THE PSYCHOLOGICAL VALUE OF TIME:

TWO EXPERIMENTS ON THE APPRAISAL OF TIME DURING THE TRAIN JOURNEY

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1. INTRODUCTION

The value of time is an important aspect for passengers who undertake a train journey. In transport economics the value of time usually refers to the costs of the time a passenger spends on the journey, and utility is derived from the amount that a passenger is willing to pay in order to save time (Wardman, 2004). From this point of view, it is generally in the interest of passengers to opt for the most convenient (i.e., quick, cheap and effortless) route. Therefore, most railway operators focus on optimization of travel time, for instance by improving train punctuality, frequencies, and scheduling of trains (Wardman, 2004). Much research in the field of public transport takes this approach, and values time as the ratio of the marginal utilities of time and money. As such, travel time is considered as a disutility or cost, but a view is emerging that some people actually enjoy travel time in the act of travel itself, and that travel time can be experienced intrinsically as meaningful and pleasurable (e.g., Jain and Lyons, 2008; Mokhtarian and Salomon, 2001). Although time can be spent on different activities (e.g., work, leisure, travel), people only have a limited amount of time to spent, (i.e., twenty-four hours per day), and they will allocate time and money budgets dependent on context and motivation. Following the pioneering work of Becker (1965) on the allocation of time, it can be postulated that an hour spent on a meaningful activity is more valuable than an hour spent on a less valuable activity (Festjens and Janiszewski, 2015). As such, the value of travel time is not only related to hours and money spent but also to the value of time as experienced by the passenger (Warffemius et al, 2016).

This paper aims to contribute more insight into the subjective experience of time in public transport, and its relation to customer experience among railway passengers. For many railway passengers prevailing goals are to spend time as good as possible. For the *must* passengers (commuters), a train journey typically has an obligatory character and these passengers tend to be task oriented toward attainment of functional goals during their journey (Van Hagen, Galetzka and Pruyn, 2014). Being able to engage in work related activities such as reading and e-mailing during the train journey saves time at the destination, and creates value while travelling. Also for *lust* passengers (leisure, shopping, visiting friends, etc.), travel time is not 'wasted' time either. Some passengers enjoy the trip and scenery intrinsically (just imagine being on the Orient Express), and are more receptive to distraction from time. This, of course, also produces utility, and calls for a more psychological perspective on the value of time (Warffemius et al., 2016).

Studies taking this psychological perspective on time have shown that when people are in a comfortable environment they are not only distracted from time but also have a more positive customer experience (Pruyn and Smidts, 1998; Block and Zakay, 1997). In this paper we present an overview of studies that explore the relationship between objective travel time, subjective appraisal of time and customer experience. More specifically we focus on the effect of distracters from time such as in-train digital signage and background music on customer experience in a more or less comfortable railway environment.

2. SUBJECTIVE APPRAISAL OF TIME

Research and investments in the railway sector have traditionally been aimed at shortening the train journey and optimizing the objective traveling time. Less attention is paid to the subjective appraisal of time among passengers, i.e. how they experience time during their stay at the station and in the train. The idea that there is a difference between objective time and subjective appraisal of time was first identified by the French geologist Michel Siffre who lived in a cave for 2 months without a clock. Although he experienced the time to pass very slowly, he estimated the time spent in the cave to be only about four weeks. Apparently, subjective appraisal of time differed from the actual objective time spent, and was influenced by the conditions within the cave (no clock, no light, low temperature etc.) (Siffre, 1963). The *attentional model of time* (Zakay,1989; Zakay and Block, 1997) builds on the notion that the subjective appraisal of

time is not only determined by clock time (actual objective time) but is also influenced by information processing and the events people experience. The model explains that people perceive time by two processors: 1) temporal processing implies that people are consciously aware of the passing time, and focus on how long a journey takes. When people are strongly focused on time because they are in a rush, time can be considered a disutility, and will be associated with negative emotional experience; 2) non-temporal processing is thinking about things that are not time-related. This type of processing implies that people experience positive emotions when they are distracted from time and able to do something useful or enjoyable. Under these conditions time passes more quickly. On the extreme side, when a person is fully immersed in an activity, temporal experience becomes distorted and one's subjective experience of time is altered and one even loses sense of space and time (Nakamura and Csikszentmihályi, 2009). It can be argued that value of time in terms of utility or disutility depends on how passengers experience time (i.e., positively or negatively). The differentiation between objective (clock) time and the subjective appraisal of time seems promising because it offers an opportunity to influence the psychological value of time.

3. TIME APPRAISAL AT THE NETHERLANDS RAILWAYS

Evidence has shown that taking people's mind off time can positively contribute to both the customer experience and the estimation of time (Hornik, 1993; Pruyn and Smidts, 1998; Thomas and Weaver, 1975). It would therefore be beneficial to make sure that the train journey is designed to take people's mind off the time and enable them to spend their time in a functional or enjoyable way. For instance, Bailey and Areni (2006) showed that background music impacts processing of time and duration estimates. These findings suggest that pleasant surroundings, information, activities and other forms of distraction result in less information being temporarily processed, which in turn enhances the subjective appraisal of time. Recently, nine field and virtual reality studies were conducted within the railway environment of Netherlands Railways (NS) which focused on the role of a distracting (vs non distracting) platform environment (Van Hagen, 2011). NS is a Dutch travel organisation that wants its customers to be able to spend their travel time and time waiting at stations both efficiently and pleasantly. It is their goal that all stations maintain the right balance between travel and waiting, and shopping and services (www.ns.nl).

Three studies focused on the impact of visual environmental stimuli (colour and lighting) in an actual railway station (field study), a virtual reality laboratory, and an online simulation. Three studies focused on the impact of auditive stimuli (background music, musical tempo and musical genre) in an actual railway station and an online visualisation. Three other studies focused on the impact of advertising and digital signage in a field setting and an online visualisation (pace of advertising & programming content) (for a complete overview of the nine studies see: Van Hagen, 2011). These studies showed that passengers spend two-thirds of their time at the station under waiting conditions. Under these –rather tedious- waiting conditions they systematically overestimated the duration of time, but it was not the estimation of time but rather the appraisal of time (i.e., short/long, pleasant/boring) that determined how satisfied passengers were with the service. Overall, it can be concluded that consciously perceived stimuli, such as music, advertising and infotainment, afford distraction from time which means that there is less processing capacity to keep an eye on the time, which – in accordance with the attentional model- then seemed to pass more quickly (Van Hagen, Galetzka and Pruyn, 2014). In this paper we report on the findings of two more recent studies, which focus on the use of digital signage and background music as distracter from time *within* the train.

4. STUDY 1 DIGITAL SIGNAGE ON IN-TRAIN SCREENS

Digital signage is a relatively new medium for distributing in-train content. Positive effects of digital signage on customer perceptions were repeatedly reported by Dennis and colleagues (2010, 2014). Borges, Herter and Chebat (2015) used digital signage as a distracter from waiting time at a drugstore and restaurant, and showed that digital signage reduced perceived time duration (short/long) and increased waiting time satisfaction, especially when content was congruent to the waiting situation (i.e., showing how food is prepared in a restaurant). Shimamura and colleagues (2012) also applied digital signage to a waiting situation at a restaurant and found that the use of digital signage had a positive effect on the appraisal of the time (short/long) and estimates of waiting time (in minutes).

4.1 Method

The present study examined the effect of video content on in-train screens as explicit distracter on the appraisal of time. In an online study, 835 panel

members of the NS Netherlands Railways panel (392 male, age range 17-87 years, Median age 58) participated in a 2 (no advertising vs advertising) x 2 (no tickertape vs tickertape) x 2 (not NS congruent vs NS incongruent) between subjects experiment. The participants were asked to imagine that they were on the train (from Amsterdam to Nijmegen) and that their seat had a view on the screen on the wall of the train. Then they were randomly exposed to one of eight videos (see Figure 1, video length between 03:11 and 03:20 minutes), showing travel information and commercials. In the advertising conditions the video's showed commercials of Mentos and the Sofa company or NS congruent commercials; the no advertising conditions showed no commercials at all. In the NS congruent conditions the commercials were related to NS catering and the NS organisation. The incongruent condition displayed video content of non-related parts of the Netherlands (i.e., paragliding in the dunes), and non-related commercials (Mentos/Sofa Company commercials). The videos had either tickertape at the bottom of the screen (showing time of arrival at the next station), or not .

Figure 1. Screenshot of in-train screens.

After watching the video, participants filled out a questionnaire measuring appraisal of time and customer experience. Appraisal of time was measured on several dimensions. A single item measured the *cognitive appraisal of time* "I thought time was going fast while watching the video" (1 = strongly disagree, 5 = strongly agree). *Hedonic appraisal of time* was measured with 3 items. Participants could indicate on a 5 point scale what they thought of the time they spent while traveling (unpleasant-pleasant, disagreeable-agreeable, nice-not nice, α=.95). *Utilitarian appraisal of time* was also measured with 3 items (useless-useful, valuable, non-valuable-valuable, senseless-sensible, α=.95). *Customer experience* was measured with 6 items (derived from the *pleasure* dimension of Mehrabian and Russell, 1974). Participants could indicate on a 5

point scale how they felt (unhappy-happy, pleased-annoyed, satisfied-unsatisfied, contended-melancholic, hopeful-despairing, relaxed-bored, α=.90).

4.2 Results and discussion

Univariate analyses of variance (ANOVA's) were conducted to measure the effects of advertising video content, NS congruent video content and the use of tickertape on cognitive, hedonic and utilitarian appraisal of time, and pleasure. The presence of advertising had main effects on the cognitive appraisal of time (F(1,893)=8.44, p<.01), hedonic appraisal of time (F(1,893)=9.34, p<.01), utilitarian appraisal of time (F(1,893)=16.63, p<.001), and pleasure (F(1,893)=9.37, p<.01). Main effects of tickertape were found for the hedonic appraisal of time (F(1,893)=5.0, p<.05) and pleasure (F(1,893)=4.57, p<.05). Main effects of congruency were non-significant.

Table 1.
Mean scores (and standard deviations) in the advertising/no advertising, tickertape/no-tickertape and NS congruent/NS non-congruent conditions

	Advertising	No advertising
	M (SD)	*M (SD)*
Cognitive appraisal of time	2.44 (1.08)	2.65 (1.10)
Hedonic appraisal of time	2.71 (1.08)	2.93 (1.02)
Utilitarian appraisal of time	2.49 (1.08)	2.78 (1.03)
Pleasure	2.80 (.80)	2.96 (.78)
	Tickertape	**No tickertape**
	M (SD)	*M (SD)*
Cognitive appraisal of time	2.51 (1.11)	2.59 (1.08)
Hedonic appraisal of time	2.71 (1.08)	2.93 (1.02)
Utilitarian appraisal of time	2.57 (1.04)	2.70 (1.08)
Pleasure	2.82 (.78)	2.94 (.81)
	NS congruent	**NS non-congruent**
	M (SD)	*M (SD)*
Cognitive appraisal of time	2.57 (1.07)	2.53 (1.12)
Hedonic appraisal of time	2.79 (1.05)	2.85 (1.06)
Utilitarian appraisal of time	2.61 (1.05)	2.65 (1.07)
Pleasure	2.87 (.80)	2.90 (.79)

As can be seen in Table 1, the use of advertising was not appreciated as the no-advertising conditions resulted in time going faster, time being considered as more useful and pleasant, and resulting in more pleasure than when advertising was used. The same goes for the use of tickertape.

The effects of advertising were qualified by interactions with tickertape for utilitarian appraisal of time (F(1,893)=6.87, p<.01), hedonic appraisal of time

(*F*(1,893)=8.32, *p*<.01), and pleasure (*F*(1,893)=5.02, *p*<.05). As can be seen in Figure 2, only in absence of advertising and tickertape, digital signage had a positive impact on utilitarian ($p < .01$) and hedonic ($p < .001$) appraisal of time and pleasure ($p < .01$).

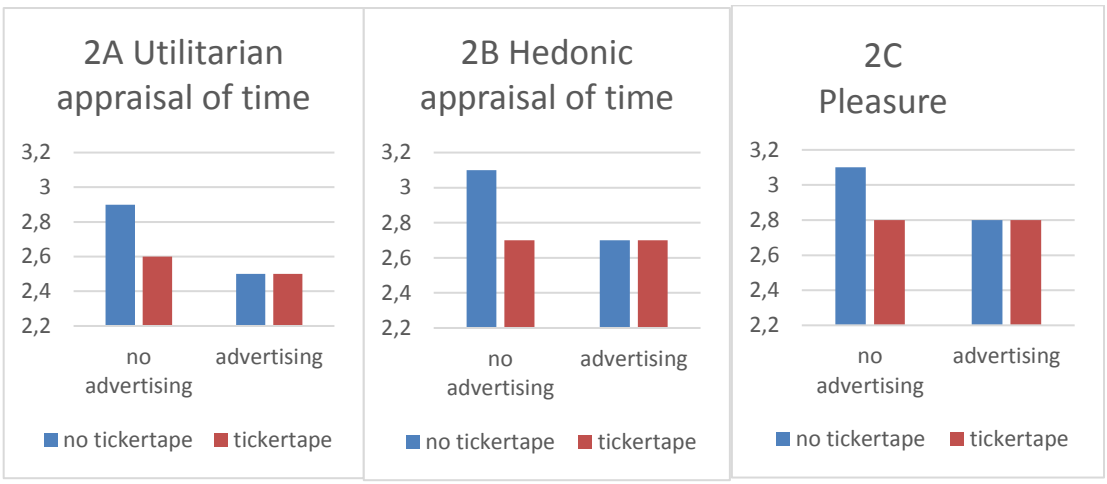

Figure 2. Interaction effects of advertising and the use of ticker tape on utilitarian (2A) and hedonic (2B) appraisal of time and pleasure (2C).

Overall, the results of this study show that digital signage as a distracter impacts both appraisal of time and customer experience, but that the effects strongly depend on the content of the digital screens. Based on the current findings it would be recommended to stay away from advertising. When asked to indicate their preference for what they would like to see, participants indicated they would prefer travel information, news items and weather reports on the digital signage screens in-train.

5. STUDY 2 BACKGROUND MUSIC IN A CLEAN ENVIRONMENT

Background music is an ambient environmental variable which is capable of evoking complex emotional, cognitive and physiological responses (e.g., Grewe et al, 2007; Magnini and Parker, 2009; Tansik and Routhieaux, 1999). Studies have revealed that music influences the experience of time (e.g., Bailey and Areni, 2006; Kellaris and Kent, 1992; Kellaris, Mantel and Altsech, 1996; Yalch and Spangenberg, 2000), but the area has been plagued by contradictory findings. Naturally, the effects of music vary dependent on the type of music manipulation (e.g., genre, tempo, pitch, and mode; see Bruner 1990 for a review), and context in which the music is perceived. The present study takes in a special context variable, cleanliness of the environment, and explores how music tempo and cleanliness influence appraisal of time and approach simultaneously. Although literature does not provide direct evidence for the relation between cleanliness and time experience, it can be argued that clean environments will be perceived as more comfortable than unclean environments. Based on the notion that in comfortable environments, people tend to enjoy the situation and have a more positive experience when they are distracted from time, we argue that background music as a distracter from time will have a positive effect on customer experience, but only in clean – comfortable- conditions (as opposed to unclean conditions).

5.1 Method

This study employed a 3 (background music: no music vs slow tempo vs high tempo) x 2 (cleanliness: unclean vs clean train compartments) between subjects design. Participants (*N*=123, 41% male, mean age 47 years, *SD* = 19.2 years) were invited to a mock-up of a compartment of a sprinter train of NS, and asked to imagine that they were on a train journey from Stoevaart to Beumen (12 minute ride). During the 12 minute ride background music was played. The participants were randomly assigned to one of the music conditions (no music, < 72 BPM songs or > 94 BPM songs) in either a clean or unclean compartment (see Figure 3). When the participants arrived in Beumen, they completed a questionnaire while they were still in the compartment (with background music being played dependent on the condition they were in).

Appraisal of time was measured on several dimensions. *Time estimation* was measured by asking the participants to estimate the travel time (in minutes) that passed from the moment they departed until arrival in Beumen. *Cognitive appraisal of time* was measured with a single item (derived from Pruyn and

Smidts, 1998) that asked the participants to assess the duration of their journey on a 7-point scale (1 = very short, 7 = very long). *Affective appraisal of time* was measured with 5 items. Participants could indicate their affective response towards time, such as enjoyable, annoying, boring, cosy and stressful (α =.70). *Approach* was measured with 5 items (derived from Mehrabian and Russell, 1974, α =.91). Examples of items are "I would return to this compartment" and "I would recommend travelling in this particular compartment to others (1 = highly disagree, 7 = highly agree).

Figure 3: Photos of the unclean and clean compartment

5.2 Results

Between subjects ANOVA's were used to investigate the effects of background music and cleanliness on appraisal of time and approach. The ANOVA's revealed significant main effects of cleanliness on estimates of time ($F(1,117)=4.05$, $p<.05$) and approach intentions ($F(1,117)=15.59$, $p<.001$). The main effects showed that under clean conditions estimates of travel time were significantly lower (and also more accurate) (M_{clean}=12.66 minutes, SD=3.99) than under unclean conditions ($M_{unclean}$=14.64 minutes, SD=6.31). Approach intentions were also higher under clean conditions (M_{clean}=5.29, SD=1.08) than under unclean conditions ($M_{unclean}$=4.43, SD=1.31).

Although the main effects of background music were all non-significant, significant interactions were found in combination with cleanliness for affective appraisal of time ($F(2,117)=9.91$, $p<.001$) and approach intentions

(*F*(1,117)=3.01, *p*=.05). Follow up analysis indicated that slow tempo music resulted in more positive appraisal of time under clean conditions (as opposed to unclean conditions, *p*<.01). As can be seen in Figure 4 a similar effect was found for approach intention (*p*<.01). However, fast music resulted in more positive appraisal of time under unclean conditions (as opposed to clean conditions. *p*<.01). These effects were non-significant for the no music conditions.

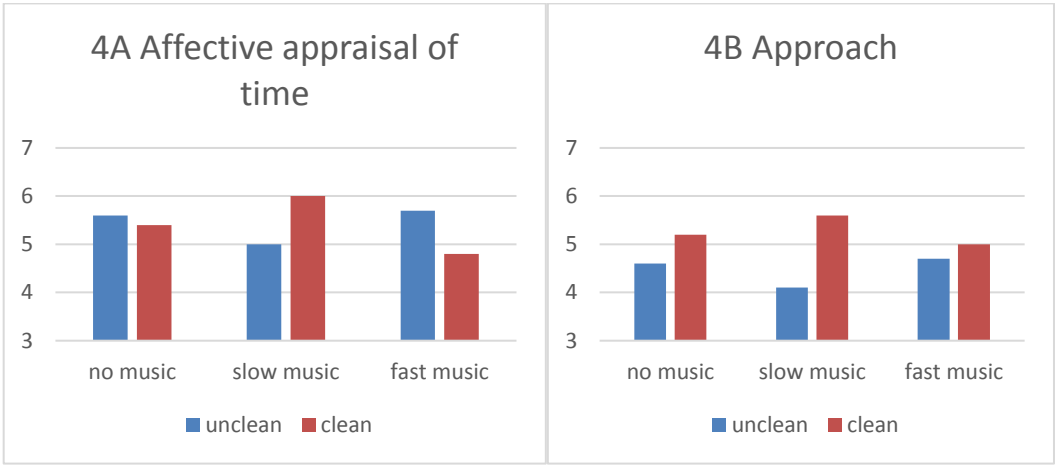

Figure 4. Interaction effects of background music and cleanliness on affective appraisal of time (4A) and approach (4B).

From the findings it can be concluded that passengers estimate travel time as shorter in clean (i.e., more comfortable) conditions compared to unclean conditions. Congruence between the arousal levels of music and cleanliness (slow tempo+clean environment or fast music+unclean environment) seemed to enhance the appraisal of time (as being more enjoyable and resulting in approach intentions). Cleanliness seems to be the key predictor of the experience of time during a train journey.

6. DISCUSSION

The studies demonstrated that time perceptions and travel experience can be influenced but that the effects of digital signage and background music depend on varying conditions. Showing entertaining or informative content on digital screens, hearing slow music in a clean environment or hearing fast music in an unclean environment afforded distraction from time and a more pleasant travel experience among railway passengers. These results are in sync with the attentional model discussed in paragraph 2.

In the infotainment study we see that adding information about travel time with a tickertape, makes passengers (consciously) more aware of the (passing) of time which has a negative influence on the appraisal of time. In the (affective) condition without advertisement and information it appears that passengers are (unconsciously) distracted from time perception which leads to positive emotions and a higher utilitarian and hedonic appraisal of time.

The interaction results from the music study in a clean and unclean environment show that a clean (i.e., comfortable) environment initiates approach behaviour and a positive appraisal of time, especially when distracted by slow music. The affective and unconscious reactions might be that in a clean, low arousing environment, the low arousing musical stimuli are congruent with the neat environment and gives the passengers a relaxed feeling. A relaxed state of mind is a positive emotional situation and under these circumstances people have a higher affective appraisal of time (Van Hagen, 2011). However when music tempo is high, passengers are more stimulated and a clean environment may not be experienced in sync with the created high arousal environment, while a less clean environment might (because of the extra visual stimuli) be more congruent in these circumstances. In both (congruent) situations passengers are unconsciously distracted from the travel time and have a higher appraisal of time, which can successfully be explained by the attentional model (Zakay and Block, 1997).

Overall, the findings shed light on the role of distraction under various journey conditions, and its impact on the customer experience and the appraisal of time by railway passengers. Exploiting the idea that travel time is able to create value can be an opportunity for the public transport industry. Further research, both in field and laboratory settings, is needed to investigate the impact of distraction as a means to re-direct the goal oriented focus on time, and make people enjoy their train journey, thus enhancing the psychological value of time.

REFERENCES

Bailey, Nicole, and Areni, Charles S. (2006) When a few minutes sound like a lifetime: Does atmospheric music expand or contract perceived time? *Journal of Retailing,* **82** (3) 189 - 202.

Becker, Gary S. (1965) A theory of the allocation of time, *The Economic Journal*, **75** (299) 493-517. doi: 10.2307/2228949

Block, R.A., and Zakay, D. (1997) Prospective and retrospective duration judgements: A meta-analytic review, *Psychonomic Bulletin & Review, **4*** 184-197.

Borges, A., Herter, M. M., and Chebat, J. C. (2015) “It was not that long!”: The effects of the in-store TV screen content and consumers emotions on consumer waiting perception, *Journal of Retailing and Consumer Services*, ***22*** 96-106.

Bruner, G. C. (1990) Music, mood, and marketing, *Journal of Marketing*, ***54*** (4) 94-104.

Cameron, M. A., Baker, J., Peterson, M., and Braunsberger, K. (2003) The effects of music, wait-length evaluation, and mood on a low-cost wait experience, J*ournal of Business Research, **56*** (6) 421-430. doi: 10.1016/s0148-2963(01)00244-2

Dennis, C., Joško, Brakus, J., Gupta, S., and Alamanos, E. (2014) The effect of digital signage on shoppers' behavior: The role of the evoked experience, *Journal of Business Research,* **67** (11) 2250-2257.

Dennis, C., Newman, A., Michon, R., Brakus, J. J., and Wright, L. T. (2010) The mediating effects of perception and emotion: Digital signage in mall atmospherics, *Journal of Retailing and Consumer services*, ***17*** (3) 205-215.

Festjens, Anouk, and Janiszewski, Chris. (2015) The Value of Time, *Journal of Consumer Research*, **42** (2) 178-195. doi: 10.1093/jcr/ucv021

Grewe, O., Nagel, F., Kopiez, R., and Altenmüller, E. (2007) Listening to music as a re-creative process: Physiological, psychological, and psychoacoustical correlates of chills and strong emotions, *Music Perception*, ***24*** (3) 297-314.

Hornik, J. (1993) The role of affect in consumers' temporal judgments, *Psychology & Marketing*, ***10*** (3) 239-255.

Jain, Juliet, and Lyons, Glenn. (2008) The gift of travel time, *Journal of Transport Geography*, **16** (2) 81-89. doi: 10.1016/j.jtrangeo.2007.05.001

Kellaris, J. J., and Kent, R. J. (1992) The influence of music on consumers' temporal perceptions: does time fly when you're having fun? *Journal of consumer psychology*, ***1*** (4) 365-376.

Kellaris, J. J., and Mantel, Susan R.J., and Altsech, M.B. (1996) Decibels, disposition, and duration: The impact of musical loudness and internal states on time perceptions, *Advances in Consumer Research,* ***23*** (1) 498-503.

Magnini, V. P., and Parker, E. E. (2009) The psychological effects of music: Implications for hotel firms, *Journal of Vacation Marketing*, ***15*** (1), 53-62.

Mehrabian, A., and Russell, J. (1974) *An Approach to Environmental Psychology*, MIT Press, Cambridge.

Mokhtarian, P. L., and Salomon, I. (2001) How derived is the demand for travel? Some conceptual and measurement considerations, *Transportation Research Part A: Policy and Practice*, ***35*** (8) 695-719. doi: 10.1016/S0965-8564(00)00013-6

Nakamura, J., and Csikszentmihályi, M. (2009) Flow theory and research. In S. J. Lopez. & C. R. Snyder (Eds.), *Oxford Handbook of Positive Psychology* (pp. 195-206), Oxford University Press, New York.

Pruyn, Ad, and Smidts, Ale. (1998) Effects of waiting on the satisfaction with the service: Beyond objective time measures, *International Journal of Research in Marketing*, **15** (4) 321-334.

Shimamura, Takeshi, Kaihara, Toshiya, Fujii, Nobutada, and Takenaka, Takeshi. (2013) Improving customer's subjective waiting time introducing digital signage. In C. Emmanouilidis, M. Taisch & D. Kiritsis (Eds.), *Advances in Production Management Systems*. Competitive Manufacturing for Innovative Products and Services: IFIP WG 5.7 International Conference, APMS 2012, Rhodes, Greece, (pp. 385-391), Springer Berlin Heidelberg, Berlin.

Siffre, M. (1963) *Hors du temps,* Paris, 1963.

Tansik, D. A., and Routhieaux, R. (1999) Customer stress-relaxation: The impact of music in a hospital waiting room, *International Journal of Service Industry Management*, ***10*** (1) 68-81.

Thomas, Ewart, A. C., and Weaver, Wanda B. (1975) Cognitive processing and time perception, *Perception & Psychophysics,* **17** (4) 363-367. doi: 10.3758/bf03199347

Van Hagen, M. (2011) *Waiting Experience At Train Stations* (Dissertation), University of Twente, Enschede.

Van Hagen, M., Galetzka, M., and Pruyn, A. (2014) Waiting experience in Railway environments, *Journal of Motivation, Emotion and Personality*, **3** 41-55. doi: 10.12689/jmep.2014.305

Wardman, M. (2004) Public transport values of time, *Transport policy, **11*** (4) 363-377.

Warffemius, P., Van Hagen, M., De Bruyn, M., Bakker, P., and Van der Waard, J. (2016) The value of comfort in train appraisal. In *European Transport Conference 2016,* Association for European Transport (AET).

Yalch, R. F., and Spangenberg, E. R. (2000) The effects of music in a retail setting on real and perceived shopping times, *Journal of Business Research, **49*** (2) 139-147.

Zakay, D. (1989) Subjective time and attentional resource allocation: An integrated model of time estimation, *Advances in Psychology, **59*** 365-397.

Zakay, D. and Block, R.A. (1997). Temporal cognition, *Current Directions in Psychological Science, **6*** (1) 12-16.