Applying affective event theory to explain transit users' reactions to service disruptions

Rumana Islam Sarker[1*], Sigal Kaplan[2], Markus Mailer[1] & Harry J. P. Timmermans[3]

[1]*Unit for Intelligent Transport Systems, University of Innsbruck, Austria*
[2]*Department of Transport, Technical University of Denmark*
[3]*Urban Planning Group, Eindhoven University of Technology, Eindhoven, The Netherlands*

1. Introduction

According to Edvardsson (1998) *"Dissatisfaction and complaints do not begin, there is always an event beforehand"*. This study applies the Affective Events Theory (AET, Weiss and Cropanzano, 1996) to explain the behavioral motivators underlying the relations between operational service disruptions and intentions to reduce transit use. AET postulates that affective reactions to events and their associated affect driven behaviors are motivated by event characteristics, the organizational, social or service climate in which these events occur and personal dispositions.

The contribution of the current study is four-fold. Firstly, previous studies offered an independent view of the effect of information, customer care, event frequency and individual access to alternative modes on reduced transit use due to perceived unreliability. While passenger satisfaction was found to relate to service reliability and the organizational climate including customer care, information simplicity and system design (Friman et al., 2001), there is a gap in understanding the link between the organizational climate and affective responses to service disruptions. AET fills this gap by offering a rigorous behavioral framework explaining how these factors jointly affect transit users' affective reactions to disruptions. Secondly, while empirical applications of AET are rare and mostly aimed at explaining work-related experiences, the current study is the first to apply AET to a transit service context. Thirdly, Edvardsson (1998) noted that while service disruptions could cause passenger dissatisfaction, most often this will not translate into complaints or transit use discontinuity. Papangelis et al. (2016) noted that following disruptions individuals either resume their normal travel patterns or engage in new travel behavior change. This study offers an explanation to the choice between staying and enduring, complaint behavior and reduced transit use by showing that transit users' reactions are related to the service climate and frequency of undesired incidents.

2. Methods

2.1 The behavioral framework

The behavioral framework applied in this study is presented in Figure 1. Among the six categories of primary emotions suggested by the AET as possible affective reactions, this study considers anger and frustration as the most common emotions associated with service disruptions (Edvardsson, 1998; Watkins et al., 2011; Pender et al., 2014; Papangelis et al., 2016). Within the transit service context, according to AET, the organizational climate experienced by passengers is characterized by service quality (Friman et al., 2001; de Oña et al., 2013). In this study, we consider personnel behavior (i.e. courtesy, empathy, respect), system design (network coverage, operating hours, information, vehicles and facilities), operator efficacy (considering user needs, responsiveness, reliability and quality assurance), and overall satisfaction with the transit system.

As overt behavior in response to service disriptions we adopt the responses suggested by Edvardsson (1998) to passenger dissatisfaction: voicing complaints and/or temporary transit use discontinuity versus a ‘staying and enduring’ option of continued transit use. The relation between affective reaction, complaint behavior and intentions to avoid transit use is encapsulated by the Hirschman (1970) exit-voice-loyalty framework, previously applied to explain consumer dissatisfaction about an airline service in a laboratory setting (Maute and Forrester, 1993). The framework identifies exit, voice and loyalty as three possible reactions to adverse events. Exit is a strategic or tactical choice to dissociate oneself from the object of dissatisfaction. Voice is an active response aimed at inducing systematic change manifested as complaint behavior. Loyalty refers to a lack of behavioral response to dissatisfaction. According to the theory, voicing and exit response are interrelated, although the relationship can be either complementary or substitutional (Weiss and Beal, 2005). In the case of transit users, some are transit captives for whom opt out option may be more difficult versus complaint behavior or staying or enduring. Thus all three responses depend on volitional control of the individual according to their mobility resources, perceived difficulties and social norms within a certain context (Paul, 1992). Within the transit service context, ‘exit’ translates into mode switching behavior and reduction in transit use following service disruptions. In the transit service context, loyalty implies that travel behavior will remain unchanged despite service disruptions. The strength of voicing complaints in the case of service disruptions is obvious from looking at data from social media (Pender et al., 2014; Casas and Delmelle, 2017), while exit behavior is manifested by reduced ridership and mode switching behavior in response to service disruptions (Chakrabarti, 2015; Chakrabarti and Giuliano, 2015).

AET postulates that overt behavior is driven by affective reactions in addition to judgement. Hence, AET helps to explain the observation of Edvardsson (1998) and Papangelis et al. (2016) pointing out the mismatch between affective reactions to service disruptions and overt behavior in response to these disruptions.This study considers individual characteristics and trip attributes as possible antecedents of affective reactions and overt behavior. In line with Ettema et al. (2012), we consider individual socio-demographics, in-vehicle activities related to transit satisfaction, trip purpose, location and leg duration. The socio-demographics are related to mobility resources influencing the volitional control and the ability to exit versus voicing complaints or staying and enduring. As suggested by Carrel et al (2013), bicycle and car availability is employed as an additional individual disposition. Lastly, normative goal framing is possibly a motivational factor for transit use (Lindenberg and Steg, 2007; Bamberg et al., 2007). Thus, in this study we consider the role of transit involvement for environmental reason on affective reaction and behavioral response to service disruptions. The following research hypotheses stem from the behavioral framework:

H1: Higer frequency of service disruptions is associated with ‘hot’ emotions of anger and frustration

H2: Perceived high quality organizational climate is hypothesized to mitigate ‘hot’ emotions of anger and frustration associated with negative stimulus events.

H3: Stronger negative affective reactions are associated with a stronger tendency to voice complaints

H4: Greater intention to voice complaints is associated with lower exit intentions of avoiding transit on the next trip

H5: Individual and situational trip characteristics are associated with variation in the affective state and with the behavioral outcome of voicing complaints and avoiding the next transit trip

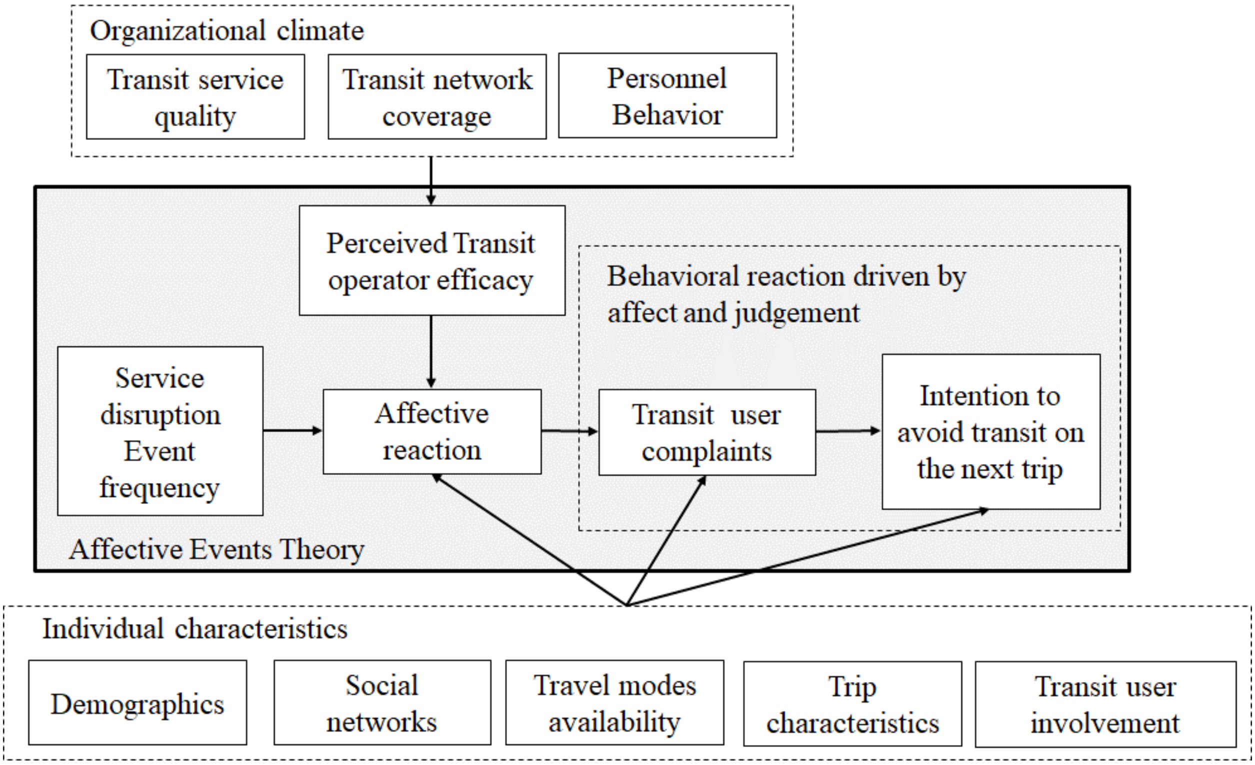

Figure 1: Behavioral framework for explaining transit user reactions to service disruptions

2.2 Survey design and administration

The data for investigating the research hypotheses was collected using a tailor-made survey developed in collaboration with the regional transit operators in Innsbruck (Innsbrucker Verkehrsbetriebe, IVB) and Tirol (Verkehrsverbund Tirol, VVT).While the regional transit operators conduct annual passenger satisfaction surveys, this survey is the first in the Tirol region to collect information regarding transit user reactions to service disruptions. The items were elicited using a 5-point likert scale. Four types of service disruption were addressed in the survey: line cancellations, non-functioning ticket machines, vehicle failure and missed transit connections. Participants were asked about their frequency of transit mode use and the frequency of travelling by alternative modes (car, bike), trip characteristics, in-vehicle activities, trip location, and payment method. The socio-economic attributes include age, gender, and employment status. The daily activity rhythm varying between hectic to active and relaxed was also elicited as a possible precursor to frustration due to service disruptions. The survey was administered in Innsbruck, Austria in German and English during August 2017 on board and through the official websites of the transit operators. The on-board survey covered 70% of the city lines, 4 out of 6 of the suburban train lines, 40% of the regional bus lines and the regional train line. The buses to board were randomly chosen by the surveyors using the "first vehicle" strategy, which takes into account stratification by line frequency.

2.3 Mathematical model

A structural equations model (SEM) served for the estimation of the behavioral framework for explaining transit user reactions to service disruptions as represented in Figure 1. The model contains measurement equations linking the latent motivational factors to observed indicators (eq. 1) and structural equations linking the latent factors to individual characteristics (eq. 2), and structural equations relating the motivational factors to complaining and avoiding using transit on the next trip (eq. 3).

$$I_{dn} = Z^*_{ln}\alpha_d + \upsilon_{dn} \quad and \quad \upsilon_n \sim N\left(0, \Sigma_\upsilon\right) \quad for\ d = 1,...,D \quad (1)$$

$$Z^*_{ln} = SC_{ln}\beta_l + \omega_{ln} \quad and \quad \omega_n \sim N\left(0, \Sigma_\omega\right) \quad for\ l = 1,...,L \quad (2)$$

$$R^*_{in} = Z^*_{ln}\beta_r + \xi_{in} \quad and \quad \xi_n \sim N\left(0, \Sigma_\xi\right) \quad for\ i = 1,...,I \quad (3)$$

Where Z^*_{ln} is the value of latent construct l for individual n, I_{dn} is the value of an indicator d of the latent construct Z^*_{ln}, SC_{ln} is a vector of socio-economic characteristics, and R_{in} is a vector of intentions to avoid transit on the next trip . Error terms are expressed as elements υ_{dn}, ω_{ln}, and ξ_{in} of the vectors following a normal distribution with respective covariance matrices Σ_ω, Σ_υ, and Σ_ξ, while parameters to be estimated are α_d, β_l and β_r. There are D measurement equations estimating a $(D\times 1)$ vector α of parameters. L latent constructs translate into estimating a $(M\times L)$ matrix of β parameters. The model was estimated with M-Plus.

3. Results and discussion

In total, the survey yielded 1,629 complete responses (95.8% response rate). The on-board survey yielded 55% completed questionnaires. Table 1 presents the sample characteristics, which are compared to results available from the IVB 2016 official customer survey (ÖPNV-Kundenbarometer, 2016). The age distribution in this study is in line with the documented age structure of transit users in Innsbruck. Nevertheless, in the current survey there is a higher rate of pupils and students (39% versus 23%) and a lower rate of senior citizens (11% versus 24%) compared to the official customer survey. Notably, both the car and the bicycle are used in parallel to public transport by a significant share of the sample. Thus transit users in our sample have car and bicycle availability and can choose to switch from transit to other modes, at least occasionally upon the occurrence of a critical incident. When asked regarding normative goal framing 16% strongly agreed and 19% agreed with the sentence “I travel with public transport because of environmental reasons” while 31% strongly disagreed and 14% disagreed. Thus, 35% show user involvement.

Variable	**Categories (%)**					
Gender	**Male**	**Female**				
	33	67				
Age	**18-20**	**21-25**	**26-30**	**31-35**	**36-40**	**>40**
	17	25	17	9	7	25
Travel party	**Alone**	**Friends**	**Parents**	**Partner**	**With children**	

	83	9	0	3	5	
Employment status	**Full-time**	**Part-time**	**Pupil/ student/ apprentice**	**Retired**	**Other**	
	35	11	39	11	4	
Daily rhythm	**Hectic**	**Active**	**Relaxed**			
	12	63	25			
Trip location	**IBK* City**	**IBK Land**	**Others**			
	68	22	10			
Transit mode		**Once a month**	**2-3 times/ month**	**Once a week**	**2-4 times/ week**	**Daily**
	Bus/Tram	21	10	9	24	36
	Regional Bus	58	8	8	12	14
	Suburban Train	68	10	7	9	6
Non-transit modes		**Once a month**	**2-3 times/ month**	**Once a week**	**2-4 times/ week**	**Daily**
	Car	47	7	12	22	12
	Bicycle	50	7	8	15	20
Ticket options	**Yearly**	**Semester**	**Other**			
	50	18	32			
Daily travel duration	**<15 min**	**16-30**	**31-45**	**46-60**	**>60**	
	14	31	22	17	16	

*IBK=Innsbruck

Table 1: Individual characteristics

3.2 Service climate perceptions and reaction to service disruptions

Table 2 details the responses to questions regarding the transit service climate. The service climate perceptions are in agreement with the results from the IVB 2016 official customer survey, showing generally high satisfaction with the transit system.

Network coverage and overall satisfaction In the current study, roughly 77-79% of the respondents agree that they are happy with the transit system and that it caters to their needs. From the official survey results, 91% are satisfied with the overall transit service quality.

Punctuality and reliability In our study, 62% agree that buses and trams are generally on time, compared to 84% in the official survey who are satisfied with the punctuality and reliability of their main transit mode.

Tangibles (vehicles and stops) In our survey, 85% of the respondents perceive the vehicle fleet as clean and comfortable, compared to 94% in the official survey who are satisfied with the cleanliness and “smartness” of the vehicles.

Personnel behavior The results in the current survey show that 77% agree that drivers are courteous, respectful and empathic to user needs. From the official survey, 86% are satisfied with the drivers’ friendliness.

Information provision In our study, 80% perceive transit information as easily available and reliable. From the official survey, 71% are satisfied with the operators’ home page, 89% are satisfied with the information provided inside the vehicles; 84% are satisfied with the transit information app. From our survey, 74% perceive that the operators communicate service disruptions well. From the official survey, 89% are satisfied with the in-vehicle announcements and 78% are satisfied with information at transit stops concerning disruptions or delays.

	Strongly disagree	Disagree	neutral	Agree	Strongly agree
Network coverage and quality	**(%)**	**(%)**	**(%)**	**(%)**	**(%)**
Lines are well distributed around the city	0	0	7	34	59
Stations are at convenient locations	0	1	10	40	49
Transit lines have a high frequency	2	5	22	36	35
Operating hours are convenient	3	7	23	36	31
Bus/train lines are on time	4	8	26	37	25
Vehicles are clean and comfortable	1	3	11	38	47
Stations have proper facilities	2	9	27	28	34
Transit information is easily available	4	3	14	31	48
I am satisfied with the overall quality of the system	3	4	14	39	40
The system satisfy mobility needs	3	5	15	40	37
	Strongly disagree	**Disagree**	**neutral**	**Agree**	**Strongly agree**
Personnel behavior	**(%)**	**(%)**	**(%)**	**(%)**	**(%)**
Drivers are courteous	1	4	18	42	35
Conductors handle users respectfully	1	5	18	41	35
Drivers are empathic to user’s needs	2	7	23	37	31
Personnel prioritizes handling complaints	27	34	26	8	5
	Strongly disagree	**Disagree**	**neutral**	**Agree**	**Strongly agree**
Operator efficacy	**(%)**	**(%)**	**(%)**	**(%)**	
Operator provides reliable information	0	3	16	49	32
Operator provides high-quality service	1	4	18	43	34
Operator considers user's needs	1	6	26	37	30
Operator provides alternative service when there is a problem	3	7	26	33	31
Personnel assists coping with disruptions	2	7	28	34	29

Table 2: Perceived transit service climate

Table 3 shows the perceptions of service disruptions. The IVB 2016 official customer survey does not include information about service disruptions. In our study, 64% perceive that missed connections occur rarely or never, compared with 87% who are satisfied with the line transfer connections in the official survey. In our study, 74% state that non-functioning ticketing machines occur rarely or never, compared with 60% who are satisfied with the functioning of the ticketing machines in the official survey.

	Never	Rarely	Sometimes	Often	Very often
Service disruption events	**(%)**	**(%)**	**(%)**	**(%)**	**(%)**
Sudden bus/train cancellation	27	48	21	2	2
Not-functioning ticket machine	48	26	18	6	2
Technical failure of the bus/train	42	42	13	3	0
Missed connection of next bus/train	38	26	21	11	4
	No Problem	**Bothered**	**Very upset**	**Extremely angry**	
Affective (emotional) reaction	**(%)**	**(%)**	**(%)**	**(%)**	
Sudden bus/train cancellation	23	24	42	11	
Not-functioning ticket machine	47	22	24	7	
Technical failure of the bus/train	45	38	14	3	
Missed connection of next bus/train	28	16	36	20	
	Highly unlikely	**Unlikely**	**Neutral**	**Likely**	**Highly likely**
Behavioral reaction: the likelihood of complaining to the operator upon event occurance	**(%)**	**(%)**	**(%)**	**(%)**	**(%)**
Sudden bus/train cancellation	52	22	10	11	5
Not-functioning ticket machine	59	17	10	10	4
Technical failure of the bus/train	68	19	10	2	1
Missed connection of next bus/train	52	18	11	14	5
Behavioral reaction: avoiding public transport on the next trip	**Take car or other modes**	**Continue using public transport**			
Sudden bus/train cancellation	17	82			
Not-functioning ticket machine	8	92			
Technical failure of the bus/train	7	93			
Missed connection of next bus/train	17	82			

Table 3: Service disruptions frequency and transit user reactions

3.3 Model results

The analysis included exploratory factor analysis followed by a confirmatory factor analysis and SEM estimation. Scale validity, reliability and sample adequacy were tested and confirmed using Cronbach's alpha = 0.929 and KMO = 0.921, confirming its suitability for factor analysis and SEM estimation. Principal axis factoring with Kaiser normalization yielded four transit service climate factors labelled 'Network coverage', 'Personnel behavior', 'Service quality' and 'Operator efficacy'. The SEM analysis was conducted both considering each event separately and together, obtaining similar results. The estimated model for the affective and behavioral reactions validates the proposed framework and shows an excellent goodness of fit (CFI=0.948) and Root Mean Square of Approximation within the acceptable range (RMSA=0.051). Table 4 presents the measurement equations derived from the factor analysis and Table 5 shows the structural equations of the model linking the perceived service climate and event frequency to the affective and behavioral transit user reactions.

Transit personnel behavior	est.	t-stat
Drivers are courteous	1.000	-
Conductors handle users respectfully	1.304	13.33
Drivers are empathic to user’s needs	0.827	20.09
Personnel prioritizes handling complaints	0.841	15.64
Transit network coverage	**est.**	**t-stat**
Lines are well distributed around the city	1.000	-
Stations are at convenient locations	0.974	16.00
Regional lines have a high frequency	1.128	15.02
Operating hours are convenient	0.999	14.73
The overall system quality is good	2.682	11.59
The system satisfies my mobility needs	2.225	13.99
Transit operator efficacy	**est.**	**t-stat**
Operators provide reliable information	1.000	-
Operators provide high-quality service	1.688	16.27
Operators consider user's needs	1.863	16.25
Operators provide alternative service when there is a problem	1.519	17.39
Personnel assist coping with service disruptions	1.619	17.20
Operators communicate service disruptions	1.078	19.66
Transit service quality	**est.**	**t-stat**
Bus/train lines are on time	1.000	-
Vehicles are clean and comfortable	1.101	13.76
Stations have proper facilities	1.174	14.13
Transit information is easily available (e.g.at stations, apps)	0.767	14.30
Service disruption events	**est.**	**t-stat**
Sudden line cancellation	1.000	-
Not functioning ticket machine	1.134	11.94
Technical failure of the bus/train	0.545	11.14
Missed connection of next bus/train	1.485	12.30
Affective reaction	**est.**	**t-stat**
Sudden bus/train cancellation	1.000	-
Not-functioning ticket machine	0.725	14.11
Technical failure of the bus/train	0.615	14.83
Missed connection of next bus/train	1.239	14.27
Behavioral reaction: complaints	**est.**	**t-stat**
Sudden bus/train cancellation	1.000	-
Not-functioning ticket machine	0.786	13.52
Technical failure of the bus/train	0.805	14.59
Missed connection of next bus/train	1.037	13.58
Behavioral reaction: transit avoidance on the next trip	**est.**	**t-stat**
Sudden bus/train cancellation	1.000	-
Not-functioning ticket machine	0.538	4.30
Technical failure of the bus/train	0.504	4.32
Missed connection of next bus/train	0.663	4.28

Table 4: Measurement equations

The results reported in Table 5 confirm the proposed AET framework. A better perceived transit operator efficacy and lower perceived event frequency is related to a lesser extent of negative emotions (being upset or angry) associated with service disruptions thus confirming hypotheses H1 and H2. Operator efficacy is mainly associated with service quality and the network, while the effect of personnel behavior on the perceived operator efficiency is significant but relatively marginal. Higher complaint behavior relates to stronger negative emotions of being upset or angry thus confirming hypothesis H3. Greater intention to voice complaints is associated with lower intentions to avoid transit on the next trip, thus confirming hypothesis H4.

Transit operator efficacy	**est.**	**t-stat**
Transit personnel behavior	0.085	8.29
Transit network coverage	0.285	10.32
Transit service quality	0.480	11.24
Affective (emotional) reaction of being upset or angry	**est.**	**t-stat**
Transit operator efficacy	-0.375	-7.65
Service disruption events	0.970	11.25
Transit user's involvement– normative goal framing (i.e., using transit because of environmental reasons)	0.488	5.94
Car	0.335	4.28
Bike	0.624	7.46
Social media engagement	0.217	2.61
Average transit travel time (31-45 min)	-0.176	-1.87
Average transit travel time (46-60 min)	-0.201	-1.87
Complaining about the service	**est.**	**t-stat**
Affective (emotional) reaction (feeling upset or angery)	0.752	13.61
Age (18-20 years)	-0.274	-2.56
Retired	-0.846	-4.60
Relaxed	-0.550	-5.40
Transit avoidance on the next trip	**est.**	**t-stat**
Complaining about the service (voicing complaints)	-1.387	-5.21
Trip purpose – Work	0.620	2.75
Spend time watching *Infoscreen* in the Bus/Tram	-0.503	-2.29
Travel region- IBK City	0.736	2.63
Transit network coverage	**est.**	**t-stat**
Transit personnel behavior	1.043	11.19
Transit service quality	**est.**	**t-stat**
Transit personnel behavior	1.370	12.50
Transit network coverage	0.659	12.04
Service disruption events	**est.**	**t-stat**
Transit personnel behavior	-0.969	-11.01
Transit network coverage	-0.488	-11.62
Transit service quality	-0.536	-10.89

Table 5: Structural equations

In line with the AET, individual characteristics and trip attribute are associated with the affective reaction and behavioral responses of voicing complaints and avoiding the next transit trip, thus confirming H5. Multi-modal use, namely the use of car or bicycle in parallel to transit use is associated with higher frustration levels. Thus, the availability of alternative modes increases the frustration level with service disruptions, possibly due to regret associated with the non-chosen alternatives (Chorus et al., 2008). Higher transit user involvement, namely the choice to use transit based on normative goal framing (i.e., "I travel by transit due to environmental reasons") is associated with stronger negative emotions of being angry or upset upon service disruptions. Possibly, normative goal framing increases problem awareness in terms of social and environmental implications (Lindenberg and Steg, 2007). Another possibility is that involvement is associated with higher service quality expectations (Machado-León et al., 2016) and thus increased sense of being angry or upset upon service disruptions. Lastly, social-network engagement is associated with increased sense of being upset or angry, pointing out that social media engagement acts as an amplifier of transit users' negative emotions upon critical service incidents. Daily travel duration of over 45 minutes is related to lower frustration levels upon event occurrence. Possibly, the perceived delays associated with service disruptions are deemed less important with the increase in travel time. This result indicates that the importance of service disruptions is proportional to the percentage increase in daily total travel duration.

4. Conclusions

The results of the analysis bring forward insights that have some important policy implications. Firstly, the model results show that complaint behavior helps in relieving frustration following service disruptions. Thus, providing official channels to help 'air out' passenger frustration could be helpful to retain ridership even in the case of service disruptions. Nevertheless, because negative e-word-of-mouth (e-wom) could be detrimental to transit image, research could investigate the effect of formal and informal complaints on transit avoidance and the potential benefits of an easy-to-use and transparent complaint handling system in generating higher customer loyalty. Secondly, the results show that in-vehicle info screens showing news reports, advertisements, city information and weather forecasts could be a useful tool for reducing users' complaint behavior. Thirdly, the results show that commuting trips are the most susceptible to service disruptions because if the trip is work related, after service disruptions passengers will have a higher tendency to avoid transit use on the next trip. Thus, supply-side disruption management should take care to schedule planned service operations during off-peak and night hours should prioritize addressing peak-hour disruption management scenarios and should consider a compensation to passengers who experience excessive delays during their commute due to service disruptions. Lastly, in our case study, the majority of transit users are satisfied with the transit system and thus only a small share of the passengers complain or act out their frustration upon the occurrence of disruptive events. The results provide excellent news to service quality schemes because a high-quality service climate is associated with higher passenger resilience to service disruptions.

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