The Influence of Traffic Congestion, Daily Hassles, and Trait Stress Susceptibility on State Driver Stress: An Interactive Perspective[1]

DWIGHT A. HENNESSY,[2] DAVID L. WIESENTHAL, AND PAUL M. KOHN
York University
Toronto, Ontario, Canada

State driver stress was measured in both low and high traffic congestion using cellular telephones. The contributions of time urgency, trait driver stress, and hassles were also examined. Drivers showed substantially more state driver stress under high than low congestion. Time urgency made a significant positive contribution to state driver stress at both congestion levels. Trait driver stress also contributed positively under low congestion. There was a significant hassles X trait stress interaction under high congestion. Hassles exposure moderately increased state driver stress for high trait stress drivers, but reduced state driver stress for medium and low trait stress drivers. These findings indicate that state driver stress is influenced by a combination of situational and personal factors, including factors external to the driving context.

Most driver stress research has viewed stress as the outcome of a negative cognitive appraisal of driving situations (Glendon et al., 1993; Gulian, 1987; Hennessy & Wiesenthal, 1997). It is only when driving is interpreted as demanding or dangerous that stress manifests itself in negative affect, such as anxiety and worry (Gulian, Matthews, Glendon, Davies, & Debney, 1989), or physiological responses, such as increased heart rate and blood pressure (Robertson, 1988). Individuals who describe driving as highly stressful have been found to report a higher incidence of speeding violations (Matthews, Dorn, & Glendon, 1991) and minor traffic accidents (Gulian, Glendon, Matthews, Davies, & Debney, 1990; Selzer & Vinoker, 1974).

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[2]Correspondence concerning this article should be addressed to Dwight A. Hennessy, who is now at the Department of Psychology, State University of New York College at Buffalo, 1300 Elmwood Avenue, Buffalo, NY 14222.

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Although no single factor will necessarily be interpreted as stressful by all individuals, some factors have been identified that frequently lead to negative interpretations and stress. One of the most common contributors to driver stress is traffic congestion (Gulian, Debney, Glendon, Davies, & Matthews, 1989; Hennessy & Wiesenthal, 1999; Stokols, Novaco, Stokols, & Campbell, 1978). According to Novaco, Stokols, and Milanesi (1990), most regular commuters experience some level of daily traffic congestion. Congested traffic is often interpreted as a negative event in that it tends to slow or block the attainment of goals, such as driving at a certain speed or getting to a destination at a scheduled time (Novaco, Stokols, Campbell, & Stokols, 1979). Those who are forced to drive below a desired speed, especially for long distances, tend to report greater levels of driver stress. Gulian, Debney, et al. (1989) found that 50% of highway drivers in the United Kingdom frequently experience irritation in traffic congestion, regardless of time demands. Other driving scenarios that are often perceived as undesirable include merging with fast moving traffic, failing to overtake other drivers, bad weather, and poor road conditions, such as those found in narrow construction lanes (Gulian, Debney, et al., 1989).

According to Gulian, Matthews, et al. (1989), interpretations of driving situations may also be influenced by factors unrelated to driving, such as problems experienced within the work or home environments. They have advocated the use of the term “driver stress” rather than “driving stress,” because stress is influenced by the whole life experiences of the driver rather than factors exclusively within the driving situation (Gulian, Glendon, Matthews, Davies, & Debney, 1988).

Individuals experience a wide range of daily hassles, or minor daily pressures, that can accumulate and lead to the experience of stress (Flannery, 1986; Johnson & Stone, 1987). Frequently, new stressors must be dealt with before old issues are resolved (Cohen, 1980). The influence of hassles that are not effectively dealt with can persist, even when no longer in conscious awareness, and add to the pressures of subsequent hassles (Kohn & Macdonald, 1992b; Lazarus, 1981; Taylor, 1991). These “after-effects” can continue to do psychological and physiological damage, and may intensify over time as they accumulate with other previously unresolved stress reactions (Glass & Singer, 1972). Gulian et al. (1990) found that participants who reported a difficult day at work subsequently reported greater levels of fatigue and stress during their commute home. When unresolved “nondriving” hassles carry forward into the driving situation, events are more likely to be interpreted as negative, increasing the potential for driver stress. As a further complication and danger, driver stress can also carry over from the driving situation and create difficulties within the work or home environments which may then, in turn, influence further driver stress interpretations (Novaco et al., 1990).

Acute driver stress has been found to have a cumulative effect, producing a lasting general propensity or personality disposition toward driver stress

(Glendon et al., 1993; Gulian et al., 1990). Those who repeatedly experience driving as stressful may develop an overall negative view of driving, which heightens the probability of experiencing driver stress (Matthews et al., 1991). Hennessy and Wiesenthal (1997) found that certain driving situations were more likely to be experienced as stressful, but individuals with a greater propensity toward driver stress were more likely to report stress reactions within actual driving situations. Individuals who possess this “trait driver stress” susceptibility have been found to show heightened levels of arousal, and unpleasant mood when driving (Gulian, Matthews, et al., 1989; Matthews et al., 1998). The ultimate consequence lies in the fact that the negative interpretations that are influenced by this disposition, heighten the occurrence of driver stress which, in turn, serves to maintain the disposition. As the cycle continues, the deleterious sequelae of driver stress tend to intensify.

Previous research has established that situational and personal factors are necessary to accurately determine driver stress levels (Matthews et al., 1998). State driver stress is generally greater in high than in low congestion, although this effect is much more pronounced for high trait stress drivers than for low trait stress drivers (Hennessy & Wiesenthal, 1997). In addition, Gulian, Matthews, et al. (1989) found that problems experienced in nondriving situations can also magnify the perception of driver stress. Therefore, it was hypothesized that state driver stress would be greater among high trait stress drivers in both low and high congestion. However, in high congestion, where frustration and irritation are typically greatest, state driver stress would be predicted by the interaction of trait driver stress susceptibility and daily hassles. High trait stress drivers, under the added influence of elevated daily hassles, will report greater state driver stress.

Previous research has also demonstrated that time urgency can magnify negative interpretations of driving events (Hennessy, 1995; Koslowsky, 1997). Time urgent drivers may be more likely to perceive others as an obstacle to reaching a destination on time; thus, it was hypothesized that time urgency would lead to greater state driver stress.

Hypotheses

Hypothesis 1. State driver stress will be greater in high than in low traffic congestion.

Hypothesis 2. Time urgency will lead to greater state driver stress.

Hypothesis 3. In high congestion only, state driver stress will be predicted by the interaction of daily hassles and trait driver stress susceptibility. Specifically, state stress will be greater among high trait stress drivers, but exaggerated among those with elevated daily hassles.

Hypothesis 4. In low congestion, state driver stress will be greater among high trait stress drivers.

Method

Participants

Participants consisted of 28 females and 28 males who commuted regularly along Highway 401 in Metropolitan Toronto, between home and work/school in the North York region. The age range was from 19 to 55 years, with an average of 26.5 years. Participants were obtained through course recruitment, word of mouth, or campus advertisements at York University.

Apparatus

Nokia Cellular telephones (Model LX12/C15) were equipped with a cigarette lighter power adapter for continuous power access, and a stationary antenna. A visor mounted microphone provided hands free capability.

Measures

1. Driving Behaviour Inventory—General (DBI-Gen). "Trait" driver stress was measured using the Driving Behaviour Inventory-General Driver Stress scale (DBI-Gen; Gulian, Matthews, et al., 1989). The DBI-Gen consists of 16 items that tap a general disposition, or "trait" susceptibility, to driver stress. Previous research has established the DBI-Gen as a valid, robust, and reliable measure of trait driver stress (Glendon et al., 1993; Hennessy & Wiesenthal, 1997, 1999; Matthews et al., 1991). In the present study, responses were made on a Likert scale ranging from 0 to 100, indicating agreement or disagreement with each statement, rather than on the original 0 to 4 Likert scale. Previous research has shown this scaling revision to maintain high reliability ($\alpha = .90$; Hennessy & Wiesenthal, 1997). Scoring consisted of the mean response to the 16 items, with a possible range of 0 to 100. Higher scores indicated greater trait driver stress susceptibility.

2. State Driver Stress Questionnaire. The State Driver Stress Questionnaire was intended to assess the state experience of driver stress; thus, it was designed to be administered verbally in actual driving situations (Hennessy & Wiesenthal, 1997). It consisted of 11 items similar to those from the DBI-Gen and 10 items from the Stress Arousal Checklist (Mackay, Cox, Burrows, & Lazzerini, 1978). Half of the Stress Arousal Checklist items indicated positive mood (relaxed, contented, peaceful, comfortable, and calm) and the other half indicated negative mood (tense, bothered, nervous, uneasy, and distressed). All items were worded to the present tense, in order to represent "state" measures of stress. For example, "Trying but failing to overtake is frustrating me" was used rather than "When I try but fail to overtake, I am usually frustrated." Stress Arousal Checklist items were transformed from an adjective, to a statement regarding present feelings (e.g. "I am feeling nervous" rather than "Nervous"). For the present study, responses were provided verbally, using a Likert type scale ranging from 0 (*strongly disagree*) to 100 (*strongly agree*), indicating the extent to which each item pertained to the driver's experience in the immediate driving situation. Previous research has found the State Driver Stress Questionnaire to demonstrate high reliability in low (α = .92 to .94) and high (α = .95 to .97) traffic congestion conditions (Hennessy & Wiesenthal, 1997, 1999; Wiesenthal, Hennessy, & Totten, 2000). For scoring purposes, the positive mood items were reverse keyed. Scoring consisted of calculating the mean response of the 21 items, with a possible range of 0 to 100. Higher scores indicated greater state driver stress.

A manipulation check item was added to determine whether low and high traffic congestion conditions were perceived as differing in congestion level. Participants were asked to rate the level of congestion, from 0 to 100, in both low and high congestion as it was experienced. A higher rating indicated greater congestion. Also, since time urgency has been linked to driver stress (Evans & Carrere, 1991; Koslowsky, 1997), three items were added to evaluate its influence (Hennessy & Wiesenthal, 1997).

3. Survey of Recent Life Experiences (SRLE). The Survey of Recent Life Experiences (Kohn & Macdonald, 1992a) is a self-report measure of exposure to daily hassles, that has been developed as an alternative to the Daily Hassles Scale (Kanner, Coyne, Schaefer, & Lazarus, 1981). Critics have argued that the Daily Hassles Scale is contaminated by items pertaining to psychological and physical distress, and by a response format that may reflect such distress rather than predict it (e.g., Dohrenwend, Dohrenwend, Dodson, & Shrout, 1984; Dohrenwend & Shrout, 1985; Green, 1986; Kohn & Macdonald, 1992a). A great deal of stress and hassles research has been focussed on determining potential links between stress and psychological or physiological symptomology, therefore conceptual overlap and common items found in the Daily Hassles Scale may lead to inflated relationships. Also, response options to the Daily Hassles Scale provide no alternative for those who have not recently experienced a particular item as distressing (Kohn & Macdonald, 1992b). Judgements of the severity of individual hassles may actually reflect, rather than predict, subjective distress; accordingly, Kohn and Macdonald (1992a) based their response format on the degree of exposure to each hassle rather than its judged severity.

The present study used the shortened version of the SRLE (Kohn & Macdonald, 1992a), which consists of 41 items intended as a measure of accumulated hassles over the course of a given time period. Participants were required to indicate the extent that each item had been part of their lives over the past month.

Responses were scored on a Likert type scale, from 1 (*not at all*) to 4 (*very much*). Scoring consisted of the sum of ratings across items with a possible range of 41 to 164. Higher scores indicated greater experience of hassles over the past month. The SRLE has been found to have high internal consistency ($\alpha = .91$), and to correlate significantly with trait anxiety, perceived stress, psychiatric symptomology, and minor physical ailments (Kohn, Gurevich, Pickering, & Macdonald, 1994; Kohn, Hay, & Legere, 1994; Kohn & Macdonald, 1992a). deJong, Timmerman, and Emmelkamp (1996) also found that a translated version of the SRLE displayed strong reliability and construct validity within a Dutch sample.

Procedure

The present study was designed to measure driver stress in actual low and high congested conditions through the use of cellular telephones. Research participants were enlisted through course recruitment or personal contact. During an initial appointment, informed consent was obtained, and instructions regarding the experimental procedure and cellular telephone operation were given. Following the instruction period, participants completed the DBI-Gen in order to assess their trait susceptibility toward driver stress, and the SRLE to evaluate hassles exposure over the previous month. Participants then provided information regarding their regular travel route along Highway 401, because all measures were administered during their usual daily commute. Highway 401 was chosen because it is the major east-west traffic artery for Metropolitan Toronto, with as many as 14 lanes, divided into a series of express (core) and collector lanes. The average daily traffic on this highway for the Metropolitan Toronto area in 1991 was over 255,000 vehicles (Ontario Ministry of Transportation, 1992). For each participant, two areas along their regular commuting route were chosen: one that is typically low and one that is typically high in traffic congestion. A landmark unique to each chosen area was then selected, that would be subsequently used during the participant's actual journey as a cue to initiate a cellular telephone call to the experimenter. Both the low and high congestion telephone interviews were scheduled during a single journey.

An equal number of participants were randomly assigned to either a morning or an evening measurement group, in which they would be measured during either their regular morning or evening commute, respectively. This was done in order to control for the potential impact of the time of day on driver stress levels. Previous research has found that driver stress is slightly higher during evening commutes compared to morning commutes (Gulian et al., 1990). Within these groups, drivers were further divided into those who typically encountered high prior to low traffic volumes in the course of their daily commute ($n = 28$), and those who encountered low prior to high volumes ($n = 28$). This process eliminated possible confounding effects due to fatigue or practice on state driver stress by counterbalancing order of exposure to low and high congestion. Prior to initiating their commute, participants were instructed to make a practice cellular telephone call to the experimenter in order to ensure that the telephone was functioning properly and to avoid any confusion regarding its use while actually driving. No measurement took place during the pretest telephone call. Participants were reminded of the response scale to the State Driver Stress Questionnaire and instructed to commence their journey as usual. Upon approaching their first designated landmark (i.e., for the low or high congestion area), participants telephoned the researcher, through a single-button speed-dial operation. When successful telephone contact was made, the State Driver Stress Questionnaire was administered verbally, while drivers were engaged in the actual driving process. Upon completion of the first telephone interview, the cellular telephone call was terminated and the participants continued driving until their second landmark was reached, which prompted the second telephone call. The State Driver Stress Questionnaire was, again, administered verbally. Termination of the second telephone call concluded participation.

All measures were obtained between February and March of 1998. Participants were tested once, either on a Tuesdays, Wednesdays, or Thursdays. Weekends were excluded because most participants were not available, and Mondays and Fridays were excluded because driving-induced stress and stress elicited by extrinsic factors have been found to be most consistent between Tuesdays and Thursdays (Gulian et al., 1990). In order to eliminate the possibility of poor weather increasing stress, participants were tested only on partly cloudy to sunny days.

Results

Intercorrelations, means, standard deviations, and alpha reliabilities for the State Driver Stress Questionnaire, DBI-Gen, SRLE, and Time Urgency appear in Table 1. Alpha reliabilities for all measures were high, ranging from .80 to .92.

Separate state driver stress scores were obtained from the State Driver Stress Questionnaire for both low and high congestion. Scores were calculated as the mean response across individual items in the particular congestion condition. Higher scores indicated greater state stress in that congestion condition.

In order to examine the influences of congestion level and driver sex on state driver stress, a split plot factorial analysis was performed with the two levels of congestion as the within groups variable and driver sex as the between groups variable. Consistent with Hypothesis 1, Table 2 demonstrates that state driver stress was greater in high than in low congestion, $F(1, 54) = 94.62$, $p < .01$. In fact all 56 participants showed greater state driver stress in high congestion, and according to η^2, congestion level accounted for 64% of the observed variablity in state driver stress. In contrast, driver sex and the Congestion Level × Driver Sex

Table 1

Intercorrelations, Means, Standard Deviations, and Reliabilities of the State Driver Stress Questionnaire, DBI-Gen, SRLE, and Time Urgency

	1	2	3	4	5	6
1. State driver stress questionnaire: Low congestion	—	—	—	—	—	—
2. State driver stress questionnaire: High congestion	.78**	—	—	—	—	—
3. Driving behaviour inventory-general (DBI-Gen)	.50**	.65**	—	—	—	—
4. Survey of recent life experiences (SRLE)	.06	.18	.29*	—	—	—
5. Time urgency: Low congestion	.44**	—	.09	.18	—	—
6. Time urgency: High congestion	—	.31*	.09	.16	.55**	—
M	28.41	43.08	43.30	77.62	47.09	48.09
Mdn	24.00	41.25	44.90	77.00	50.00	50.00
SD	15.72	17.53	16.41	17.56	17.09	17.00
Minimum	1.00	8.00	2.00	47.00	0.00	3.00
Maximum	62.00	84.00	78.00	115.00	83.00	100.00
α	.92	.90	.80	.92	—	—

Note. $n = 56$.
$^{*}p < .05$. $^{**}p < .01$.

Table 2

Mean State Driver Stress Levels Between Congestion Conditions and Driver Sex

	M	*SD*	*n*
Congestion level			
Low	28.41	15.72	56
High	43.08	17.53	56
Driver sex			
Female	33.58	17.57	28
Male	37.92	15.61	28

interaction had no significant impact on state driver stress, $F(1, 54) = 1.08$, *ns*, and $F(1, 54) = 0.78$, *ns*, respectively.

In order to determine predictors of state driver stress within low and high congestion conditions, separate multiple regressions were computed for each. The main effect predictors were daily hassles, trait driver stress, time urgency, and driver sex. In addition, all possible product terms for two way interactions were included in each initial model.

A hierarchical entry stepwise procedure was used to produce final models, which included only two classes of effects: those that were statistically significant and those that, significant or not on their own, were implicated in a significant interaction. The procedure was to enter all main effects forcibly and add the interactions stepwise on the first run. If any interactions proved significant, they would be entered forcibly on the second run along with the implicated main effects. All other significant main effects would be added stepwise on the second run. However, in the event that no interactions proved significant on the first run, the main effects would be entered stepwise on the second run. This strategy has been reported in greater detail elsewhere (e.g., Kohn & Macdonald, 1992b; Kohn et al., 1994).

High Congestion

The final regression model for high congestion appears in Table 3. Hassles and time urgency both made significant contributions to state driver stress, as did the Hassles × Trait Driver Stress interaction. Consistent with Hypothesis 2, highly time urgent drivers demonstrated greater state stress than did those under less time urgency. Also, Hypothesis 3 was confirmed in that state driver stress was predicted by the interaction of daily hassles and trait drivers stress susceptibility (Figure 1).

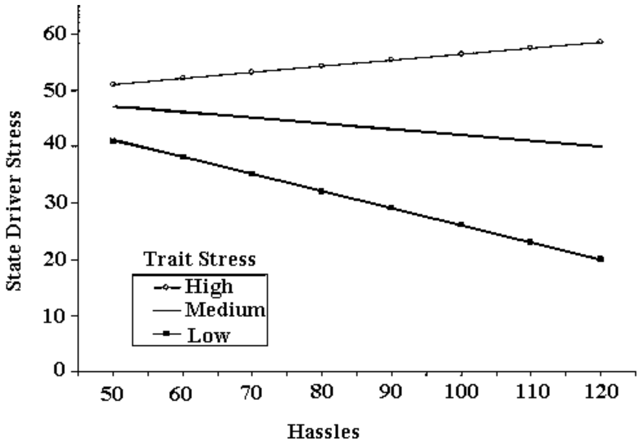

Figure 1. State driver stress as a function of daily hassles and trait driver stress susceptibility under conditions of high traffic congestion.

Table 3

Predictors of State Driver Stress Within High Congestion

Criterion	Predictor	*b*	*t*	R^2 change
State driver stress: High congestion	Hassles × Trait Stress	0.010	2.04*	.362
	Hassles	-0.531	-2.09*	.121
	Time urgency	0.283	2.80**	.05
	Trait stress	-0.090	-0.023	.001
	Intercept	40.232	2.05	

Note. R^2 = .533, $F(4, 51) = 14.56$, $p < .01$.
$^*p < .05$. $^{**}p < .01$.

To generate Figure 1, which shows the line of best fit for state drivers stress as a function of hassles and trait driver stress, the regression equation in Table 3 was applied to 24 idealized cases generated as follows: a hassles score that is a multiples of 10 in the range of 50 to 120 (where the observed range was 47 to 115); a trait driver stress score either 1 *SD* below the mean, at the mean, or 1 *SD* above the mean; and the mean value for time urgency. The 24 idealized cases thus represent 8 levels of hassles × 3 levels of trait driver stress. The mean value

Table 4

Significant Predictors of State Driver Stress Within Low Congestion

Criterion	Predictor	*b*	*t*	R^2 change
State driver stress: Low congestion	Trait stress	0.451	4.46**	.257
	Time urgency	0.369	3.80**	.159
	Intercept	-8.46	-1.36	

Note. $N = 56$. $R^2 = .417$, $F(2, 53) = 18.92$, $p < .01$.
$^{**}p < .01$.

for time urgency was included as a constant across the 24 cases because, although the variable was not implicated in the Hassles × Trait Stress interaction, it figured significantly in the final regression model shown in Table 3.

Figure 1 illustrates that, although a Hassles × Trait Driver Stress interaction was found, its form is not quite as expected. Low trait stress drivers exhibited marked *reduction* in state driver stress as hassles exposure increased and medium trait stress drivers showed little reduction; however, the high trait stress drivers did show a modest increase in state driver stress with increased hassles exposure. Collectively the predictors in the final model for high congestion accounted for approximately 53% of the variability in state driver stress.

Low Congestion

The final regression model for low congestion appears in Table 4. Consistent with Hypothesis 2, state driver stress was greater among highly time urgent drivers. Hypothesis 4 was also confirmed, in that high trait stress drivers demonstrated elevated state driver stress. These predictors accounted for approximately 42% of the observed variability in state driver stress under low congestion.

Discussion

According to Lazarus (1966), events or stimuli that are perceived as undesirable or taxing on personal resources typically result in some degree of psychological stress. In this respect, the stress response is not a stable entity that is automatically induced by external forces. Rather, particular response levels depend on individual interpretations of each experience (Mason, 1975). Automobile driving has been identified as a common event that is frequently interpreted as stressful (Gulian, Matthews, et al., 1989; Hennessy & Wiesenthal, 1997;

Novaco et al., 1990). Within any driving encounter, there is a multitude of stimuli that may be perceived as undesirable, including bad weather, time pressures, and slow moving vehicles. Perhaps one of the most pressing and frequent dilemmas faced by drivers is traffic congestion (Gulian, Matthews, et al., 1989; Novaco et al., 1979). The number of private automobiles used on a daily basis has been steadily multiplying, with little increase in the construction of public roads and highways (Donelly, 1998; Taylor, 1997). As a result, congestion levels, competition for space, and potential sources of frustration, irritation, and stress have escalated. In the present study, driver stress was greater in high than in low congestion for all participants. Indeed, congestion level accounted for 64% of the observed variability, which represents a very strong predictor of state driver stress. For many, elevated traffic volume can slow travel pace and block goals, such as getting to work on time or travelling at a desired pace, which increases the potential for negative interpretations of the driving experience and, ultimately, driver stress (Broome, 1985).

Previous research has identified time constraints as a major precursor to driver stress (Hennessy & Wiesenthal, 1999; Koslowsky, 1997). In the present study, as hypothesized, time urgency predicted state driver stress in both low and high traffic congestion. Specifically, hurried drivers were more likely to report elevated state driver stress were than those with a flexible time schedule. To a driver concerned with time, other drivers represent obstacles that block the goal of reaching a destination on time, which can lead to heightened frustration, anxiety, and negative affect (Broome, 1985; Novaco et al., 1979). According to Gulian, Debney, et al. (1989), techniques designed to properly manage time concerns should help minimize the occurrence of driver stress. The most direct solution would be the allotment of greater time to reach a destination, particularly on days where traffic volume is typically greatest (Mizell, 1996). Similar approaches could include scheduling of events during “nonpeak” times, when traffic volume is typically low, or planning greater flexibility in the commencement of appointments.

As expected, and consistent with previous research (Hennessy & Wiesenthal, 1997), state driver stress was also linked to a “trait” susceptibility toward driver stress. Specifically, high trait stress drivers were more likely to report experiencing stress in actual driving situations compared to low trait stress drivers. According to Glendon et al. (1993), a trait susceptibility to driver stress can develop as a result of recurrent negative driving experiences, which can then, in turn, heighten the potential to interpret isolated driving situations as stressful.

The present findings also provided support for an interactional interpretation (Endler & Edwards, 1986; Endler & Parker, 1992; Lewin, 1935) of driver stress, where elements of the person, and elements of the situation are necessary to determine stress levels. As with previous research (Hennessy & Wiesenthal, 1997; Stokols et al., 1978) the situation, notably in terms of congestion, was instrumental in determining state driver stress levels, but the degree of reaction was also dependent on personal experience and trait susceptibility. Specifically, within high congestion state driver stress was predicted by the interaction of daily hassles and trait stress. Consistent with Gulian, Matthews, et al. (1989), nondriving demands (i.e., hassles) were carried forward to the driving environment and impacted negatively on driver stress levels, although only among high trait stress drivers, who are most susceptible to experience driving as a negative event. Unexpectedly, however, hassles exposure actually led to decreased state driver stress among medium and especially low trait stress drivers.

One possible explanation for the unexpected form of the interaction may be that low trait stress drivers, and to a lesser extent medium trait stress drivers, demonstrate greater adaptiveness (Kohn, 1996) when confronted with the focal stressor of high traffic congestion. According to Kohn, self-control and passive responses are more adaptive in situations in which no effective active solution exists. In this respect, rather than exert a great deal of cognitive energy in attempting to actively confront the demands of high congestion, low trait stress drivers may distract themselves by reflecting on nondriving related problems (i.e., daily hassles). As a result, with increased hassles exposure, the tendency to focus coping resources on previous hassles may increase while the tendency to focus resources on demands within the driving environment may actually decrease, leading to decreased perceptions of driver stress.

In contrast, high trait stress drivers may presumably cope less adaptively with the demands of high traffic congestion. Owing to negative past driving experiences, high trait stress drivers are generally more prone to perceive current driving events in a negative manner. This tendency may lead them to focus attention more distinctly on current driving events compared to low trait stress drivers. Thus, previous hassles may amplify the immediate demands of high congestion rather than serve as a distractor. Having to consider previous hassles in addition to those within high congestion may lead high trait stress drivers to feel overwhelmed and perceive their resources as inadequate to meet the demands of the driving situation, leading to elevated state driver stress.

The Need to Minimize Driver Stress

Repeated exposure to stress, without effective coping, has been linked to a variety of physiological and psychological pathologies (Everly, 1986; Lipowski, 1984), including increased heart rate, blood pressure, anxiety, and negative affect (Henry & Stephens, 1977; Spence, 1988; Stokols et al., 1978). The fact that driver stress has also been found to influence performance, mood, and health in work and home environments (Novaco et al., 1990; Schaeffer, Street, Singer, & Baum, 1988) heightens the importance of developing techniques for dealing with personal and situational antecedents to state driver stress. For example, stress reducing techniques should concentrate on minimizing trait driver stress susceptibility, due to its link with elevated state stress in both low and high congestion. Since repeated negative experiences contribute to a trait susceptibility, it may be possible to reduce this disposition through frequent positive driving experiences, such as leisurely travel on weekends. In extreme cases, group or individual counselling sessions can help deal with life problems and provide stress reducing techniques that can be performed prior to, during, and immediately following driving excursions, such as time management, trip planning, listening to music, muscle relaxation techniques, meditation and adaptiveness training (Gulian, Debney, et al., 1989; James, 1999; Kohn, 1996; Mizell, 1996; Wiesenthal et al., 2000).

Additionally the problem of traffic congestion must also be addressed, due to its substantial importance in determining driver stress levels. One approach may be to offer special reduced rates for public transportation during periods of high traffic volume, or to increase construction of car pool lanes to encourage "ride share" programs. Further, more efficient design, planning, and construction of roadways may be necessary to deal adequately with the growing volume of traffic (Mackey, 1999). However, this latter suggestion is likely to be met with a degree of resistance, due to the high costs involved in the redesign and/or reconstruction of present transportation routes.

Limitations of the Present Study

Despite the fact that the usefulness of an interactional approach to driver stress research was demonstrated, the present study represented a narrow evaluation of personal and situational influences. Future research is needed to examine greater variation in the level of situational constraints. Specifically, the present study intentionally selected two driving situations that were extreme contrasts (i.e., low and high congestion); therefore, it was not possible to determine the effects that intermediate levels of congestion might have had on stress and driving behavior. By considering greater variation in congestion level, it may be possible to evaluate the threshold values at which background stressors, such as daily hassles, affect state driver stress. Another limitation was the fact that state measures were collected during a single commute, representing only a limited and short-term assessment. According to Willumeit, Kramer, and Neubert (1981), daily fluctuations in both personal factors (e.g., dispositions, fatigue) and situational factors (e.g., weather, road conditions) can alter driving behavior. A longitudinal analysis, where single drivers are evaluated over an extended period of time, may be necessary to more fully understand the process of driving responses. Finally, the present study did not fully address aspects of the vehicle that might interact with the person and the situation to influence driver stress, such as seat comfort, air conditioning, vehicle noise, all wheel drive, air bags, and antilock brake systems (Cantilli, 1981; Evans, 1991; Huddart & Dean, 1981). Further research is needed to specifically examine the role of the vehicle in the interactional process between the individual and the situation.

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