Commuters’ Subjective Perceptions of Travel Impedance and Their Stress Levels

The purpose of this project was to investigate automobile commuters’ subjective perceptions of travel impedance and their driver stress. The distance and time of the commute in relation to driver stress were also assessed. Commuters with high driver stress reported higher subjective perceptions of travel impedance, but the commuters with longer distance and time commutes did not report greater driver stress. The findings indicate that one of the key factors in determining a commuter’s stress level is the perception of impedance rather than whether physical impedance actually occurred. These findings suggest that persons with short distance and time commutes also feel driver stress and that a commuter does not have to have a long-distance or time-consuming commute to experience driver stress.

Almost 90% of the labor force in the United States commutes to work while driving alone (Novaco, Stokols, & Milanesi, 1990). The experience of the commuter is particularly interesting for its potentially negative effects on both work organizations and home environments. Although commuting is a relatively common experience, little research has been conducted on this phenomenon (Kluger, 1998). Prior research has focused primarily on the manner in which the experience of commuting affects the commuter’s health and well-being. This study investigated subjective perceptions of travel impedance and their relation to driver stress. Although past research has looked specifically at the relations between subjective perceptions of travel impedance and driver stress, researchers have only investigated these two factors independently.

Novaco, Kliwer, and Broquet (1991) defined impedance as a behavioral impediment to motion or goal attainment. Impedance includes any factor that hinders the objective to arrive at a particular destination. Novaco et al. (1991) divided impedance into two categories, physical and subjective. Physical impedance refers to the concrete external factors of the commuting environment, and it has historically been measured by using the miles and minutes commuted. Subjective perception of travel impedance involves the commuters’ perception of the constraints of the commute. This variable is measured by the commuter’s self-report of the commute (e.g., number of times brakes were applied, reduction of travel speed due to traffic lights or stop signs, etc.). Koslowsky and Krausz (1993) hypothesized that commuters’ perceptions of the commute could have more influence on their stress levels than the actual physical experiences.

In a longitudinal study, Novaco et al. (1990) used commuters from Irvine, California, to investigate physical and subjective perceptions of travel impedance. They assessed health effects, mood at home after commuting, and satisfaction with work, commuting, and the commuting environment. The findings indicated that subjective perceptions of travel impedance had a stronger influence on stress levels than physical impedances.
ing, and home. The health effects included how often the commuter was absent from work due to illness and the number of self-reported physical ailments such as colds, flu, and chest pain. Novaco et al. (1990) did not find a relation between the number of sick days, colds, or incidences of flu and subjective perceptions of travel impedance, but they did find that subjective perceptions of travel impedance were related to the number of reports of chest pain. However, the sample was small: only 7 of 79 participants reported chest pain. Novaco et al. (1990) also found that higher levels of subjective perceptions of travel impedance were related to a more negative mood at home after commuting, and less residential satisfaction.

In a study of 99 commuters from two large industrial companies in Irvine, Novaco et al. (1991) did not find any significant relations between subjective perceptions of travel impedance and desire to move, residential satisfaction, home physical environment, or cocooning (i.e., home is seen by the person as insulating the person from the outside world). In support of their 1990 finding, the authors again found that subjective perceptions of travel impedance negatively affected commuters’ mood at home.

Several researchers have also assessed various forms of driver or commute stress. Researchers have measured driver stress by using both physiological and psychological reactions. Gulian, Debney, Glendon, Davies, and Matthews (1989) note that the definition of driver stress has been problematic because of its possible physical and psychological components. The present study looks at the psychological aspects of driver stress, which include frustration and negative feelings. Driver stress is different from subjective perceptions of travel impedance because it involves perceived constraints on travel.

Schaeffer, Street, Singer, and Baum (1998) studied governmental employees who commuted to work using automobiles. Twenty-seven of the commuters were single drivers, and 19 were car-pool drivers. Schaeffer et al. (1998) found that single drivers with high physical impedance had significantly higher blood pressure and decreased performance on behavioral tasks at work, as compared to their low-physical impedance peers. They operationalized physical impedance as total distance traveled and total time of the trip.

Koslowsky and Krausz (1993) studied nurses from several large hospitals in Israel to evaluate commuting and stress symptoms. They evaluated stress symptoms by using the Pines & Aronson (1981) burnout scale. The results of their study showed that the increase in stress symptoms associated with increases in commute time was related to employee attitudes. Those participants reporting more stress symptoms also reported more negative attitudes about their jobs.

Novaco, Stokols, Campbell, and Stokols (1979) and Stokols, Novaco, Stokols, and Campbell (1978) investigated the effects of traffic congestion by studying industrial employees who commuted to work by automobile. Traffic congestion was defined as distance and duration of the commute. Stokols et al. (1978) found that the commuters with the longest distances and durations reported the most annoyance and traffic congestion. The authors reported that greater commute times and distances were related to tense and nervous moods and increases in systolic blood pressure.

Evans and Carrère (1991) also examined the effect of traffic congestion on drivers’ stress levels. However, they recruited male bus drivers in Los Angeles as participants and studied their psychological stress. Increased exposure to peak traffic was associated with elevated levels of urinary catecholamines for the bus drivers. Urinary catecholamines are a reliable and valid indicator of occupational stress during a workday (Frankenhaeuser & Johansson, 1986). The bus drivers also had more difficulty with their ability to adjust speed, change lanes, and maneuver into curbside areas to pick up and discharge passengers when they were exposed to increased traffic congestion.

Based on the previous research, we predicted that commuters with high subjective perceptions of travel impedance would report higher driver stress levels. We also predicted that the commuters with high driver stress would report commuting for longer distances and times.

Method

Participants

A 1997 study by the Environmental Protection Agency found that Atlantans have the longest average commute of any city worldwide, at 34.7 miles per day (Wiechman, 1998). Therefore, we felt it would be appropriate to ask Atlanta-area commuters to participate in our research study.

One hundred and ninety-one Atlanta-area commuters completed the same survey using either the one posted on the Internet (n = 123) or a paper version (n = 68). The participants who chose to take the paper survey (M = 41.10) were older than the participants who chose to take the survey on the Internet (M = 36.23), but they did not differ in reported levels of education, distance of commute, or length of commute. Six participants were dropped from the study because they did not report working
at least 30 hr a week. We felt that it was important to use only full-time workers because they commute on a more regular basis than part-time workers. The final number of Atlanta commuters used in this study was 186, 66 men and 116 women (4 did not report sex). The participants reported their race as being Caucasian/White (89%), African American/Black (4%), Asian (3%), Hispanic (2%), and American Indian (1%). Two of the participants did not report their race. The average age of the sample was 37.62 years. The majority of the participants had a bachelor’s degree or higher (66%). The average number of miles commuted a day was 38.86, and the total time commuting both ways was 67.94 min.

Materials

Subjective perceptions of travel impedance. Novaco et al. (1990) developed the Subjective Impedance Scale (SI) to assess perceived constraints in driving. An example item is “How often is your average speed reduced by heavy traffic while traveling to work?” The SI consists of 11 items and has two subscales including Evening Congestion and General Congestion Aversiveness. The higher scores on a 7-point Likert scale (1 = never, 7 = always) indicated more perceived constraints in driving. We summed the ratings to obtain an overall subjective impedance score for each participant. Novaco et al. (1991) reported a Cronbach alpha reliability coefficient of .91 for their scale.

Trait driver stress. Hennessy and Wiesenthal (1997) developed the 11-item Trait Driver Stress Inventory (TDSI) by revising Gulian, Matthews, Glendon, Davies, and Debney’s (1989) Driving Behavior Inventory. Hennessy and Wiesenthal defined trait driver stress as an individual’s general disposition to stress related to driving. An example item is “When I drive I feel frustrated.” Higher scores on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree) indicated greater trait driver stress. We summed the ratings to obtain an overall trait driver stress score for each participant. Hennessy and Wiesenthal reported a Cronbach alpha reliability coefficient of .92 for their scale.

Procedure

The researchers gave paper surveys and the Internet address for the Internet survey to coworkers, friends, and family members living in the Atlanta area. Some of the participants recruited other participants to be in the study. The participants who used the Internet survey submitted their data electronically, and the participants who filled out the paper surveys used postage-paid envelopes to send back their responses. The participants’ contribution to the research was voluntary.

Results

We calculated intercorrelations for subjective perceptions of travel impedance, driver stress, distance commuted, and time commuted (see Table 1). All of the correlations were significant and positive, except driver stress was not reliably correlated with distance or time commuted. This finding was unexpected because we predicted that there would be a strong positive relation between those variables, with those who commuted longer distances and took longer times having higher driver stress.
Hennessy and Wiesenthal (1997) did not find sex differences in driver stress. A t test was used to assess whether the male and female commuters in our study differed on their reported levels of driver stress. Because the men (M = 38.94, SD = 10.94) and women (M = 37.85, SD = 13.34) did not reliably differ on their reported levels of driver stress, t(171) = .55, p = .582, the rest of the analyses were combined.

We split the participants into three groups based on their total subjective perceptions of travel impedance scores in order to assess whether those participants with high subjective perceptions of travel impedance had higher driver stress. Past researchers (Novaco et al., 1991) split their sample into two groups of participants with high and low subjective perceptions of travel impedance, respectively, based on median splits, but the larger sample size in this study allowed us to include an additional intermediate stress group. The commuters above the 75th percentile were considered to have high subjective perceptions of travel impedance (total score of 61 to 77), and the commuters between the 25th and 75th percentile were considered to have average subjective perceptions of travel impedance (total score of 49 to 60). The commuters lower than the 25th percentile were considered to have low subjective perceptions of travel impedance (total score of 11 to 42).

A one-way analysis of variance (ANOVA) showed that the commuters with high, average, and low subjective perceptions of travel impedance reported significantly different levels of driver stress, F(2, 171) = 9.61, p < .0001. Scheffé comparisons indicated that the commuters with high subjective perceptions of travel impedance reported significantly (p < .05) higher driver stress (M = 45.54, SD = 13.74) than the commuters with average subjective perceptions of travel impedance (M = 37.98, SD = 11.47) and the commuters with low subjective perceptions of travel impedance (M = 31.00, SD = 12.88). The commuters with average subjective perceptions of travel impedance also reported significantly (p < .05) higher driver stress than the commuters with low subjective perceptions of travel impedance.

Again, a one-way ANOVA comparing commuters with high, average, and low driver stress and commute distances and time was calculated, and percentiles were used to determine high, average, or low groups. The commuters above the 75th percentile (total score of 49 to 77) were considered to have high driver stress, and the commuters between the 25th and 75th percentile (total score of 27 to 48) were considered to have average driver stress. The commuters lower than the 25th percentile (total score of 11 to 26) were considered to have low driver stress. The one-way ANOVAs did not reveal differences in driver stress as a function of the number of miles commuted, F(2, 172) = .524, p = .593, or the amount of commute time, F(2, 173) = .19, p = .825.

**Discussion**

As predicted, this study found that high subjective perceptions of travel impedance were related to higher driver stress in commuters. This finding is consistent with Koslowsky and Krausz’s (1993) hypothesis that commuters’ perception of their travel constraints could have more influence on their stress levels than the actual physical constraints. The findings of this study indicate that one of the key factors to determining a commuter’s stress level is the perception of impedance as opposed to whether physical impedance, as measured by the distance and time of the commute, actually occurred.

Commuters experiencing high driver stress as a result of subjective perceptions of travel impedance should look into eliminating some of their stress. They could reduce stress by changing their work hours to avoid the rush hour, car-pooling so they do not have to drive every day of the week, avoiding driving on congested interstates or highways, or using public transportation. These alternatives could help to reduce the subjective perceptions of travel impedance that commuters experience.

The commuters with high driver stress did not commute for longer distances or for longer amounts of time. These findings could mean that persons with short-distance and short-time commutes also feel driver stress and that a commuter does not have to have a long-distance or time-consuming commute to experience driver stress.

Driver stress, subjective perceptions of travel impedance, and the possible variables related to them should be studied further in future research. Past research has found commuting stress to be related to aggressive driving (Gulian, Matthews, et al., 1989) and poor concentration (Matthews, Dorn, & Glendon, 1991). Both aggressive driving and poor concentration can lead to road-rage incidents or accidents. Also, long-term stress effects from commuting can accumulate and carry over into other aspects of a person’s life (Hennessy & Wiesenthal, 1997). For example, stress from commuting could possibly affect the commuter’s productivity at work, and increase absences or illnesses (Kluger, 1998).

One limitation of this study was that the participants provided their information through the use of a self-report questionnaire using either an Internet survey or a paper survey. The self-report questionnaire was appropriate for assessing subjective perceptions.
of travel impedance and driver stress from a psychological perspective, but physical measures of driver stress also would have been useful. Another limitation of this study is the lack of diversity within the sample. The majority of the sample reported that they were Caucasian/White and they had completed a bachelor’s degree or higher, which is not typical of the entire Atlanta population. Future research should use groups from different racial/ethnic backgrounds to see if those persons reporting high subjective perceptions of travel impedance also reported higher driver stress levels. Finally, commuters who consistently report high driver stress or those whose driver stress varies with the daily varying experiences of subjective perceptions of travel impedance should be studied longitudinally.

References


