delft. Bicycle users reported an acceptable travel time of 48.8 min in Berkeley and 31.3 min in Delft. Finally, walkers in Berkeley and Delft appeared to accept on average commute times of 25.0 min and 38.8 min respectively. No statistical significant differences (at $p = 0.05$ level) of the ideal and acceptable commute times were identified between Berkeley and Delft.

The acceptable commute time typically exceeded actual commute time. The only exception is public transport users who reported an acceptable commute time that was equal (in the case of Berkeley) or lower (in the case of Delft), on average, than the actual commute time. At first face it seems strange that the acceptable travel time is shorter than the actual travel time. A possible explanation is that people made choices in the past that they regret from hindsight. They might have chosen a combination of work and residential location forcing them to commute longer than expected (and desired) or the commute trip might be experienced more negatively than anticipated, now exceeding what they think is acceptable.

3.2.2. Open-ended questions

The subjects defined acceptable commute times mostly based on perceptions (50% in Berkeley) and feelings (63% in Delft) rather than

Table 2
Actual, ideal and acceptable commute times by travel mode in Berkeley, CA and Delft, The Netherlands. The 95% confidence intervals for commute times are presented in brackets (lower and upper bound).

	Commute time (min)					
	Actual		Ideal		Acceptable	
	Berkeley	Delft	Berkeley	Delft	Berkeley	Delft
Car	19.0	21.9	16.9	13.8	36.3	33.1
	[17.3, 20.7]	[14.8, 28.9]	[14.5, 19.2]	[12.3, 15.2]	[28.9, 43.6]	[25.3, 41.0]
Public transport	60.0	55.6	23.8	17.8	60.0	42.5
	[33.2, 86.8]	[24.2, 87.0]	[11.0, 36.5]	[9.5, 26.0]	[26.1, 93.9]	[22.3, 62.7]
Bicycle	27.5	11.9	26.9	11.3	48.8	31.3
	[6.2, 48.8]	[9.5, 14.2]	[9.5, 44.2]	[5.4, 17.1]	[20.9, 76.6]	[22.0, 40.5]
Walking	14.3	20.9	12.5	15.9	25.0	38.8
	[3.6, 24.9]	[13.2, 28.6]	[5.9, 19.1]	[6.3, 25.5]	[19.3, 30.7]	[21.6, 55.9]
All modes	30.9	27.6	20.0	14.7	42.5	36.4
	[18.5, 43.4]	[16.3, 38.8]	[14.2, 25.8]	[11.3, 18.0]	[30.5, 54.5]	[29.5, 43.3]

attitudes and experiences (38% and 25% respectively in both case studies; see Table 3). The subjects both in Berkeley and in Delft described acceptable commute times as not too long, not breaking into someone's free time and not consuming (or wasting) much time or energy: *"I can get there in a good amount of time without having to wake up extraordinarily early. And, yeah, it's just not taking extraordinary a lot of time to get to the place I need to go to"* (Berkeley, male, 25–29, walking, 30 min). Describing feelings associated with unacceptable travel time, such as being tired, frustrated, unhappy, anxious, nervous or loosing enjoyment of travel was also a popular way to provide a definition of acceptable commute time: *"I feel like maybe I will not enjoy the time I'd be walking [beyond acceptable commute time] but instead I'd be thinking about when I will reach there so it's something that is not good. So you will lose the enjoyment"* (Delft, female, 25–29, walking, 30 min). Some subjects thought about acceptable commute in derived utility terms such as job accessibility or in terms of consistency with the duration of all daily activities: *"[acceptable is] a commute time that allows me to have access to a rich job environment. So I can access the jobs I want. But on the other hand, I can also have the after-work rhythm that I want. I can still be active. I can engage with my friends, family. I can go to the gym instead of just eating and going to bed or dozing off in front of the TV"* (Delft, female, 25–29, public transport, 80 min). Others showed an even more fixed way of thinking about an acceptable commute time as a 'hard' boundary: *"For me it is always like half an hour. I don't want to go to work further than half an hour, it is a psychological barrier … like, I don't want to be further away"* (Delft, male, 30–34, car, 20–25 min). A quite high percentage of subjects in both case studies (38% in Berkeley and 31% in Delft) also referred to factors that are likely to affect their acceptable commute time. For Berkeley subjects these factors comprise mainly travel mode, productivity and travel experience, for Delft subjects these are activities during travel and commuting frequency.

4. Conclusions, discussion and directions for future research

The aim of this study was threefold: first, to further investigate the validity of the acceptable travel time concept, second, to offer a comparison of results about acceptable travel time between Delft and Berkeley, and third, to enrich the discussion on acceptable travel times by identifying possible factors influencing it. To this end, 32 semi-structured interviews have been analyzed (16 from each city), involving both open and closed-ended questions about satisfaction with a range of hypothetical commute times and identification of the acceptable commute time. Below, the conclusions of this study are first presented. Then, a conceptual framework for possible factors influencing the acceptable travel time is provided. This section closes with suggestions about future research on the acceptable travel time concept.

4.1. Validity of the acceptable travel time concept

The results of this study offer support for the validity of the acceptable travel time concept. First, the results concerning variation of satisfaction with a range of commute times offer support for the assumed relationship between intrinsic utility and travel time. In both case studies (Berkeley and Delft), positive satisfaction with commute time started low at 0 min, took its maximum value at 15 min and then gradually decreased. On the other hand negative satisfaction, started high, took its minimum value at the 15-min commute time and increased thereafter. Thus, intrinsic utility (i.e. net satisfaction with travel) might be expected to increase up until the ideal travel time and decrease thereafter, intersecting travel time axis two times: the first quite close to 0 min and the second one at about 30 min (for the two cases explored in this study). This additional evidence about variation of intrinsic utility with travel time supports the hypothesis that a theoretical acceptable travel time is likely to exist *"when the decrease rate of intrinsic utility equals the increase rate of derived utility"* (Milakis et al., 2015b: 84; see also Fig. 1). Second, the subjects in Berkeley and Delft directly identified an acceptable travel time of 42.5 and 36.4 min on average respectively. Moreover, they defined the acceptable travel time based on perceptions and feelings, but also according to attitudes and past experiences. The subjects in both cases responded that a commute time of 45 min or longer becomes too long, not effective, a waste of time and energy, undependable, tiring, stressful or even exhausting. They also stated that such a commute time would break into their personal time and that they would need to adjust their schedule accordingly. Others identified such long commute time as the ultimate threshold they could tolerate to travel. All these negative reactions and concerns are in line with earlier indications about the existence of the acceptable travel time threshold due to factors such as stress (Novaco et al., 1990; Wener et al., 2003; Evans and Wener, 2006; Legrain et al., 2015), energy concerns (Young and Morris, 1981), the need to return home (Hägerstrand, 1985), the need to spend time on other activities (Hupkes, 1982) and other cognitive considerations about travel time and duration of activities (Dijst and Vidakovic, 2000; Schwanen and Dijst, 2002).

4.2. Differences in acceptable travel time between Berkeley and Delft

The differences in acceptable travel times between Berkeley and Delft are now discussed. The average acceptable travel time was found lower in Delft than in Berkeley, but this difference was not statistically significant according to the Mann-Whitney *U* test. Yet, we cannot exclude the possibility that low statistical significance is due to the small sample size of this study. Moreover, results of both close- and open-ended questions about satisfaction with commute time show that participants from Delft are less satisfied with longer commute times (especially over 45 min) compared to respondents from Berkeley. The difference in satisfaction levels with higher commute times and possibly in the acceptable travel time between Delft and Berkeley could be attributed to differences in congestion levels, spatial structure, job accessibility, perceptions of travel time related to country size between the two cities.

Table 3
Subjects' descriptions of acceptable commute time based on their perceptions, feelings, attitudes and life experiences. Percentage refers to the share of subjects that defined acceptable travel time through perceptions, feelings (both emotional and physical sensations), attitudes or experiences. The last row describes the factors that subjects believed would affect their acceptable travel time. The codes are presented hierarchically based on the number of times they were identified in each theme and are in bold if the frequency was greater than one.

		% of subjects	# of codes	Codes (definition of acceptable commute time)
Perceptions	Berkeley	50	15	**Not too long, not breaking into my free time, not a huge chunk of the day**, fine with it, manageable, not wasting my time commuting, would not look to shorten it
	Delft	44	9	**Not too long, not breaking into my free time, not wasting my time commuting,** manageable, not wasting my energy commuting
Feelings	Berkeley	38	7	**Tired, unhappy,** frustrated, not rushed, unpleasant, unsatisfied
	Delft	63	21	**Not bothered, tired, anxious, frustrated, nervous, convenient**, annoyed, comfortable, motion sick, no enjoyment, not irritated, out of balance, stressed
Attitudes	Berkeley	38	7	**Allow myself to travel to a job, consistent with the duration of all daily activities,** not my upper boundary
	Delft	38	10	**Not my upper boundary, consistent with the duration of all daily activities, allow myself to travel to a job,** not too expensive
Experiences	Berkeley	25	5	**Past experiences with commuting**
	Delft	25	4	**Past experiences with commuting**
Factors affecting acceptable travel time	Berkeley	38	15	**Travel mode, productivity, travel experience**, activities during travel, commuting frequency, driving vs riding, life stage, salary, travelling companions
	Delft	31	6	**Activities during travel, commuting frequency,** travelling companions, travel mode

Delft, unlike Berkeley, has clearly defined urban boundaries that separate it from other cities in the region. Moreover, congestion levels on motorways and other roads connecting Delft to other cities in the region (such as Rotterdam, The Hague) are high and trains run frequently, but are often very crowed, especially during peak hours. Dutch residents are also very sensitive to (un)reliability of public transport (Rietveld et al., 2001). Thus, people might prefer to relocate if their job is outside Delft or select a job closer to home, instead of extending their commute time. Berkeley on the other hand is located within an urban continuum of multiple adjacent centers, with congestion being more severe in regional arteries (e.g., to San Francisco or San Jose) than within the Berkeley region. Therefore, people living in Berkeley might tolerate a longer commute. Moreover, the Netherlands is a small country compared to the US even California. The car trip from the north to the south boundary of the Netherlands takes almost 4 h, whereas this trip takes about 15 h in California. So, people in the Netherlands might have a different perception of travel time that could lead to less tolerance of long commutes.

4.3. A conceptual framework for factors influencing acceptable travel time

Fig. 6 conceptualizes the impact of several factors on derived and intrinsic utility and next the impact of both forms of utility on the acceptable travel time. The impact of both forms of utility on the acceptable travel time (arrows 1 and 2) is explained in section 1 and in more detail in (Milakis et al., 2015b: 77). Intrinsic utility depends on travel characteristics – it is those characteristics that people appreciate, such as the joy of moving, resulting in intrinsic utility (arrow 4). Derived utility on the other hand only depends on the utility of doing activities at different places, and as a result depends on the land use system (which activity locations are sited where), the labour market and the housing market (arrow 3).

Attitudes, perceptions, feelings and experiences influence both travel characteristics and the activities system. We first explain the impact on the activities system (arrow 5). For example, a person for whom the status or income of a job is very important (attitude), will experience a higher utility from a prestigious more remote job. A person that does not feel happy in a specific neighbourhood (feelings) might prefer to live in another neighbourhood, despite longer travel times and costs that come with that choice. Next, we explain the impact on travel (arrow 6). A person who recently had a serious accident (experience) might dislike to travel. Or a person who thinks that the exercise of walking and cycling is really healthy for her (perceptions) might enjoy walking of cycling for that reason.

And there is a feedback loop, as expressed by the dashed lines. The example of the person who recently had an accident illustrates the feedback from travel to the block including attitudes (arrow 8). And a person, who once enjoyed participating in certain activities, might change her attitudes toward future participation in equal activities (arrow 7).

Finally we argue that other personal characteristics matter. We firstly refer to socio-economic and demographic variables. For example, the higher the education level, the more specific the type of job is that a person might be interested in, and a higher income might bring a nice but expensive house within reach (arrow 9). A highly educated person might like to travel over a long distance by train more than average, because she can work while travelling (arrow 10). Biological abilities or instincts may influence the effort of travelling (arrow 10) or the question if a person (thinks she) can fulfil specific job requirements (arrow 9). Cultural and social norms may influence if a person thinks it is OK or not to accept a job below her education level (arrow 9), or if it is OK or not to become a long distance commuter travelling with a comfortable but inefficient car (arrow 10). This block of variables can also influence attitudes, perceptions, feelings and experiences (arrow 11). For example, a visually handicapped person might have developed a negative attitude towards travelling, maybe based on past experiences.

4.4. Future research

Future research about the acceptable travel time concept can focus on at least three areas: (a) theory, (b) validation and influencing factors and (c) application of the concept.

Considering theory, Milakis et al. (2015b) suggested possible connections of acceptable travel time concept to two theoretical concepts in decision-making: 'satisficing' (Simon, 1956, 1955) and the 'consideration sets' (Wright and Barbour, 1977). Milakis et al. (2015b:78) argue that the trip time budget is related to these concepts in two ways. "First, the acceptable travel time is related to the extent to which the individual would consider a "satisficing'' threshold for the duration of the trip and therefore would not search for destinations with a longer travel time; second, the "time region'' up to the acceptable travel time threshold is

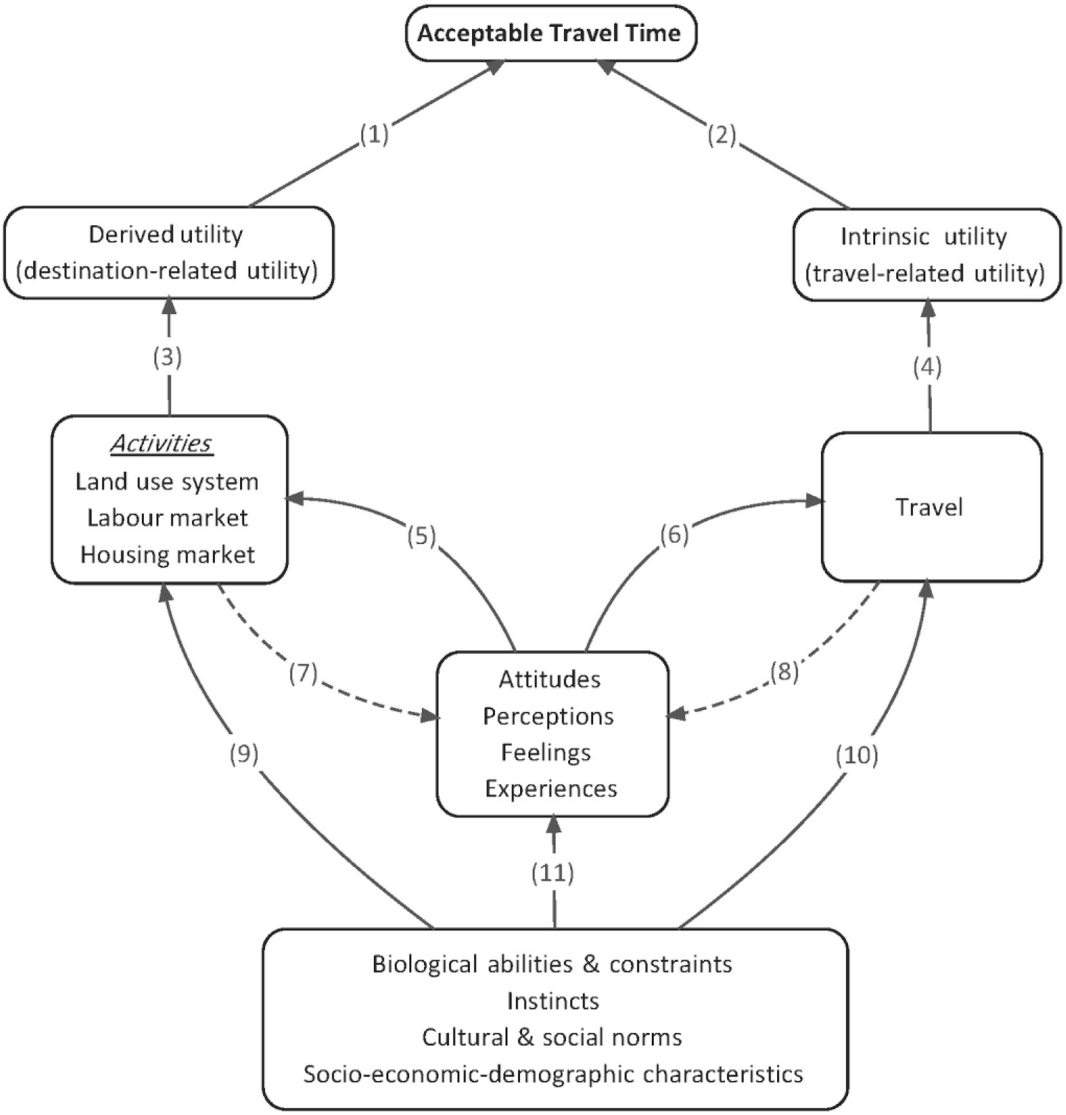

Fig. 6. A conceptual model for factors influencing derived and intrinsic utility, and next the acceptable travel time.

related to the "consideration set of travel times'' that the individual might incorporate into the travel and destination decision-making process to either maximise utility or minimise regret". Future research could focus on the importance of satisficing for both the consideration set and the evaluation of options in that set. Additional connections to concepts originated from the field of behavioural economics can be explored. For example, what is the connection of acceptable travel time to the idea of reference points in people's decision-making (Metcalfe and Dolan, 2012)? And if acceptable travel time is perceived as a reference point, are there connections between loss aversion (see prospect theory, Kahneman and Tversky, 1979) and the valuation of travel time beyond the acceptable travel time threshold?

A second area for future research is further validation of the acceptable travel time concept and exploration of influencing factors. The acceptable travel time concept can be further validated using stated and revealed preference data. A large scale stated choice survey could explicitly incorporate both derived and intrinsic utility related factors and allow not only further validation of the concept, but also exploration of the influence of various factors' on acceptable travel time. For example, this survey could include factors such as salary and housing expenses, attitudes, perceptions, feelings and experiences about activities and travel, and background factors such as socio-economic-demographic characteristics and biological constraints (see Fig. 6). Moreover, such study could use a finer timescale (e.g. home-0 min, 5 min, 10 min, 15 min and so forth) to avoid problems from very broad discretization of travel time. Earlier studies employing revealed preference data offer initial support to the existence of an acceptable travel time threshold (see He et al, 2016; Clark et al., 2003; Vale, 2013; Van Ommeren et al., 1997). A longitudinal empirical study exploring connections between activities, attitudes, background factors and commuting time could offer additional evidence about this concept. Since time series data sets might be difficult to acquire, a quasi-longitudinal approach could be applied where people would be asked about changes in those factors between time points in the past and today (see Handy et al., 2005; Milakis et al., 2017). A mobility biographies approach could also reveal connections between key changes in the life course of the so-called influencing factors of acceptable travel time (e.g. biological ability, social norms, socio-economic characteristics, residential relocation or job/workplace change) and commuting time (see Scheiner, 2007 and a review of studies using mobility biographies approach here Müggenburg et al., 2015). A critical question, independently of the method, is whether the acceptable travel time concept applies to other trip purposes than commuting. For example, to what extent people consider an acceptable travel time for recreational purposes, visiting friends or relatives?

A third avenue for future research could be the importance of travel time variability (e.g. Kölbl and Helbing, 2003; Gallotti et al., 2015) for

the acceptability of travel times. We hypothesize that a larger variability could reduce the acceptability of a given average travel time, due to the uncertainty in itself, but also due to potential scheduling (of activities) problems.

Finally, a fourth area for future research is potential application of acceptable travel time in transportation planning and transportation projects assessment. For example, how acceptable travel time can be incorporated as behavioural assumption in land use transportation models (see e.g., Moeckel, 2017)? And which could be the possible effects on transportation projects assessment if such a non-linear valuation of travel time would be applied (see e.g., Welch and Williams, 1997)?

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