Further Validation of the Larson Driver Stress Profile

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FURTHER VALIDATION OF THE LARSON DRIVER STRESS PROFILE

by

Michael Paul Moore

Abstract of a Dissertation
Submitted to the Graduate School
of The University of Southern Mississippi
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy

August 2011
ABSTRACT

FURTHER VALIDATION OF THE LARSON DRIVER STRESS PROFILE

by Michael Paul Moore

August 2011

Much of the literature on unsafe driving has focused on studying the role of single variables (e.g., driving anger, sensation seeking, etc.) and the degree to which they may increase one’s propensity to engage in aggressive or otherwise risky driving behavior. However, it is becoming increasingly clear that motor vehicle accidents and accident-related behavior are sufficiently complex as to require the use of multiple predictors. The current study examined the psychometric properties of the Driver Stress Profile (DSP; Larson, 1996), a brief self-report scale designed to assess four variables of interest in the driving literature. The DSP and measures of similar constructs were completed by 411 college student volunteers. Exploratory factor analysis suggested that the DSP could be enhanced through some relatively minor modifications to the subscales. Using a revised version of the DSP based on these analyses, the present study provided evidence of convergent and discriminant validity. Moreover, hierarchical multiple regressions demonstrated that the DSP predicted unsafe driving behavior and driving anger expression over and above respondent gender and average miles driven per week. The implications of these findings for future research and traffic safety efforts are discussed.
The University of Southern Mississippi

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by

Michael Paul Moore

A Dissertation
Submitted to the Graduate School of The University of Southern Mississippi in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy

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ACKNOWLEDGMENTS

First and foremost I would like to thank my committee chair and major professor, Dr. Eric Dahlen, for his advice and support throughout this project. Additionally, I would like to recognize members of my dissertation committee, Dr. Emily Bullock Yowell, Dr. Michael Madson, and Dr. J.T. Johnson, for sacrificing time from their busy schedules to attend committee meetings and offer insightful feedback.

Special thanks to my family. I am eternally indebted to my wonderful wife, Stephanie, and children, Brooklyn and Carter. Thank you for putting up with the crazy hours and supporting me through this demanding time in our lives. You kept me grounded throughout this process, and I could not have completed this without you. You were and are my motivation.
TABLE OF CONTENTS

ABSTRACT ........................................................................................................................................... ii

ACKNOWLEDGMENTS .................................................................................................................. iii

LIST OF TABLES .......................................................................................................................... v

CHAPTER

I. INTRODUCTION ........................................................................................................................ 1

Demographic Variables
Driver Personality
Beyond Single Predictors: The Case for Multivariate Assessment
The Driver Stress Profile: An Untested Example of Multivariate Assessment
The Present Study
Research Questions
Statistical Hypotheses

II. METHODOLOGY ..................................................................................................................... 44

Participants
Instruments
Procedure

III. RESULTS ................................................................................................................................... 51

Preliminary Analyses
Primary Analyses

IV. DISCUSSION .......................................................................................................................... 70

Limitations
Implications and Future Research

APPENDIXES .................................................................................................................................. 85

REFERENCES .................................................................................................................................. 89
LIST OF TABLES

Table

1. Alphas, Means, Standard Deviations, and Univariate Tests for Gender Differences ................................................................. 52

2. Initial Eigenvalues and Explained Variance from a Principal Axis Factoring of the Driver Stress Profile .................................................. 55

3. Factor Loadings from the Rotated Pattern Matrix: Principal Axis Factoring With Promax Rotation ................................................... 55

4. Internal Consistencies and Item-Total Correlations for the Four Factors Extracted ........................................................................ 58

5. Intercorrelations among Variables ........................................................................................................ 59

6. Logistic Regression Predicting Minor Accidents .................................................................................. 62

7. Summary of Hierarchical Multiple Regressions ............................................................................. 62

8. Summary of Hierarchical Multiple Regressions: Incremental Validity ................................ 66
CHAPTER I

INTRODUCTION

Each day, millions of people utilize motor vehicles as their primary means of transportation, allowing for greater mobility (National Highway Traffic Safety Administration [NHTSA], 2006). While convenient, motor vehicle operation carries a serious risk for injuries and is the leading cause of death in the United States for individuals between the ages of 2 and 34 (NHTSA, 2006). In fact, 2006 U.S. data show 42,642 fatalities and 2,575,000 non-fatal injuries among the 5,973,000 vehicular accidents reported to police. These numbers translate into 117 fatalities each day, or 1 every 12 minutes, as a result of motor vehicle accidents. In fact, motor vehicle accidents represent one of the most deadly public safety issues in the United States and many other countries.

Motor vehicle accidents also have a significant economic impact, costing the United States and its citizens an estimated $230.6 billion in 2000, which is equivalent to $820 per person living in the United States, and is 2.3% of the United States gross domestic product (NHTSA, 2002). This estimate includes (a) property damage, (b) rehabilitation costs, (c) travel delay, (d) productivity losses, (e) legal and court costs, (f) emergency services, (g) medical costs, (h) insurance administration costs, and (i) cost to employers. It has been estimated that the lifetime cost of one motor vehicle related fatality due to loss of household and workplace productivity is $977,000 (NHTSA, 2002). Similarly, the cost related to one critically-injured survivor increases to $1.1 million, which mostly consists of lost productivity plus medical costs (NHTSA, 2002). However, motor vehicle accidents exert an economic toll even when they do not result in injuries or
loss of life. Using 2000 data, the cost of motor vehicle accidents involving only property
damage was roughly $59.8 billion dollars (NHTSA, 2002). Those not directly involved in
the accidents pay for approximately three quarters of these costs through traffic delay,
insurance premiums, and taxes, which, according to the NHTSA (2002) total over $170
billion/year.

The staggering costs of motor vehicle accidents, both in injuries/fatalities and in
economic terms, motivate efforts to understand, prevent, and reduce the severity of
vehicular accidents. Some approaches emphasize “target hardening,” seeking to avoid
accidents, minimize injuries, and increase survival rates. Advances in automobile design
and the incorporation of various safety systems (e.g., anti-lock brakes, airbags, safety
belts, etc.) are common examples. Automobiles are also undergoing increasingly rigorous
safety testing (e.g., pushing vehicles to the limit of cornering to assess potential risk of
roll-over). Furthermore, improvements in roadway design have been pursued, such as
road curvature, lane width, and roadside design (Federal Highway Administration, 2008).
Other preventative efforts focus on investigating the causes of accidents. As predictors of
motor vehicle accidents are identified, some may be useful amenable to change,
informing accident prevention programs. For example, educational campaigns such as
“Click it or Ticket” have been employed in an effort to encourage drivers to engage in
more responsible driving behavior (NHTSA, 2006b).

The complex set of behavioral and cognitive demands involved in operating a
motor vehicle, combined with the vast array of potential factors contributing to motor
vehicle accidents, suggest that sophisticated explanatory models are needed. Motor
vehicle accidents are best regarded as being the product of several different variables
interacting with one another (United States General Accounting Office [GAO], 2003). According to the GAO, the causes of motor vehicle accidents have been grouped into three broad categories: human factors (e.g., aggression, drinking, cell phones, etc.), roadway environment factors (e.g., weather, car problems, road conditions, etc.) and vehicle factors (e.g., maintenance, faulty equipment, etc.).

Of the three factors, human factors are considered the most important and have been the subject of considerable research efforts (GAO, 2003). Human factors research seeks to understand both actions taken by the driver while driving and the condition or state of the driver (e.g., intoxicated, sleepy, angry, etc.). Much of the human factors literature has focused on identifying risk factors which increase the likelihood of accidents. Risk factors may include driver behaviors known to elevate accident risk (e.g., speeding, driving while intoxicated, using a cell phone while driving, etc.) or driver characteristics associated with increased accident rates and/or other risky driving behaviors, such as those just mentioned (e.g., trait anger, sensation seeking, impulsivity, etc.).

Speeding is an important example of the sort of risky driving behavior often investigated and is one of the most prevalent factors contributing to motor vehicle accidents. In fact, speeding was cited as a contributing factor in 31% of fatal motor vehicle accidents (NHTSA, 2006). Driving while intoxicated is another common example. Alcohol impairment was implicated as a causal factor in 41% of all fatal automobile accidents in 2006 (NHTSA, 2006). Additionally, traffic control violations, such as running red lights or stops signs, are examples of behaviors that frequently result in injury or death. An analysis of motor vehicle accidents between 1997 and 2001 found
that 39% of automobile accidents occurred at traffic control devices, such as stop lights or stop signs (GAO, 2003). Given that human factors result in a high number of motor vehicle accident related injuries or death and play the largest role in motor vehicle accidents they have been the subject of most psychological research conducted in this area (GAO, 2003). The relatively greater predictability and control of human behavior as compared with environmental and vehicular factors suggests that these efforts are likely to be beneficial.

Research on driver characteristics generally involves two categories: demographic variables and personality variables (Dahlen, Martin, Ragan, & Kuhlman, 2005; Hemenway & Solnick, 1993; Krahe & Fenske, 2002; Smith & Heckert, 1998). Demographic factors include variables such as age, gender, and driving exposure (i.e., miles driven). Examples of personality factors that have been identified as predictors of driving behavior are sensation seeking and impulsiveness (Dahlen et al., 2005; Schwebel, Severson, Ball, & Rizzo, 2006). Due to their relevance to psychological research on motor vehicle accidents in general and to the present study specifically, this literature will be reviewed in the following sections.

Demographic Variables

Age. Age has been found to be a significant predictor of driving behavior and accident outcomes. Specifically, younger drivers are at greater risk for engaging in aggressive and risky driving behavior (Begg & Langley, 2001; Hemenway & Solnick, 1993; Williams, 2003). Per mile driven young drivers ages 16-19 are at four times the risk of being involved in a motor vehicle accident, with the risk being the highest at age 16 (Insurance Institute for Highway Safety [IIHS], 2008). Similarly, drivers 16 to 20 had
higher incidents of motor vehicle accidents resulting in fatality, injury without fatality, and property damage only compared to all other ages (NHTSA, 2006).

Several explanations have been offered to account for the higher levels of motor vehicle accidents and risky driving behavior among younger drivers, such as, inexperience, greater exposure to dangerous driving situations, and a higher propensity toward risky driving (Jonah, 1990). More recent studies have expanded on the relationship between young drivers and risky driving behavior. For example, Machin and Sankey (2008) administered questionnaires designed to assess personality factors, risk perception, and driving behavior to one hundred and fifty nine students between the ages of 17 and 20. Findings of this study demonstrated that speeding behavior was predicted by higher levels of excitement-seeking, lower levels of altruism, greater perceived likelihood of an accident, and a lower aversion to risk taking.

In addition to younger drivers, older drivers have been found to be at increased risk for being involved in motor vehicle accidents. However, the contributing factors related to poor driving behavior appear to differ, such as, diminishing health, decreases in cognitive functioning, vision loss, and other physical impairments (Janke, 1994). For example, Ott et al. (2008) conducted a longitudinal study to examine the effects of Alzheimer disease on driving behavior. The study was conducted over a three year period with a sample of 128 older drivers, which was comprised of 84 older adults who had been diagnosed with Alzheimer disease, and 44 control subjects. Results indicated that driving behavior in both the Alzheimer and control group declined over the course of the study. However, the subjects with Alzheimer disease declined at a greater and more severe pace than controls. Additionally, Baldock, Mathias, McLean, and Berndt (2006), in a study of
90 adult drivers between the age of 60 and 91, found that subjects who visual processing
time was longer were more likely to perform more poorly on an on road driving test.
Furthermore, the researchers found the strongest inverse correlation between reaction
time and driving performance.

Gender

Relatively consistent gender differences have been observed in certain driving
behaviors and accident-related outcomes. Male drivers are involved in more motor
vehicle fatalities than female drivers in any age group (NHTSA, 2007). Additionally,
men have a higher rate of injury-only and property damage-only automobile accidents
than women. Similarly, Espino, Hasselberg, and Laflamme (2006) found that men,
regardless of age, had a higher incidence of crash involvement than women in both single
and multiple vehicle crashes.

Gender differences in the type and incidence of motor vehicle accidents have led
many researchers to seek behavioral differences. Several studies have found that men are
more prone to engage in aggressive or risky driving than women (Begg & Langley, 2001;
Hemenway & Solnick, 1993; Lonczak, Neighbors, & Donovan, 2007; Miller &
Cervantes, 1997; Ozkan & Lajunen, 2005; Sarkar & Andreas, 2004; Smith & Hechert,
1998). According to the NHTSA (2006), speeding-related fatalities are highest among
young males as compared to all other groups. Similarly, Smith and Hechert (1998) found
that men reported receiving six times as many speeding tickets as women. Gender
differences have also been indentified in seat belt use, as more women report using seat-
belts than men (NHTSA, 2003; Wells, Williams, & Farmer, 2002). Men are also more
likely to drive while under the influence of alcohol and were involved in more than twice
as many fatal motor vehicle accidents while intoxicated from 1982 to 2006 (Hemenway & Solnick, 1993; NHTSA, 2006; Miller & Cervantes, 1997; Sarkar & Andreas, 2004).

With increased interest on aggressive driving, a growing number of researchers have examined the construct of driving anger (i.e., one’s propensity to experience angry feelings while driving). The role of gender has been examined here as well to determine whether male drivers take more risks and drive more aggressively because of a greater tendency to become angry behind the wheel. However, there is little evidence of consistent or meaningfully large gender differences in driving anger (Deffenbacher, Deffenbacher, Lynch, & Richards, 2003c; Lonczak et al. 2007). Women and men to not appear to differ on trait driving anger.

Despite the lack of support for gender differences in driving anger, there is evidence that women and men express angry feelings differently while driving and in the types of driving situations that provoke anger (e.g., giving the finger, cutting someone off, cursing/screaming, etc.). For instance, Deffenbacher, Huff, Lynch, Oetting, and Salvatore (2000) found that high anger men were more likely to engage in verbally and physically aggressive behavior than other groups of drivers, such as high anger women, and low anger women and men. Additionally, Lonczak and colleagues (2007) found that women had higher levels of anger when the provoking situation dealt with traffic obstructions or illegal behavior of other drivers. Nevertheless, although they were angered more than men in these situations they displayed fewer outward expressions of anger. Furthermore, men appear to experience greater levels of driving anger toward slow and discourteous drivers (Deffenbacher et al., 2000b).
Overall, there appears to be no difference in the level of driving anger experienced by men and women. However, gender differences do seem to arise when examining how driving anger is expressed, with men engaging in more verbal and physically aggressive means of driving anger expression. Furthermore, men and women appear to differ in the source of their anger when driving.

Driving Exposure

It has been postulated that driving exposure, defined as the amount of time an individual spends driving over a specified time frame, may predict unsafe driving behavior. Driving exposure is most often operationally defined as the number of miles driven over a specified interval of time (i.e., a week). The idea is that some drivers may take more risks or be more aggressive than others at least in part because they have greater exposure to frustrating events as a function of spending more of their time driving.

Several studies report a positive relationship between driving exposure and both traffic violations and motor vehicle accidents. For example, analyzing data collected from over 1,800 Southern California residents, Hemenway and Solnick (1993) found positive relationships between miles driven and accident involvement, traffic violations (e.g., red light running, speeding), and driving while drunk. Similarly, Davey, Wishart, Freeman, and Watson (2007) found that the amount of kilometers driven was predictive of traffic violations and traffic fines among Australian fleet drivers. Furthermore, in a sample of 1,000 New York State licensed drivers miles driven annually was found to be positively correlated with a tendency to become drowsy while driving (McCartt, Ribner, Pack, &
Hammer, 1996). Therefore, research indicates that driving exposure plays a role in driving behavior.

These findings have led some researchers to suggest that driving exposure should be routinely assessed and analyzed in studies of driving behavior. In order to ensure that an obtained relationship between a predictor (e.g., driving anger) and a criterion (e.g., risky driving) is not due, in part or in whole, to driving exposure, some measure of miles driven can be used as a control variable. That is, it is important to make sure that the predictor’s apparent effect on the criterion is not merely due to the frequency or distance with which respondents drive. Thus, potential predictors of driving behavior are often evaluated while partialling out the effects of driving exposure.

Driver Personality

Aside from demographic variables, personality variables have been the focus of a large body of research in relation to driving behavior. Prominent examples include sensation seeking, impulsiveness, and trait driving anger. These variables have been shown to predict a range of risky driving behaviors and accident-related outcomes (Dahlen & White, 2006; Dahlen et al., 2005; Machin & Sankey, 2008; Owsley, McGwin, & McNeal, 2003; Smith, Waterman, & Ward, 2006). Most studies in this area have focused on identifying risk-enhancing factors, but there is some evidence that risk-reducing factors (e.g., the ability to consider the future consequences of one’s actions, trait forgiveness, etc.) are important as well. For instance, Moore and Dahlen (2008) found that individuals who had higher levels of trait forgiveness were less likely to engage in risky and aggressive driving behavior. Additionally, the researchers found that the more prone individuals are to consider the possible consequences of their behavior
the less likely they are to engage in risky and aggressive driving behavior and utilize more productive ways to express their anger while driving.

*Sensation Seeking*

Sensation seeking has been defined as “a trait defined by the seeking of varied, novel, complex, and intense sensations and experiences, and a willingness to take physical, social, legal, and financial risks for the sake of such experience” (Zuckerman, 2007, p. 49). It is considered relevant to accident-related behaviors and outcomes because individuals high in sensation seeking may take more risks in pursuit of gratification without thought to the physical and social risks involved (e.g., speeding, unsafe passing, racing other vehicles, etc.).

There is a robust body of literature supporting the utility of sensation seeking in relation to driving behavior and motor vehicle accidents. Across several studies, a consistent relationship between sensation seeking and risky driving has been observed such that drivers high in sensation seeking engage in higher rates of risky driving. In fact, Jonah’s (1997) review of literature involving sensation seeking and risky driving behavior found that only four out of the 40 studies reviewed failed to demonstrate a positive relationship between sensation seeking and some form of risky driving. Correlations between measures of sensation seeking and those of risky driving ranged between .30 and .40, and such relationships were found in several countries, such as the Canada, Finland, Great Britain, the Netherlands, Norway, Sweden, and the United States. More recently, several studies have found outcomes similar to those studies outlined in Jonah’s (1997) literature review, in which sensation seeking was found to be predictive of
risky driving behavior (Dahlen & White, 2006; Fernandes, Soames Job, & Hatfield, 2007; Iverson & Torbjorn, 2002; Lonczak et al., 2007).

Jonah (1997) also reported some evidence of a differential relationship between sensation seeking and risky driving behavior by gender. Specifically, the relationship appears to be stronger for men than for women. However, the majority of the studies that were included in Jonah’s (1997) review focused exclusively on men. Therefore, conclusions about gender and sensation seeking in relation to risky driving need further exploration.

Sensation seeking also appears to be a significant predictor of driving behavior regardless of age. In a study of high school students ages 17 and 18, Arnett (1996) and Arnett, Offer, & Fine (1997) found that students who reported high levels of sensation seeking were more likely to report having driven over 80 miles per hour, driving 20 miles per hour over the speed limit, racing other cars, and passing in a no-passing zone. Furthermore, in a study of adults over the age of 75, Schwebel, Ball, Severson, Barton, Rizzo, and Viamonte (2007) found that sensation seeking was predictive of traffic violations, as well as receiving citations for traffic violations.

Several types of driving behavior have been predicted by sensation seeking (Dahlen et al., 2005). In an effort to explore the effectiveness of combining single predictors of unsafe driving behavior Dahlen and colleagues (2005) surveyed a sample of 224 college students. Each participant was provided a battery of instruments designed to measure driving behavior, as well as several personality constructs, such as sensation seeking. Results of their study indicated that sensation seeking was predictive of several unsafe driving behaviors, such as, lapses in concentration, minor losses of vehicular
control, aggressive driving, risky driving, physically and verbally aggressive driving
anger expression, use of the vehicle to express anger, and constructive/adaptive driving
anger expression. In a similar study Dahlen and White (2006) explored the utility of
combining several single predictors to more efficiently predict driving behavior. A total
of 312 undergraduate students were recruited and provided with a battery of instruments
measuring driving behavior and personality. Consistent with Dahlen and colleagues
(2005), sensation seeking predicted aggressive driving, loss of concentration while
driving, moving citations, minor accidents, and major accidents. Moreover, Jonah,
Thiessen, and Au-Yeung (2001) found that among a sample of 279 college students in
Canada, high sensation seekers were more likely to speed, weave in and out of traffic,
and not wear safety belts than those low in sensation seeking.

Research has also indicated an association between sensation seeking and driving
while intoxicated. In a study exploring DUI recidivism Schell, Chan, and Morral (2006)
found that individuals high in sensation seeking reported drinking more and possessing a
riskier style of driving. Research has demonstrated that drivers who had been previously
arrested for driving while intoxicated demonstrated significantly higher levels of
sensation seeking when compared to the general population (Donovan, Queisser,
that high school students who rated themselves high in sensation seeking were more
likely to dive while intoxicated. Additionally, Arnett (1990) found that sensation seeking
in high school students was associated with lower estimates of being involved in an
accident, or receiving a ticket from drunk driving, when compared to lower sensation
seeking peers. Jonah, Thiessen, and Au-Yeung (2001) found that high sensation seekers
were more likely to drive after drinking, and perceived a low risk of detection for impaired driving. Additionally, these same subjects reported having the belief that they could drink more beer before being impaired than those low in sensation seeking.

Furthermore, sensation seeking has been found to predict negative consequences related to risky driving. For instance, Lonczak and colleagues (2007) conducted a large study exploring gender differences in the prediction of risky driving behavior. Their sample consisted of 5,440 total participants, who were identified and randomly sampled through the Washington State Department of Licensing. Participants were divided into two groups: (1) general population drivers and (2) high risk drivers, defined as those with multiple driving citations. They found that sensation seeking, together with frequency of alcohol use, predicted group membership (i.e., who had received a traffic violation). Additionally, these researchers found that involvement in a traffic accident was predicted by sensation seeking in combination with stress, negative affect, and tobacco use.

The results of these findings clearly demonstrate that sensation seeking is a valuable predictor of certain types of driving behavior. Specifically, sensation seeking appears to be useful in the prediction of risky and unsafe driving behavior, such as, driving while intoxicated, moving citations, minor accidents, and major accidents. However, the sensation seeking and driving behavior research has been criticized by some for having an overrepresentation of men in studies of sensation seeking and driving behavior (Jonah’s, 1997). Because of this limitation, conclusions about gender differences and sensation seeking would be premature and thus warrant further research.
Impulsiveness

Impulsiveness has been defined as ‘‘a predisposition toward rapid, unplanned reactions to internal or external stimuli without regard to the negative consequences’’ (Moeller, Barratt, Dougherty, Schmitz, & Swann, 2001, p. 1784). Similar to sensation seeking, impulsiveness indicates that an individual engages in a certain type of behavior with a disregard for the negative consequences. However, sensation seeking indicates a search for novel stimuli, whereas impulsiveness indicates an unplanned response to a stimulus. An individual high in sensation seeking is assumed to intentionally engage in risky behavior (e.g., speeding or illegal drag racing) in order to experience the thrills associated with such behavior. In contrast, the impulsive person need not pursue stimulation but may simply have difficulty controlling impulses to act. For example, a highly impulsive individual may respond to provocation with dangerous or risky behaviors (e.g., tailgating, using their car as a weapon, etc.) almost reflexively. Therefore, drivers high in impulsiveness may pose a danger to themselves and other drivers due to the sudden and spontaneous nature of their behavior.

Impulsiveness has received considerably less attention in the driving literature than sensation seeking but has been implicated in several studies. Smith and colleagues (2006) collected data regarding the relationships among driving behavior, aggression, anger, and impulsivity from a sample of 473 British drivers. Of the 473 participants, 185 were undergraduates, 106 were from the general population, and 182 were offenders (individuals incarcerated for criminal acts). Offenders scored higher on all measures of impulsiveness than both the undergraduate and general public groups. Additionally, results indicated that offenders reported more episodes of aggression, as well as more
convictions for driving offenses. Although impulsivity was not predictive of extreme forms of driving violence (i.e., “road rage”), a moderate relationship was found among impulsivity, driving offenses, convictions, anger, and aggression.

Smith and colleagues’ (2006) findings seem to suggest that although impulsivity may not be a significant predictor of so-called road rage, a descriptor generally reserved for only the most extreme forms of driving violence, it may be related to other types of unsafe driving behavior or other personality factors associated with unsafe driving behavior. Consistent with this possibility, high anger drivers have been found to report greater levels of impulsiveness than drivers who were lower in driving anger (Deffenbacher, Filetti, Richards, Lynch, & Oetting, 2003a). In addition, Owsley and colleagues (2003) found that older adult drivers who reported traffic violations and driving errors were more likely to rate themselves higher in impulsivity. Respondents with four or more driving errors were also higher in impulsiveness.

Specific types of driving behavior have also been linked to impulsiveness. For instance, impulsiveness has been found to be predictive of tickets, risky driving, and the use of a vehicle to express anger (Dahlen et al., 2005). Other studies have associated impulsiveness with greater risk-taking behavior, such as, drunk driving and not wearing seat belts (Stanford, Greve, Boudreaux, Mathias, & Brumbelow, 1996).

Finally, some researchers have suggested that anger may moderate the relationship between aggressive driving behaviors and impulsivity. For instance, DePasquale, Geller, Clark, and Littleton (2001) reasoned that the catalyst for aggressive driving may involve the interaction of impulsivity and anger that leads to aggressive driving behavior, as opposed to impulsivity alone.
Although impulsiveness is related to risky and unsafe driving behavior, the relationships reported in the literature are not as robust as those of sensation seeking. In addition, considerably less is known about the potential role of impulsiveness in more aggressive forms of driving behavior. However, there is evidence that impulsiveness, when added to driving anger, appears to exacerbate the severity of the unsafe driving behaviors. Thus, the severity of risky and unsafe driving behavior may increase as the number of predictive factors increase.

Consideration of Future Consequences

Consideration of future consequences (CFC) is a relatively new construct, defined by Strathman, Gleicher, Boninger, and Edwards (1994) as, “the extent to which individuals consider the potential distant outcomes of their current behaviors and the extent to which they are influenced by these potential outcomes” (p. 743). Although, this construct may appear to be the inverse of impulsiveness, it differs in that its focus is on the thought process that an individual may engage in when weighing out current needs and concerns with future consequences, whereas impulsiveness implies an unplanned reaction to a stimulus.

CFC has been shown to be a valid and reliable predictor of many types of risky behavior (Appleby, Marks, Ayala, Miller, Murphy, & Mansergh, 2005). For example, CFC has been useful in exploring a variety of issues, such as fiscal responsibility (Joireman, Sprott, & Spangenberg, 2005), health behavior (Orbell, Perugini, & Rakow, 2004; Sirois, 2004), environmental concern (Ebreo & Vining, 2001; Joireman, Van Lange, & Van Vugt, 2004), and anger (Joireman, Anderson, & Strathman, 2003).
In addition, Joireman and colleagues (2003) found strong support for a link between aggression and CFC. Specifically, the researchers conducted several studies exploring the relationships among aggression, sensation seeking, and consideration of future consequences utilizing a sample of 845 college students. Results of these studies indicated that individuals high in CFC experienced lower levels of aggression when the aggressive behavior would most likely result in future negative consequences. In contrast, individuals scoring low in CFC reported lower levels of aggression if the aggressive behavior carried with it more immediate negative consequences. Individuals scoring lower in CFC reported more aggressive behavior, especially if the consequences were not immediate. Low CFC individuals also reported more hostility and anger than those scoring higher in CFC. Thus, individuals who are less likely to consider the implications of their behavior experience more anger and aggression and appear to engage in riskier behavior.

To date, only one published study has examined the role of CFC in driving behavior. Moore and Dahlen (2008) administered questionnaires assessing driving behavior and various personality traits to a sample of 316 undergraduate participants. They found that CFC was inversely related to physically aggressive driving anger expression (i.e., initiating physical fights with other drivers) and use of the vehicle to express anger (i.e., cutting people off, bumping other cars). Additionally, CFC was positively related to adaptive driving anger expression. Moreover, CFC predicted aggressive driving and driving anger expression when controlling for respondent gender, miles driven, and trait driving anger. Thus, the addition of CFC demonstrated incremental
validity over driving anger in the prediction of aggressive driving and driving anger expression.

Overall, CFC has been found to be predictive of risky behavior, anger, and aggression generally. More recent research has also demonstrated that CFC appears to be a valid predictor of unsafe driving behavior and driving anger. Although a modest amount of research has been conducted to explore the relationship between CFC and driving behavior the results of such research are significant and appear promising in opening the door for further research in this area.

Driving Anger

The construct of driving anger was developed by Defenbacher, Oetting, and Lynch (1994) as a context-specific form of trait anger. It refers to the general propensity of some drivers to experience more frequent and intense anger while driving. Closely related to trait anger, driving anger can be conceptualized as narrower in its scope and more context- or situation-bound. Deffenbacher and associates (2003c) have recently taken their model of driving anger a step further, postulating a state-trait anger model wherein certain drivers may be predisposed to become angry while driving (trait driving anger), which is exacerbated by specific driving situations (state driving anger), such as waiting in traffic or being cut off by another driver.

Of all the individual personality variables explored in relation to aggressive and risky driving, driving anger has the most empirical support (Blanchard, Barton, & Malta, 2000; Dahlen et al., 2005; Deffenbacher et al., 2000b; Deffenbacher et al., 1994; Deffenbacher, Lynch, Deffenbacher, Oetting, 2001; Deffenbacher et al., 2003a; Deffenbacher et al., 2003c; Lajuen, & Parker, 2001). Driving anger may be manifested in
several forms, such as physiological/emotional arousal, aggressive behavior, and being angry but not acting on the anger (Deffenbacher et al., 2003c).

Much of the initial research on driving anger sought to identify the correlates of the construct. This work has permitted researchers to develop a sort of profile of the high anger driver. For instance, Deffenbacher (2000) conducted a study in an attempt to identify certain characteristics specific to high driving anger individuals. Participants were 57 college undergraduates recruited from introductory psychology courses. In the study, high anger drivers who were seeking counseling related to driving anger were compared to a group of low anger drivers. Findings supported the state-trait anger model in that high anger drivers appeared to react to their environment at a greater rate than low anger drivers. Additionally, high anger drivers appeared to get angry across several different situations, as opposed to just a few. High anger drivers were also more likely to become angry in stressful driving situations, such as rush hour, as well as in everyday driving. Furthermore, high anger drivers engaged in more risky and aggressive driving behavior and reported being involved in more accidents and accident related incidents than low-anger drivers. Lastly, high anger drivers tended to suppress angry feelings while driving tended to suppress their anger, and expressed their anger in less controlled and more outward ways than low-anger drivers.

More recently Deffenbacher and colleagues (2003a, 2003c) have conducted studies comparing high and low anger drivers, which provided further support for the role of driving anger in the prediction of unsafe driving behavior. Deffenbacher and colleagues (2003a) compared characteristics of two groups of drivers acquired from a sample of 300 undergraduate college students. Participants were separated into two
groups; (a) high anger drivers acknowledging their problems and seeking counseling for their driving anger; and (b) high and low anger drivers who denied driving anger problems and were not interested in seeking counseling. Participants were administered several questionnaires regarding driving behavior and anger in general. Additionally, participants were given a driving log to record anger, aggression, and risky behavior while driving. Results of this study indicated that high anger drivers were more likely than low anger drivers to become angry while driving, and to experience more intense episodes of anger while driving. Additionally, the researchers found that individuals who reported higher levels of driving anger were more likely to engage in aggressive driving behavior, risky driving behavior, have more crash-related outcomes, and were less likely to use adaptive behaviors when frustrated.

In a similar study Deffenbacher et al. (2003b) compared characteristics of three groups of drivers; (a) high driving anger-problem; (b) high driving anger-no problem; (c) and low driving anger-no problem. Participants consisted of 153 undergraduate students recruited from introductory psychology courses. Participants were administered a battery of instruments inquiring about driving behavior as well as general anger. Additionally, subjects were asked to complete a driving log, in which they recorded incidents of anger, aggressive behavior and risky behavior while driving. Results found that the two groups of high anger drivers were more similar than different in their driving behavior. Both groups of high anger drivers were less likely to utilize constructive means of anger expression, engaged in more risky and aggressive driving behavior, and reported more accidents related outcomes than low anger drivers.
In addition to comparing high and low anger drivers, Deffenbacher (2008) conducted a study to explore differences in driving behavior between rural and urban drivers. Specifically, he focused on differences in anger, aggression, and risky driving behavior. Participants were 200 undergraduate college students, 100 from a rural campus and 100 from an urban campus, recruited from psychology and sociology courses. As in previous studies of this nature the participants were provided with a packet of questionnaires which assessed students’ driving behavior and driving anger. Results indicated that there were no meaningful differences between rural and urban drivers. However, the results did demonstrate that driving context appears related to the development of driving anger. For instance, Deffenbacher (2008) found that rush hour traffic elicited more anger than did ordinary road traffic. This finding is consistent with previous research conducted by Deffenbacher, Richards, Filetti, and Lynch (2005), and thus lends further support to person-environment interaction.

Although, Deffenbacher and colleagues have proposed a trait model for driving anger other models have been suggested. For instance, Neighbors, Vietor, and Knee (2002) suggest a motivational model of driving anger based on Self-Determination theory. It is postulated that an individual’s motivational orientation is influenced by exposure to certain environments, specifically autonomy-supportive versus controlling (Neighbors et al., 2002). More specifically, the controlling orientation has two components, pressure and stress, and ego defensiveness. The researchers’ hypothesized that the controlling individual would be more likely to become angry while driving as well as engage in aggressive driving behavior. In their study Neighbors and colleagues (2002) gave 111 undergraduate students a battery of questionnaires designed to assess
self determination. Additionally, these subjects were also provided a record keeping diary to record incidents of driving anger. Results of the study indicated that driving anger increased for individuals who rated themselves high in feeling pressured and ego defensiveness resulted in higher levels of driving. The researchers also found that individuals who endorsed a controlling orientation also endorsed higher levels of feeling pressure and ego defensiveness while driving. Finally, Neighbors and colleagues (2002) found that driving anger was a mediating variable between ego defensiveness and aggressive driving behavior.

Additionally, Dahlen and Ragan (2004) sought to validate an instrument that assesses ones propensity to become angry while driving, and is thus aptly names the Propensity for Angry Driving Scale (PADS). The authors recruited 232 students from undergraduate psychology courses at The University of Southern Mississippi. Subjects were provided a battery of questionnaires that assessed for driving anger as well as generalized trait anger. Results indicated that the PADS demonstrated excellent convergent validity with several other proven measures of driving anger such as the DAS. Additionally, the PADS was predictive of verbal and obscene gestures while driving. The PADS also predicted moving violations, minor accidents, and physically aggressive driving anger expression. Furthermore, discriminate validity was demonstrated validity was significant when comparing the PADS to measures of constructive and adaptive expressions of anger while driving. Aside from the validation of this instrument, this study tends to strengthen the previously established link between driving anger and maladaptive and unsafe driving behavior.
Driving anger also has a strong body of research globally and has shown similar results to those studies conducted in the United States. For example, Hoggan and Dollard (2007) examined the driving behaviors and work stress of 130 randomly selected Australian drivers in an attempt to find a relationship between work stress and road rage. Results confirmed previous findings that general anger was positively associated with driving anger (Deffenbacher and colleagues, 2003; 2003b). Additionally, Hoggan and Dollard (2007) found that individuals who experienced stress due to a perceived imbalance between their effort and the reward associated with that effort tend to experience higher levels of driving anger. However, the authors indicate that this relationship appears to be mediated by general anger and overcommitment. Finally, Hoggan and Dollard (2007) compared the results of this study to those of studies done on driving anger in the United States (Deffenbacher et al., 1994) and in the United Kingdom (Lajunen, Parker and Stradling, 1998) through single sample t-tests. Hoggan and Dollard (2007) found that Australian drivers reported higher levels of driving anger when compared to those in the United Kingdom and lower levels of driving anger when compared to United States motorists.

Similarly, Sullman, Gras, Cunill, Planes and Font-Mayolas (2007) investigated the construct of driving anger, using the DAS, within a Spanish population, which consisted of 371 university employees. Participants were provided with the DAS, which had been translated into Spanish by a native speaking translator. Sullman and colleagues (2007) compared data collected in this study to data from studies in other countries. Results of the study indicated that Spanish motorists reported higher levels of driving anger than motorists in the United Kingdom as found by Lajunen et al. (1998), similar
levels of driving anger as reported by drivers in New Zealand (Sullman, 2006), and lower levels of driving anger than American Drivers as found by Deffenbacher et al. (1994). Additionally, Sullman et al. (2007) found that female drivers reported more overall levels of driving anger than males, which is consistent with previous findings (Lajunen et al., 1998; Sullman, 2006).

Although the majority of studies exploring driving anger utilize the survey method of data collection, there are several studies that have employed driving simulators to measure this construct. For instance, Deffenbacher et al. (2003c) compared groups of high and low anger drivers independent of their acknowledgment of anger as problematic. Participants were 121 undergraduate students recruited from introductory psychology courses. Participants in the study were instructed on how to use the driving simulator, and then given four driving simulations to complete. Simulations ranged from just becoming familiarized (i.e., driving on roads with no traffic or stops) to high impedance scenarios (i.e., participant was stuck in traffic with nowhere to pull over). Prior to beginning the simulations and following each of the driving simulation scenarios participants were asked to complete the state anger scale. Upon completion of all of the driving scenarios subjects were then given the option to complete a battery of questionnaires as well as a driving log, all of which assessed driving behavior, specifically risky and aggressive driving behavior. Results of this study indicated that high anger drivers reported more risky driving behavior in simulations of impedance, such as higher rates of speed, increased accident rates, and shorter times to impact. Furthermore, high anger drivers became angrier more frequently, and reported greater intensity when angry in everyday driving situations. Moreover, high anger drivers were
less likely to employ constructive methods of expressing anger while driving, and were more likely to exercise aggressive, less adaptive means of expressing anger.

Taken as a whole, the literature related to driving anger suggests that high anger drivers are more likely to engage in unsafe driving behavior when compared to low anger drivers. Additionally, it appears that high anger drivers express their anger in more aggressive and less adaptive or constructive methods. Taken together, these types of driving behaviors place high anger drivers at a greater risk of being involved in motor vehicle accidents, placing themselves and others in jeopardy of serious injury or death.

Beyond Single Predictors: The Case for Multivariate Assessment

A growing body of psychological research has focused on identifying predictors of aggressive and risky driving behavior (Deffenbacher et al., 1994; Krahe & Fenske, 2002; Smith et al., 2006; Szlemko, Benfield, Bell, Deffenbacher, & Troup, 2008), and several have been identified, such as age, gender, driving anger, sensation seeking, impulsiveness, and consideration of future consequences (Dahlen et al., 2005; Deffenbacher et al., 1994; Jonah et al., 2001; Krahe & Fenske, 2002; Moore & Dahlen, 2008; Ozken & Lajunen, 2005). However, these predictors have been generally been studied independently and are only recently being examined in combination.

Although effective, especially in the early stages of a research program, the use of single predictors may be limiting in scope, reducing assessment efficiency. By combining multiple predictors, it may be possible to explain a greater proportion of the variance in unsafe driving and accident-related outcomes, allowing for more accurate identification of unsafe driving behavior and improved understanding. Additionally, the creation of measures which incorporate multiple constructs designed to assess unsafe driving
behavior may boost efficiency, eventually reducing the need for multiple questionnaires and shortening administration time. Clearly, this has implications for research, prevention, and intervention efforts. For instance, if multiple predictors can improve the prediction of unsafe driving behavior over and above single predictors, more effective measures may be developed, thus benefiting research in this area. Additionally, improved identification of individual differences associated with unsafe driving on multiple dimensions may assist in identifying at-risk drivers, contributing to preventative strategies and helping clinicians more effectively treat these individuals.

Dahlen and colleagues (2005) provided an example of the potential benefits of examining multiple predictors. Participants were 224 undergraduate students who were administered a battery of measures assessing driving behavior and several personality factors. The researchers identified and assessed three personality variables known to predict driving behavior independently (i.e., driving anger, sensation seeking, and impulsiveness), along with a fourth understudied variable of interest (i.e., boredom proneness), in the prediction of aggressive driving and driving anger expression. Results indicated that the combination of trait driving anger, sensation seeking, impulsiveness, and boredom proneness improved prediction over the use of any of these variables in isolation. That is, the prediction of aggressive driving and driving anger expression were enhanced through the use of a more complex predictive model utilizing multiple variables that had previously been examined in independent studies conducted by separate researchers.

In a similar study, Dahlen and White (2006) administered measures of the Five Factor Model (FFM) of personality, sensation seeking, driving anger, and driving
behavior to 312 undergraduate students. Even though the combination of predictors in this study differed from that of Dahlen and colleagues (2005), a similar outcome was obtained in that multivariate prediction (i.e., the combination of sensation seeking, driving anger, and several of the personality traits of the FFM) better predicted driving behavior as compared with single predictors.

Additionally, Moore and Dahlen (2008) conducted a study exploring the potentially protective effects of positive traits in unsafe driving behavior. Instruments measuring trait forgiveness, consideration of future consequences, trait driving anger, and driving behavior were administered to 316 undergraduate participants. Results indicated that forgiveness and consideration of future consequences were inversely related to several unsafe driving behaviors, such as aggressive driving, risky driving, and physically aggressive driving behavior. Additionally, both constructs were positively correlated to adaptive and constructive driving anger expression. Therefore, it appears that positive traits, such as willingness to forgive, and the ability to consider the consequences of one’s behavior, may reduce an individual’s propensity to engage in unsafe driving behavior. Again, the combination of predictor variables from divergent theoretical bases proved useful in understanding driving behavior.

Due to the complexity of driving behavior, there is a need to go beyond single predictors and look toward multiple predictors in an effort to more efficiently understand and predict problematic driving behavior. However, combining too many predictors may be problematic for a variety of reasons, including multicollinearity, cost in both money and participant time, and unnecessary complexity. At some point, diminishing returns will be reached as assessment batteries become unwieldy, limiting clinical use and
rendering research applications cumbersome and impractical. Therefore, brief measures of multiple variables are needed to streamline the assessment process and advance efforts to reliably and efficiently assess the risk of problematic driving behavior. Although, concise multiple risk factor measures are likely to be advantageous to both accident prevention and research efforts, very few well validated multiple factor assessment tools are currently available.

The Driver Stress Profile: An Untested Example of Multivariate Assessment

Larson’s (1996) Driver Stress Profile (DSP) is one of the few available instruments designed to assess several theoretically relevant constructs to identify aggressive unsafe driving behavior. It is a 40-item self-report measure of (a) anger, (b) impatience, (c) competing, and (d) punishing. The DSP was designed to assess an individual’s level of aggressive driving behavior specifically for use in clinical settings (Blanchard et al., 2000; Larson, 1996). Unfortunately, research validating the DSP has been sparse and suffers from a number of important methodological weaknesses. Prior to reviewing this literature, the components the DSP was designed to assess will be addressed in detail.

Anger

Although Larson did not provide an operational definition of driving anger, he appears to conceptualize it as an overreaction to an event or trigger that is perceived as a threat or challenge to one’s beliefs (Larson, 1996, 1999). For instance, Larson (1999) stated, “We each define rules of the road for our own and other drivers’ behavior-rules that we believe in strongly and are willing to defend. When other drivers challenge our rules, as they will almost every day, we get angry” (p. 42). Therefore, according to
Larson, driving anger appears to be affected by one’s cognitive interpretations of driving events and situations. Specifically individuals tend to get angry when they perceive that other drivers have violated some self-imposed rule, or wronged them in some way.

Larson’s conceptualization of anger, as measured by the DSP, appears to be rather similar to the form of driving anger measured by the DAS. Deffenbacher and colleagues (1994) developed the DAS in an effort to identify trait driving anger, or an individual’s propensity to become angry while driving. Items consist of driving situations likely to provoke anger, and respondents indicate how angry each situation would make them. Although Larson’s writing about driving anger emphasizes the violation of cognitive rules by others, the items on his anger subscale are very similar to those on the DAS. Like the DAS, Larson’s anger subscale includes items that ask about sources of provocation which might be encountered while driving. However, respondents indicate how often they become angry in these situations rather than how angry they would feel. In addition, the DSP subscale item content tends to be more general. For example, this DSP subscale includes items such as “Get angry at drivers generally” and “Get angry at passengers,” while the DAS items describe more specific situations (e.g., “Someone runs a red light or stop sign,” “A slow vehicle on a mountain road will not pull over and let people by”). Differences aside, both measures are assessing anger experienced while driving.

As discussed previously, anger experienced while driving has been associated with unsafe driving behavior. For example, several studies have compared high and low anger drivers, and results have indicated that those prone to experience anger while driving engaged in more risky and aggressive driving behavior, reported being involved
in more accidents and accident related incidents than low-anger drivers, are less likely to utilize constructive means of anger expression, engaged in more risky and aggressive driving behavior, and reported more accidents related outcomes than low anger drivers (Deffenbacher et al., 2000b, 2003a, 2003b). Therefore, Larson’s inclusion of a driving anger variable in the DSP is appropriate, as this is likely to be a robust predictor of aggressive and other forms of unsafe driving.

**Impatience**

Impatience is another construct assessed by the DSP. Larson (1996) grouped some drivers into “The Speeder: Make Good Time” category, which appears to be related to the concept of impatience (p. 39). He stated that this type of driver drives as fast as possible in order to reach a destination in a self-prescribed amount of time. If the driver’s rate of speed or schedule are impeded in any way, anger results. Larson states, “Whoever or whatever is deemed responsible for bringing about the delay becomes the object of rage” (1996, p. 39).

Although the construct of impatience has received far less attention in the traffic safety literature than driving anger, it may have important implications for driving behavior. For instance, individuals who experience a great deal of impatience may be more prone to engage in risky driving behavior, such as speeding, in order to reduce the negative feelings associated with impatience. While Larson emphasizes the anger experienced when an impatient driver encounters frustration, it is equally possible that impatient drivers may take more risks while driving, independent of angry affect.

Although a dearth of research exists in which impatience is explored in direct relation to driving behavior, there is a small body of research that examines this construct
in relation to driving behavior, specifically as a component of Type A personality. When defining the term Type A Behavior Pattern, Friedman and Rosenman (1974) stated “It is a particular complex of personality traits, including excessive competitive drive, aggressiveness, impatience, and a harrying sense of time urgency” (p. 4). In a study by Spence, Helmreich, and Pred (1987), the researchers found evidence of two relatively independent factors of Type A behavior pattern, Achievement Strivings and Impatience-Irritability. Therefore, research exploring Type A behavior and driving behavior may provide insight into the relationship between impatience and driving behavior.

In a study conducted by Perry (1986) subjects were asked to completed a measure of Type A behavior, as well as a questionnaire inquiring about the number traffic citations that had received and the number of motor vehicle accidents they had been involved in. Results indicated a significant positive relationship between Type A behavior patterns and the number of traffic citations and accidents. More pertinent to the current study, Perry (1986) found that impatience was the most significant Type A behavior factor contributing to unsafe driving behavior.

More recently Perry and Baldwin (2000) examined the relationship between Type A behavior variables and driving behavior in a student population. Students were asked to complete a measure assessing Type A behavior along with several measures which examined driving behavior. Perry and Baldwin (2000) found that Type A individuals differed significantly from Type B individuals in the types of driving behavior they engage in. Specifically, higher Type A individuals reported greater amounts of impatience, more aggressiveness while driving, greater risk taking behavior while driving, and more occurrences of accidents and traffic violations.
In an intriguing study by Boyce and Geller (2002), participants' driving behaviors were obtained using an instrumented vehicle outfitted with concealed cameras and an onboard computer which measured: driver safety-belt use; number of times a turn-signal was used left, right, and emergency flashers; vehicle velocity, average speed, velocity changes, and velocity variance (all recorded in mph); and following distance measured in meters. Additionally, Type A behavior was measured using various personality instruments. Results indicated that Type A personality was a significant predictor of unsafe driving behavior. Specifically, individuals who rated high in Type A behavior engaged in more speeding and followed other vehicles on the road more closely than individuals who did not exhibit Type A personality characteristics. The researchers concluded that “the present results appear to support prior correlations between the impatience and achievement strivings components of type A and ‘at-risk’ lifestyle choices and behaviors” (p. 62).

Similar findings have been found in studies conducted outside of the United States. For instance Karlberg, Unden, Elofsson, and Krakau (1998) had participants’ complete measures of Type A behavior and driving behavior/history. Participants were also required to participate in a videotaped structured interview. Findings from this study indicated that time pressure was significantly related to near misses of car accidents while driving. Additionally, in a study conducted in Europe, which explored the influence of social deviance, Type A behavior pattern, decision making on driving behavior, West, Elander, and French (1993) found an association between Type A behavior pattern and faster driving speeds.
Taken as a whole, research indicates that individuals who display Type A behavior patterns appear to engage in riskier driving behavior than individuals who do not endorse Type A features. Furthermore, impatience has been found to be a key component of the Type A behavior pattern, and several studies have demonstrated a clear relationship between impatience as a component of Type A behavior and unsafe and risky driving behavior. Therefore, impatience appears to be a significant predictor of unsafe driving behavior.

**Competing**

Competitiveness can be viewed as a strong desire to compete and succeed when engaged in a particular activity (Sambolec, Kerr, and Messe, 2007). Larson describes the competitive driver as an individual who is always striving to be number one. He states, “extended to the road, this belief holds that the way to gain self esteem and status is to beat the driver of another car in some self created contest” (1999, pp. 43-44). Larson (1999) postulated that when competitive drivers perceive they are losing, or actually lose some driving contest, anger results.

Similar to impatience, there is a death of literature that examines the construct of competitiveness in relation to driving behavior. However, although small in number, findings of the studies conducted which examine the relationship between competitiveness and driving behavior appear promising. In an exploratory study conducted by Galovski and Blanchard (2002), the researchers compared two groups of aggressive drivers with and without Intermittent Explosive Disorder to a group of non-aggressive drivers. Participants were 50 drivers, 30 of which were identified as aggressive drivers. Of the 30 aggressive drivers 20 drivers were referred through the
court system and 10 were self-referred through a local media advertisement. The additional 20 drivers were a non-aggressive control group. Participants were administered a battery of questionnaires which inquired about driving behavior, as well as the Jenkins Type A measure. Although the sample size was low, the researchers found that individuals in the aggressive driving group endorsed greater levels of competitiveness.

As with impatience, competitiveness has also been examined as a component of Type A behavior when explored in relation to driving behavior. For instance, Shahidi, Henley, Willows, and Furnham (1991) had participants complete a measure of Type A behavior and then engage in a competitive driving game. Subjects consisted of 20 male and 20 female undergraduate students. The participants who rated higher in Type A behavior displayed a more competitive nature, demonstrating a greater desire to win. Additionally, these same individuals exhibited more carelessness when participating in the driving game.

Overall, research indicates that competitiveness is associated with high levels of risky driving behavior, traffic violations, and motor vehicle accidents. Although the literature examining competitiveness in relation to driving behavior is sparse, some evidence suggests that this construct may be useful in the prediction of unsafe driving behavior.

Punishing

In his 1996 book, *Steering Clear of Highway Madness*, Larson developed a classification of drivers he termed “Vigilante.” He described these drivers as individuals who believe it is their duty to punish bad drivers. For example, a driver stuck behind a slow-moving vehicle might pass, pull in front, and slow down to force the other driver to
brake. Other behaviors demonstrated by these drivers may include tapping on the breaks when someone is tailgating or allowing tailgaters to pass and then tailgating them with high beams on. It appears that Larson is suggesting that punishing individuals perceive certain driving behavior by others as a personal attack, and as a result attack back. Therefore, punishing driving behavior is a response to a perceived personal attack which then leads an individual to retaliate. This type of behavior may lead individuals to engage in risky and aggressive driving behavior even in response to unintentional driving discretions by other drivers.

Individual differences in the desire to punish other drivers have been studied in a small amount of literature on driving vengeance. Vengeance has been defined as “the infliction of punishment or injury in return for perceived wrong” (Stuckless, Ford, & Vitelli, 1995, p. 1). Furthermore, vengeance has been shown to be significantly related to aggression, and has been found to be a noteworthy factor in various types of crimes, such as, theft, rape, and homicide (Stuckless et al., 1995).

Development and validation of the Drivers Vengeance Questionnaire (DVQ) has demonstrated that vengeance is a valid and functional construct which can be used to predict unsafe driving behavior (Hennessy & Wiesenthal, 2001; Wiesenthal, Hennessy, & Gibson, 2000). Moreover, research has demonstrated that vengeance is related to maladaptive behavior while driving. Specifically, evidence supports vengeance as a predictor of mild aggression (i.e., giving the finger, honking the horn, and swearing) and violence while driving (Hennessy & Wiesenthal, 2005; Wiesenthal et al., 2000). For example, Hennessy and Wiesenthal (2002) asked participants to fill out measures assessing the probability of participants engaging in mild driver aggression, the frequency
of past driver violence, driving vengeance, and willful violations. The researchers found that drivers who displayed mild forms of aggression and also rated high in vengeance were more likely to engage in violent driving behavior (i.e., drive-by shootings, physical confrontations, using the car as a weapon).

Taken as a whole, research has demonstrated that vengeance is a significant predictor of unsafe driving behavior. Specifically, more violent driving behavior, such as, using one’s car as a weapon and altercations with other drivers appear to be correlated to high levels of driving vengeance. Therefore, vengeance, or an individual’s propensity to punish other drivers for perceived infractions appears to be a useful construct in the prediction of risky and unsafe driving behavior.

Reliability and Validity of the Driver Stress Profile

Blanchard, Barton and Malta (2000) reported the results of three studies designed to evaluate the psychometric properties of the DSP. The first study was simply a small-scale ($N = 33$) evaluation of the short-term stability of the DSP. The participants consisted of 33 individuals who were recruited from the staff, students, and acquaintances. However, the researchers give no indication of where the subjects were recruited from. Subjects completed the DSP twice with a 1-week interval between administrations. Results indicated a 1-week test-retest reliability coefficient of .93 for the total score and .84 to .96 for the subscales. Thus, the DSP appears to have fairly good short-term stability.

The second study examined the internal consistency and factor structure of the DSP. Participants consisted of 176 individuals (77 men and 99 women). The researchers gave no indication in the research article of where this population of participants was
recruited from. Alpha coefficients were .93 for the full DSP scale, .78 for the Anger subscale, .82 for the Impatience subscale, .89 for the Competing subscale, and .85 for the Punishing subscale. Thus, the DSP subscales appear to measure unitary constructs. The authors also conducted a principle components analysis (PCA) from which they derived three factors: competition, impatience, and anger. Unfortunately, this study was not without its weaknesses. In addition to not having a sufficient number of subjects to support their PCA, the authors did not provide adequate detail to permit evaluation of their statistical procedures. For instance, they reported that three factors were obtained from the exploratory factor analysis accounting for 43.4% of the variance. However, 43.4% of the variance is low, and in fact a greater amount of variance is left unaccounted for. The authors failed to provide any explanation as to why they stopped at 43.4% of the variance, thus leaving the reader to wonder if more variance could have been explained if additional factors were added. Thus, the factor structure of the DSP remains unclear.

The third study reported by Blanchard et al. (2000) was designed to assess the convergent validity of the DSP via comparisons with the State-Trait Anger Scale (STAXI), the DAS, and the Jenkins Activity Survey (JAS). The researchers utilized the same participants that were used in study two. They also stated that 84 of the participants were selected from the community and 92 were college students. The authors do not provide any further information about where these participants were selected from. Participants were provided with the battery of questionnaires listed above. However, students were provided with the student version of the JAS, whereas community participants were provided with the original version of the JAS. Results indicated that the full scale DSP score and the three previously identified factors, Anger, Competition, and
Impatience scores were positively correlated with the Trait Anger and Anger Out subscales of the STAXI. Furthermore, these same DSP subscales and the full scale score were inversely related to the Anger Control subscale of the STAXI. In relation to the JAS, the DSP full scale score and all three factors of the DSP were positively related to the JAS full scale score and to the speed and impatience subscale of the JAS. Lastly, the DSP and the DAS demonstrated good overall correlation ($r = .57; 32\%$ shared variance). Thus, it appears that the DSP was generally related to measures of similar constructs in expected directions.

Houston, Johnson, Skinner, and Clayton (2006) compared four measures of driving behavior which included the Aggressive Driving Behavior Scale, the Driving Aggression Scale of the Driving Behavior Inventory, the DSP, and the DAS. Participants were 170 college undergraduates from a small liberal arts college in Florida. Participants were provided a packet of the measures listed above, a demographic form, and some open ended questions regarding the number of driving violations, accidents, and near accidents over the last year. Correlations among all measures were significant, suggesting that they were assessing the same construct. However, results also indicated that these different measures may be measuring different aspects of aggressive driving. Results also indicated adequate construct validity for all of the measures included in the study. Additionally, only the Speeding subscale of the ADBS and the Anger subscale of the DSP predicted accident involvement.

Although only peripherally related to the reliability and validity of the DSP, a study by Galovski and Blanchard (2002) suggested some sensitivity to detecting treatment effects. Their study was conducted to explore the effectiveness of a cognitive-
behavioral anger management treatment program tailored to aggressive drivers. A total of 30 Participants were recruited through media campaigns as well as through the court systems. Therefore, participants were either self-referred or court-ordered to treatment for aggressive driving behavior. Subjects accepted into the study were assigned to either the cognitive-behavioral therapy (CBT) group or to a system monitoring control group. The DSP was administered along with the Driving Anger Scale, to assess pre-, post- and follow-up driving behavior. Results indicated that the CBT group showed significant decreases in unsafe driving behavior. Relevant to the current study, significant decreases were found on the competing component of the DSP. Additionally, although not significant, decreases in the total DSP score were observed between post treatment and two month follow up assessments.

Despite unanswered questions about the latent structure of the DSP, it appears to warrant further evaluation. Preliminary evidence of short-term stability, internal consistency, and convergent validity is promising, albeit incomplete. Specifically, only a single study has been conducted to assess the psychometric properties of the DSP, which utilized an inadequate number of participants. Additionally, this same study failed to adequately make clear a significant amount of unexplained variance following an exploratory factor analysis. Furthermore, no studies to date have explored the utility of the DSP in relation to other well established driving behavior measures. Taken together, these concerns warrant further exploration in order to better understand the psychometric properties as well as the utility of the DSP.
The Present Study

Motor vehicle accidents are one of the leading causes of death in the United States (NHTSA, 2006) and have attracted considerable research attention. Current research has found that the motor vehicle accidents are not caused by a single factor, but rather are due to the combination of several factors, making prediction a complicated undertaking (GAO, 2003; Hemenway & Solnick, 1993; NHTSA, 2004; Peck, 1993). Although prediction has proven complex current research has identified human factors as the primary cause of motor vehicle accidents (Evans, 1991; GAO, 2003). Demographic variables and personality characteristics have received a great deal of attention in the driving literature, and have proven to be effective in the prediction of risky driving behavior (Espino et al., 2006; Hemenway & Solnick, 1993; Jonah et al., 2001; Jonah, 1990, 1997; Ozkan & Lajunen, 2005). Despite the understanding that motor vehicle accidents are due to multiple factors, as well as the complexity of human behavior in relationship to motor vehicle accidents, there still remains a dearth in the literature focusing on multiple predictors of driving behavior (Dahlen et al., 2005).

Additionally, current measures of unsafe driving behavior tend to focus solely on one particular construct, but seldom combine multiple predictors. However, measures that incorporate multiple constructs of driving behavior may have several benefits, such as making the process of prediction more efficient through utilizing a single measure of multiple predictors as opposed to using numerous single construct measures. Therefore, the present study will examine the validity of the Driver Stress Profile (DSP; Larson, 1996) as a multiple construct measure for assessing driving behavior. The DSP appears to be a promising multi construct instrument as demonstrated through a handful of studies.
(Blanchard et al., 2000; Galovski & Blanchard, 2002; Houston et al., 2006). However, at present more exploration is needed in relation to the validity and reliability of the DSP. There is only one reported study that has examined the psychometric properties of the DSP (Blanchard et al., 2000), however, there are concerns related to the research methods used and the lack of information provided. Therefore, further exploration is warranted in relations to the psychometric properties and utility of the DSP.

Research Questions

1. Is there support for the latent structure of the DSP?
2. Does the DSP demonstrate evidence of convergent and discriminant validity via comparisons with measures of similar and dissimilar constructs?
3. Is the DSP a useful tool in predicting motor vehicle accidents?
4. Does the DSP predict unsafe driving behavior?
5. Can the DSP demonstrate evidence of incremental validity over two well-researched measures in the prediction of unsafe driving behavior (i.e., Driving Anger Scale and Sensation Seeking Scale)?

Statistical Hypotheses

1. The latent structure of the DSP, examined via exploratory factor analysis (EFA), is generally expected to correspond with that suggested by Larson (1996). However, because of numerous problems with the previously reported EFA by Blanchard et al. (2000), this analysis is designed to be exploratory in nature.
2. The DSP will demonstrate evidence of convergent and discriminant validity in the following ways:
a. The Anger subscale will be positively correlated with the DAS, and the strength of this relationship will exceed that of the relationships of the Anger subscale with the Driving Vengeance Questionnaire, Hypercompetitiveness Scale, and student JAS.

b. The Punishing subscale will be positively correlated with the Driving Vengeance Questionnaire, and the strength of this relationship will exceed that of the relationships of the Punishing subscale with the Driving Anger Scale, Hypercompetitiveness Scale, and student JAS.

c. The Competitiveness subscale will be positively correlated with the Hypercompetitiveness Scale, and the strength of this relationship will exceed that of the relationships of the Competitiveness subscale with the Driving Anger Scale, Driving Vengeance Questionnaire, and student JAS.

d. The Impatience subscale will be positively correlated with the student version of the JAS, and the strength of this relationship will exceed that of the relationships of the Impatience subscale with the Driving Anger Scale, Driving Vengeance Questionnaire, and Hypercompetitiveness Scale.

3. Independent of respondent gender and average miles driven/week, the DSP will predict minor motor vehicle accidents.

4. Independent of respondent gender and average miles driven/week, the DSP will predict aggressive driving, risky driving, and driving anger expression.
5. Independent of respondent gender and average miles driven/week, the DSP will predict aggressive driving, risky driving, and driving anger expression over and above the Driving Anger Scale and Sensation Seeking Scale.
CHAPTER II
METHODOLOGY

Participants

Undergraduate volunteers \( (N = 411) \) from Psychology courses at The University of Southern Mississippi were recruited through a web based research system. All participants were provided an informed consent form which required an electronic signature prior to proceeding (see Appendix A). Participants were asked to complete a brief demographic questionnaire (see Appendix B) prior to completing research measures (see Appendix C). Participants were predominately female (72%), and their ages ranged from 18-53 \( (M = 21) \). Most identified themselves as either White (58.2%) or African American (36.5%), and the remainder reported their racial/ethnic backgrounds as Hispanic (1.9%), Asian/Pacific Islander (1%), American Indian/Alaska Native (.7%), and other (1.7%). Finally, the average number of years driving was 6.2, with a median of 100 miles driven per week. Participants received research credit after completing the study.

Instruments

*Driving Anger Scale (DAS)*

The tendency to become angry while driving was measured using the 14-item DAS short form developed by Deffenbacher et al. (1994). Each item provides a brief scenario that could be anger provoking which respondents rate using a five point Likert scale, \( 1 = not\ at\ all \) to \( 5 = very\ much \). The measure is keyed so that higher scores reflect a greater propensity to experience angry while driving. Six subscales were derived from the full length 33-item DAS, which include hostile gestures, illegal driving, police presence,
slow driving, discourtesy, and traffic obstructions. The short form of the DAS was created by taking items from each subscale that were highly correlated with both the subscale and full length DAS total scores. The short form of the DAS displays high internal consistency ($\alpha = 0.80$), as well as a high correlation with the DAS long form ($r = 0.95$). Deffenbacher (2000) found a moderate correlation to the trait anger scale ($r = 0.27-0.33$) suggesting that driving anger and trait anger are related but still independent constructs. Additionally, Dahlen and Ragan (2004) found a positive correlation ($r = .50$) between the DAS and the Propensity for Angry Driving Scale, and a significant correlation ($r = .52$) with the Use of The Vehicle to Express Anger subscale of the DAX. Therefore, the DAS appears to show adequate convergent validity with other measures of similar constructs.

Driving Survey

The driving survey (Deffenbacher et al., 2000) is a 35-item survey that measures frequency of aggressive and risky driving behavior and accident-related variables. The Driving Survey is divided into three sections: (a) 6 items measure crash-related conditions over the last three months, (b) 13 items measure the frequency of aggressive driving ($\alpha = .88$) over the last three months, (c) 16 items measure risky driving ($\alpha = .86$) over the last three months. Items are rated on a scale from 0 to 5+ based on how many times the participant has experienced the condition. While the aggressive and risky driving subscales provide reliable measures of their respective constructs, the crash-related conditions items are usually analyzed individually because they do not for a reliable scale (Deffenbacher et al., 2003a; Deffenbacher et al., 2001).
Driving Anger Expression Inventory (DAX)

Participants’ mode of expressing anger while driving was measured using the DAX (Deffenbacher, Lynch, Oetting, & Swaim, 2002). The DAX consists of 49 items which are rated using a four-point Likert scale ranging from, 1 = almost never to 4 = almost always, regarding how often an individual participates in a specific type of behavior. The DAX yields four subscales (αs = .80 to .90): Physically Aggressive Expression (e.g., shaking a fist at another driver), Verbally Aggressive Expression (e.g., yelling or swearing out loud at another driver), Use of the Vehicle to Express Anger (e.g., cutting in front of another driver), and Adaptive/Constructive Expression (e.g., thinking the situation through before responding). Evidence of convergent validity has been reported in the form of correlations with trait anger, aggression, and unsafe or risky driving (Deffenbacher et al. 2001, 2002).

Student Jenkins Activity Survey (SJAS)

Type A behaviors, including impatience, were assessed with the 21-item Student Jenkins Activity Survey (SJAS; Yarnold, Mueser, Grav, & Grimm, 1986; Yarnold, Bryant, & Grimm, 1987). The SJAS is a student version of the Jenkins Activity Survey (Glass, 1977) and was derived by modifying or deleting items that were unrelated to students. For instance, words such as work or job were replaced with references to course work. Additionally, an item in the original JAS referring to the number of vacation days taken was replaced by items referring to maintaining a regular schedule during school holidays and breaks in the student version. Although the SJAS measures the broader Type A pattern of which impatience is one part (Perry & Baldwin, 2000; Jenkins, Rosenman, & Zyanski, 1974; Spence et al., 1986, 1987), it was selected for the present
study because no psychometrically sound pure measures of impatience could be found. The SJAS scores can range from 0 to 21, with higher scores indicating a greater propensity toward Type A behavior. Given its purpose of assessing the broad Type A behavior pattern, it is not surprising that the internal consistency of the SJAS is fairly low, with alphas of .40 to .72 reported in the literature (Yarnold et al., 1986). However, there is evidence of excellent temporal stability, with two-week test-retest reliabilities ranging from .90 to .96 and three-month test-retest reliabilities from .74 to .86 (Yarnold et al., 1986). There appears to be a lack of information regarding the validity of the SJAS (Fisher & Corcoran, 1994). However evidence exists for the construct validity of the Jenkins Activity Scale (Ditto 1982; Jenkins et al., 1974; Nielson & Dobson, 1980), from which the SJAS was derived. The SJAS contains the majority of the original JAS questions with some changes to wording in order to relate to college populations.

Hypercompetitive Attitude Scale (HCA)

Competitiveness was measured using the HCA scale. The HCA is a 26-item scale developed Ryckman, Hammer, and Kacor (1990), which assesses the construct of hypercompetitiveness, The creation of the HCA was derived from Karen Horney’s (1937) definition of hypercompetetiveness, which Ryckman and colleagues (1990) paraphrase as “an indiscriminate need by individuals to compete and win (and to avoid losing) at any cost as a means of maintaining or enhancing feelings of self-worth, with an attendant orientation of manipulation, aggressiveness, exploitation, and denigration of others across a myriad of situations” (p. 630). Horney (1937) also stated hypercompetetiveness was maladaptive and could be deleterious to the functioning of an individual. Therefore, questions on the HCA revolve around this definition of inflating one’s self worth.
Respondents rate each question using a five-point Likert scale, ranging from 1 = *Never true of me* to 5 = *Always true of me*, which assess the extent of certain competitive behaviors and beliefs of the respondent. The HCA was developed to yield a single total score with no subscales. Internal consistency of the HCA has been shown to be strong with $\alpha = .91$ (Ryckman et al., 1990). The authors also found a positive correlation ($r = .48$) between the HCA and the Competetive Cooperative Attitude Scale (Martin & Larson, 1976), thus demonstrating adequate convergent validity with another known measure of competitiveness.

**Sensation Seeking Scale (SSS)**

Sensation seeking was measured using the 40-item SSS-V, developed by Zuckerman (1994). The SSS-V is adapted from the previous version of the SSS, as a result of concerns regarding the outdated wording of the SSS (Zuckerman, 2007). Responses are indicated using a forced choice method, in which the respondents must choose one of two options. The SSS yields a full scale score for sensation seeking, and four subscales. The full scale of the SSS has demonstrated adequate reliability, with $\alpha = .83$ to 86 (Zuckerman, 1994). The SSS has been demonstrated good construct validity when compared to other measures which assess for similar constructs (Carton, Jouvent, & Widlöcher, 1992; Gray & Wilson, 2007; Norman & Fenson, 1970; Zuckerman & Link, 1968).

**Driver Stress Profile (DSP)**

The Driver Stress Profile is a 40-item measure of personality characteristics associated with aggressive driving behavior developed by Larson (1996). Items are rated using a four point Likert scale ranging from, $0 = \text{Never}$ to $3 = \text{Always}$ corresponding to
how often an individual engages in certain types of behaviors or experiences certain types of feelings. The DSP yields four subscales each consisting of ten items: Competitiveness ($\alpha = .89$); Anger ($\alpha = .78$); Impatience ($\alpha = .82$); and Punishing ($\alpha = .85$) (Blanchard et al., 2000). Additionally, Blanchard and colleagues (2000) have demonstrated a reliability coefficient of .93 for the full scale DSP score. Information regarding the validity of the DSP is limited, specifically there has only been one study that has examined the validity of the DSP (Blanchard et al., 2000). However, Blanchard and colleagues (2000) found significant correlations between the DSP and the State-Trait Anger Expression Inventory ($r = .17$), the Jenkins Activity Survey ($r = .33$), the Student Jenkins Activity Survey ($r = .28$), and the Driving Anger Scale ($r = .33$), supporting construct validity.

**Driving Vengeance Questionnaire (DVQ)**

The DVQ is a 15-item measure developed by Wiesenthal and colleagues (2000) to assess a driver’s propensity to engage in retaliatory behavior when a perceived wrong has occurred. Each of the 15 items presents the participant with a possible driving scenario, such as “a driver passes you and makes an obscene gesture at you,” and then provides four possible response choices that descend in aggressive severity, such as “force the other vehicle off the road” to “do nothing.” In addition to the four provided responses participants are provided a fifth option in the form of an open response entitled “other,” where participants may write in a response if difference from the options provided for the question. Participants are instructed to choose the answer that is closest to how they would normally respond in the given scenario. Participant responses are scored with more aggressive responses receiving more points and less aggressive responses less points. Open responses are scored based on the level of aggression indicated in relation to
provided options. The DVQ has been found to be a reliable measure of driving vengeance 
(α = .81 - .83) (Hennessy & Wiesenthal, 2001; Wiesenthal et al., 2000). Additionally, 
driver violence and mild driver aggression measured in high traffic congestion were 
predictive of DVQ scores, specifically higher reports of driver violence and aggression 
was positively correlated with higher levels of driving vengeance (Hennessy & 
Wiesenthal, 2001). Thus, the DVQ appears to demonstrate convergent validity.

Procedure

Participants were provided with a brief overview of the study and given the option 
to participate using the Department of Psychology’s research website 
(www.experimetrix.com/usm). All data were collected online via Surveymonkey and 
were be accessible through a link from the Department of Psychology’s research website 
(www.experimetrix.com/usm). Participants were presented with an online version of the 
consent form (see Appendix A), which they read and signed electronically using their 
University of Southern Mississippi ID number before proceeding to the questionnaire. 
The consent form explained that participants were being asked to participate in a research 
project investigating the role of personality traits and various attitudes in driving behavior 
and outlined any risks and benefits that may result from participation in the study. 
Additionally, participants were advised that the study would take approximately one hour 
and be worth two research credits. Furthermore, the consent form advised potential 
participants that participation in the study is voluntary and that the participant may 
withdraw at any time without penalty or prejudice.
CHAPTER III
RESULTS
Preliminary Analyses

Data were downloaded from SurveyMonkey in the form of an Excel file and subsequently formatted into an SPSS file. Item-level frequency distributions were examined and demonstrated that all data fell within allowable ranges. Additionally, scale-level frequency distributions revealed no coding errors within the data set. Means, standard deviations, and alpha coefficients were calculated for all study variables (see Table 1).

Alpha coefficients were examined to determine whether scales measured unitary constructs and were thus appropriate for subsequent analyses. One scale, the Student Jenkins Activity Survey, demonstrated marginal internal consistency ($\alpha = .67$). Given that this instrument was designed to assess the multidimensional Type A behavior pattern, this level of internal consistency was not surprising. Based on the impressive evidence of temporal stability reported in the literature (see Yarnold et al., 1986) and the lack of alternative measures theoretically linked to impatience, it was decided to retain the Student Jenkins Activity Survey for the purpose of assessing the convergent validity of the DSP.

In order to test for potential gender differences on the measures with multiple subscales, three one-way (Gender) multivariate analyses of variance (MANOVAs) were conducted on the Driving Survey, Driving Anger Expression Inventory, and Driver Stress Profile. First, there was a significant multivariate effect on the DAX, $F(4, 406) = 2.87, p$
Wilks' Lambda = .97; $\eta^2 = .03$. Univariate tests reported in Table 1 showed that this effect was due to the Physically Aggressive Expression subscale.

Table 1

*Alphas, Means, Standard Deviations, and Univariate Tests for Gender Differences*

*(N=411)*

<table>
<thead>
<tr>
<th>Variables</th>
<th>$\alpha$</th>
<th>Men $M$</th>
<th>SD</th>
<th>Men $M$</th>
<th>SD</th>
<th>$F$ (1,409)</th>
<th>$\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driving Survey</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AD</td>
<td>.89</td>
<td>26.16</td>
<td>12.66</td>
<td>23.92</td>
<td>10.82</td>
<td>3.21</td>
<td>.008</td>
</tr>
<tr>
<td>RD</td>
<td>.89</td>
<td>41.50</td>
<td>15.67</td>
<td>37.80</td>
<td>14.69</td>
<td>5.08*</td>
<td>.012</td>
</tr>
<tr>
<td>DAS</td>
<td>.91</td>
<td>41.83</td>
<td>11.49</td>
<td>44.25</td>
<td>11.23</td>
<td>3.80</td>
<td>.009</td>
</tr>
<tr>
<td>DAX</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VA</td>
<td>.92</td>
<td>15.09</td>
<td>6.19</td>
<td>13.56</td>
<td>4.34</td>
<td>.72</td>
<td>.002</td>
</tr>
<tr>
<td>PA</td>
<td>.88</td>
<td>18.89</td>
<td>5.99</td>
<td>18.04</td>
<td>5.81</td>
<td>7.91**</td>
<td>.019</td>
</tr>
<tr>
<td>UofV</td>
<td>.91</td>
<td>32.04</td>
<td>8.82</td>
<td>33.89</td>
<td>8.92</td>
<td>1.73</td>
<td>.004</td>
</tr>
<tr>
<td>A/C</td>
<td>.92</td>
<td>26.28</td>
<td>8.16</td>
<td>25.50</td>
<td>8.49</td>
<td>3.55</td>
<td>.009</td>
</tr>
<tr>
<td>DVQ</td>
<td>.77</td>
<td>1.64</td>
<td>.77</td>
<td>1.64</td>
<td>.70</td>
<td>6.38*</td>
<td>.015</td>
</tr>
<tr>
<td>HCA</td>
<td>.82</td>
<td>71.59</td>
<td>13.14</td>
<td>68.62</td>
<td>13.20</td>
<td>4.19*</td>
<td>.010</td>
</tr>
<tr>
<td>SSS</td>
<td>.83</td>
<td>18.85</td>
<td>6.03</td>
<td>14.61</td>
<td>6.64</td>
<td>35.55**</td>
<td>.079</td>
</tr>
<tr>
<td>SJAS</td>
<td>.67</td>
<td>7.17</td>
<td>3.53</td>
<td>6.93</td>
<td>3.39</td>
<td>.38</td>
<td>.000</td>
</tr>
<tr>
<td>Driver Stress Profile</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anger</td>
<td>.83</td>
<td>8.73</td>
<td>3.67</td>
<td>9.32</td>
<td>3.72</td>
<td>2.08</td>
<td>.005</td>
</tr>
<tr>
<td>Impatience</td>
<td>.89</td>
<td>10.83</td>
<td>6.31</td>
<td>10.22</td>
<td>6.13</td>
<td>.78</td>
<td>.002</td>
</tr>
<tr>
<td>Competing</td>
<td>.94</td>
<td>4.74</td>
<td>5.72</td>
<td>2.96</td>
<td>4.94</td>
<td>9.78*</td>
<td>.023</td>
</tr>
</tbody>
</table>
Men reported higher levels of physically aggressive driving anger expression than women. Second, there was a significant multivariate effect on the DSP, $F(4, 406) = 4.42$, $p = .002$; Wilks’ Lambda = .96; $\eta^2 = .04$. Univariate tests reported in Table 1 indicated that this difference was due to the Competing factor, $F(1, 409) = 9.77$, $p = .002$, $\eta^2 = .02$. Again, men reported high levels of competitive behavior while driving than women.

Next, one-way (Gender) analyses of variance (ANOVAs) were conducted to test for possible gender differences on the Driving Anger Scale, Driving Vengeance Questionnaire, Hypercompetitive Attitude Scale, Sensation Seeking Scale, and Student Jenkins Activity Survey. As evident in Table 1, significant differences were found on the Driving Vengeance Questionnaire, Hypercompetitive Attitude Scale, and Sensation Seeking Scale. Men reported higher levels of vengeful behavior while driving, competitive behavior, and sensation seeking than did women.

**Primary Analyses**

*Exploratory Factor Analysis*

Based on Clark and Watson’s (1995) suggestion, DSP item response frequencies were examined for extremely low rates of endorsement (i.e., over 95% of the sample
selecting “never true for you”). No items showed such low rates of endorsement. Tests of sampling adequacy (Kaiser-Meyer-Olkin criterion) and multicollinearity (Bartlett’s test of sphericity) were performed next with the 40 DSP items. A Kaiser-Meyer-Olkin (KMO) criterion of .93 indicated considerable common variance among the items, suggesting that the factors extracted should account for substantial variance. Bartlett’s test indicated that the intercorrelation matrix for this sample was suitable for factor analysis, $\chi^2 (780) = 9340.56, p < .001$.

Once it was decided that the 40 DSP items were appropriate for factor analysis, item distributions were examined to assess normality. The Kolmogorov-Smirnov test was significant for all items, indicating that item distributions were not normal. Therefore, principal axis factoring was selected as the method of factor extraction (see Fabrigar, Wegener, MacCallum, & Strahan, 1999). Because the resulting factors were expected to be correlated, the 40 DSP items were subjected to principal axis factoring using an oblique rotation (Promax). Initial eigenvalues are reported in Table 2. Factor retention criteria were determined using parallel analysis (Horn, 1965) as described by Thompson (2004). This was accomplished using MacParallel Analysis (Watkins, 2000). On this basis, four factors were extracted, explaining a cumulative variance of 52.56%. Items that did not load at least .40 on any factor were deleted (items 2, 7, and 27). Next, cross-loadings were examined, and any item that loaded > .40 on more than one factor was deleted. No additional items met this criterion.

Factor loadings for the remaining 37 items are provided in Table 3. The four factors accounted for 54.15% of the variance (Factor 1 = 33.41%, Factor 2 = 10.94%, Factor 3 = 5.06, and Factor 4 = 4.74%). Factor 1 includes nine of the original 10 items
from the DSP’s Competing subscale and no additional items. Thus, the “Competing”
label will be retained. Factor 2 includes all 10 of the original 10 items from the DSP’s
Impatience subscale and four of the 10 original items from the Anger subscale. The
“Impatience” label will be retained. Factor 3 contains the remaining 4 items from the
original Anger subscale and two items from the Punishing subscale dealing with anger
expression, so the “Anger” label will retained.

Table 2

*Initial Eigenvalues and Explained Variance from a Principal Axis Factoring of the*
*Driver Stress Profile*

<table>
<thead>
<tr>
<th>Factor</th>
<th>Initial Eigenvalues</th>
<th>% Variance</th>
<th>Cumulative %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13.00</td>
<td>32.50</td>
<td>32.50</td>
</tr>
<tr>
<td>2</td>
<td>4.29</td>
<td>10.73</td>
<td>43.23</td>
</tr>
<tr>
<td>3</td>
<td>1.92</td>
<td>4.81</td>
<td>48.03</td>
</tr>
<tr>
<td>4</td>
<td>1.81</td>
<td>4.53</td>
<td>52.56</td>
</tr>
<tr>
<td>5</td>
<td>1.36</td>
<td>3.40</td>
<td>55.96</td>
</tr>
<tr>
<td>6</td>
<td>1.15</td>
<td>2.87</td>
<td>58.83</td>
</tr>
<tr>
<td>7</td>
<td>1.04</td>
<td>2.60</td>
<td>61.43</td>
</tr>
<tr>
<td>8</td>
<td>.95</td>
<td>2.39</td>
<td>63.81</td>
</tr>
<tr>
<td>9</td>
<td>.90</td>
<td>2.24</td>
<td>66.05</td>
</tr>
<tr>
<td>10</td>
<td>.81</td>
<td>2.02</td>
<td>68.07</td>
</tr>
</tbody>
</table>

Table 3

*Factor Loadings from the Rotated Pattern Matrix: Principal Axis Factoring With*
*Promax Rotation*

<table>
<thead>
<tr>
<th>Item</th>
<th>Factor Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
<td>1</td>
</tr>
<tr>
<td>Compete with other drivers.</td>
<td>.91</td>
</tr>
<tr>
<td>Compete on the road.</td>
<td>.87</td>
</tr>
<tr>
<td>Race other drivers.</td>
<td>.85</td>
</tr>
<tr>
<td>Compete with drivers who challenge you.</td>
<td>.81</td>
</tr>
<tr>
<td>Challenge other drivers.</td>
<td>.80</td>
</tr>
</tbody>
</table>
Table 3 (continued).

<table>
<thead>
<tr>
<th>Item</th>
<th>Factor Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Compete to amuse self when bored.</td>
<td>.77</td>
</tr>
<tr>
<td>Drag race adjacent car at stop lights.</td>
<td>.71</td>
</tr>
<tr>
<td>Compete with cars in tollbooth lines.</td>
<td>.43</td>
</tr>
<tr>
<td>Impatient waiting in lines (car wash, bank).</td>
<td>-.04</td>
</tr>
<tr>
<td>Impatient at stoplights.</td>
<td>.03</td>
</tr>
<tr>
<td>Impatient waiting for parking space.</td>
<td>-.09</td>
</tr>
<tr>
<td>Impatient waiting for passengers to get in.</td>
<td>-.07</td>
</tr>
<tr>
<td>Get angry when multilane highway narrows.</td>
<td>-.05</td>
</tr>
<tr>
<td>So impatient, won’t let car engine warm up.</td>
<td>.12</td>
</tr>
<tr>
<td>As passenger, impatient with driver.</td>
<td>.07</td>
</tr>
<tr>
<td>Impatient if behind schedule on a trip.</td>
<td>.01</td>
</tr>
<tr>
<td>Get angry at malfunctioning stoplights.</td>
<td>-.15</td>
</tr>
<tr>
<td>Impatient when car ahead slows down.</td>
<td>.06</td>
</tr>
<tr>
<td>Impatient driving in far right, slow lane.</td>
<td>.13</td>
</tr>
<tr>
<td>Get angry at traffic jams.</td>
<td>-.10</td>
</tr>
<tr>
<td>Impatient with pedestrians crossing street.</td>
<td>.03</td>
</tr>
<tr>
<td>Get angry at your passengers.</td>
<td>.10</td>
</tr>
<tr>
<td>Get angry when cut off.</td>
<td>.03</td>
</tr>
<tr>
<td>Get angry at slow drivers.</td>
<td>.08</td>
</tr>
<tr>
<td>Get angry at drivers.</td>
<td>.02</td>
</tr>
<tr>
<td>Curse at other drivers.</td>
<td>-.06</td>
</tr>
<tr>
<td>Complain to passengers about other drivers.</td>
<td>.01</td>
</tr>
<tr>
<td>Get angry at tailgaters.</td>
<td>.05</td>
</tr>
<tr>
<td>Block cars trying to pass.</td>
<td>-.03</td>
</tr>
<tr>
<td>Block cars trying to change lanes.</td>
<td>-.03</td>
</tr>
<tr>
<td>Make obscene gestures.</td>
<td>-.08</td>
</tr>
<tr>
<td>Seek personal encounter with bad driver.</td>
<td>.05</td>
</tr>
<tr>
<td>Use high beams to punish bad driver.</td>
<td>.12</td>
</tr>
<tr>
<td>Do you “punish” bad drivers?</td>
<td>.21</td>
</tr>
<tr>
<td>Ride another car’s tail.</td>
<td>.07</td>
</tr>
</tbody>
</table>
Finally, Factor 4 includes eight of the original 10 items from the Punishing subscale and so the “Punishing” label will be retained. Alpha coefficients and average item-total correlations for each of the four factors are presented in Table 4.

The hypothesis that the latent structure of the DSP would generally correspond with that suggested by Larson (1996) was supported (H1). The four DSP subscales, revised based on the present EFA, were used in the subsequent analyses. Although the overall factor structure was supported there were some slight differences between the obtained factors obtained in the current study and the factor structure suggested by Larson (1996). The Competing factor in the present study includes nine of the original 10 items from the DSP’s Competing subscale and no additional items. Item 27, which was an item in the original Competing subscale of the DSP was dropped from the final factor structure due to loading less than .40. The Impatience factor includes all 10 of the original 10 Impatience items suggested by Larson (1996) and four of the 10 original items from the Anger subscale, specifically items 5, 6, 9, and 10. The Anger factor as supported in the present study contains the remaining four items from the original Anger subscale and two items from the Punishing subscale dealing with anger expression, specifically items 32 and 33. Additionally, items 2 and 7 of the original DSP Anger subscale were dropped from further analysis due to low factor loadings (i.e., loadings < .40). Finally, the Punishing factor acquired in the current study includes eight of the

Table 3 (continued).

<table>
<thead>
<tr>
<th>Item</th>
<th>Factor Loadings</th>
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<tbody>
<tr>
<td>Brake suddenly to punish tailgater.</td>
<td>.13 -.03 .20 .44</td>
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</tbody>
</table>

Note. Boldface indicates highest factor loadings.
original 10 items from the Punishing subscale. As stated previously, two of the original DSP Punishing subscales were incorporated into the Anger factor.

Table 4

*Internal Consistencies and Item-Total Correlations for the Four Factors Extracted*

<table>
<thead>
<tr>
<th>Factor</th>
<th>Label</th>
<th>No. of items</th>
<th>Internal consistency ($\alpha$)</th>
<th>Mean item-total correlation ($r_{it}$)</th>
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<tr>
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<td>14</td>
<td>.89</td>
<td>.57</td>
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<td>Anger</td>
<td>6</td>
<td>.82</td>
<td>.59</td>
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<td>4</td>
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<td>8</td>
<td>.86</td>
<td>.61</td>
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*Correlations*

Bivariate correlations among all variables were calculated using the Fishers Z test in order to assess interrelationships and facilitate interpretation of subsequent regression analyses (see Table 5). In general, the predictor variables were related to the dependent variables in the predicted directions, providing evidence of convergent and discriminant validity.

As predicted, the Anger subscale of the DSP was positively correlated with the DAS, and the strength of this relationship exceeded that of the relationships of this subscale with the DVQ, Hypercompetitiveness Scale, and the SJAS, $t_s (408) = 3.04, 7.55,$ and $7.95, ps < .001, .001, and .001,$ respectively (H2a). In addition, the Punishing subscale of the DSP was positively correlated with the DVQ, and the strength of this relationship exceeded that of the relationship of the DSP Punishing subscale with the
DAS, DVQ, and the SJAS, $t$s (408) = 5.21, 4.80, and 7.98, $p$s < .001, .001, and .001, respectively (H2b). Additionally, the competitiveness subscale of the DSP was positively correlated with the Hypercompetitiveness Scale, and the relationship of this relationship exceeded that of the DSP Competitiveness subscale and the DAS and SJAS, $t$s (408) = 2.88 and 4.64, $p$s < .001 and .001, respectively.

Table 5

*Intercorrelations among Variables (N=411)*

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<td>.29*</td>
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</tbody>
</table>

* $p < .01$

Note. AB = Aggressive Behavior; RD = Risky Driving; DAS = Driving Anger Scale; DAX-VA = Verbally Aggressive Expression; DAX-PA = Physically Aggressive Expression; DAX-UV = Use of the Vehicle to Express Anger; DAX-AC = Adaptive/Constructive Expression; HCA = Hypercompetitive Attitude Scale; SSS = Sensation Seeking Scale; DVQ = Driving Vengeance Questionnaire; DSP-ANG = Anger Subscale of the Driver Stress Profile; DSP-IMP = Impatience Subscale of the Driver Stress Profile; DSP-COMP = Competitive Subscale of the Driver Stress Profile; DSP-PUN = Punishing Subscale of the Driver Stress Profile; SJAS = Student Jenkins Activity Survey.

However, the strength of the relationship between the competitiveness subscale of the DSP and the Hypercompetitiveness Scale did not exceed the strength of the correlation between the DSP Competitiveness subscale and the DVQ, $t (408) = .20, p = .84$ (H2c).

Lastly, the impatience subscale of the DSP was positively correlated with the SJAS; however, this relationship did not exceed the strengths of the relationship between the DSP Impatience Subscale and the DAS, DVQ and Hypercompetitiveness Scale, $t_s (408) = -6.23, -2.86, and -1.64, ps < .001, .001, and .10$, respectively (H2d).
Hierarchical Logistic Regression

Hierarchical logistic regression was used to test the hypothesis that the DSP would predict lifetime minor motor vehicle accidents independent of respondent gender and average miles driven/week (H3). With minor accidents serving as a dichotomous dependent variable (0 = no minor accidents; 1 = minor accidents), respondent gender and average miles driven per week were entered on Step 1, and each of the four DSP subscales were entered on Step 2. The full model, which included all predictors was statistically significant $\chi^2 (6, 411) = 18.41, p < .01$, indicating that the addition of the DSP improves our ability to predict lifetime minor accidents from 58.2% to 59.4%. Therefore, the hypothesis that the DSP would predict lifetime minor motor vehicle accidents independent of respondent gender and average miles driven weekly was supported. None of the independent variables (see Table 6) made a significant contribution to the model.

Hierarchical Multiple Regressions

Hierarchical multiple regression was used to test the hypothesis that the DSP would predict aggressive driving behavior, risky driving, and driver anger expression, independent of respondent gender and average miles driven (H4). In each of the six regressions conducted, respondent gender and miles driven/week was entered on Step 1, and the four revised DSP subscales were entered on Step 2.

After controlling for gender and average miles driven, the DSP explained an additional 40% of the variance in aggressive driving behavior (see Table 7).
Table 6

Logistic Regression Predicting Minor Accidents

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>df</th>
<th>p</th>
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<th>95.0% C.I. for Odds Ratio</th>
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<td>1.03</td>
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<tr>
<td>DSP(PUN)</td>
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<td>.04</td>
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<td>.63</td>
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<td>.42</td>
<td>.79</td>
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</tbody>
</table>

* p < .05 ** p < .01

Note. DAS (ANG) = Driving Anger Scale (Anger); DAS (IMP) = Driving Anger Scale (Impatience); DAS (COMP) = Driving Anger Scale (Competitiveness); DAS (PUN) = Driving Anger Scale (Punishing)

Table 7

Summary of Hierarchical Multiple Regressions (N=411)

<table>
<thead>
<tr>
<th></th>
<th>Aggressive Driving Behavior</th>
<th>B</th>
<th>SEB</th>
<th>β</th>
<th>R²</th>
<th>ΔR²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td></td>
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<td>.40**</td>
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<td>.18**</td>
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<td>DSP (Compete)</td>
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Table 7 (continued).

<table>
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<table>
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<th>( R^2 )</th>
<th>( \Delta R^2 )</th>
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</thead>
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<td><strong>Step 1</strong></td>
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Table 7 (continued).

### Using the Vehicle for Aggressive Expression

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### Physically Aggressive Expression

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### Adaptive/Constructive Expression

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* p < .05  ** p < .01

Note. DSP = Driver Stress Profile.
Three of the DSP subscales contributed: Anger, Impatience, and Punishing. The DSP explained an additional 23.2% of the variance in risky driving after controlling for gender and average miles driven. All four of the DSP subscales contributed. The DSP also predicted verbally aggressive driving anger expression, physically aggressive driving anger expression, use of the vehicle for aggressive expression, and constructive driving anger expression, accounting for 39%, 34.6%, 52.7%, and 5.2% of the variance beyond gender and miles driven, respectively. Verbally aggressive driving anger expression was predicted by the Anger and Punishing subscales; physically aggressive expression and use of the vehicle for aggressive expression were predicted by all four DSP subscales. None of the DSP subscales were significant predictors of constructive/adaptive driving anger expression.

A final set of hierarchical multiple regressions were run in order to test the hypothesis that independent of respondent gender and miles driven/week the DSP would predict aggressive driving behavior, risky driving, and driver anger expression over and above the Driving Anger Scale and Sensation Seeking Scale (H5). Miles driven/week and respondent gender were entered on Step 1, the Driving Anger Scale and Sensation Seeking Scale were entered on Step 2, and the 4 factors of the DSP were entered on Step three.

The DSP explained an additional 20.5% of the variance in aggressive driving behavior (see Table 8). Three of the DSP subscales contributed: Anger, Impatience, and Punishing.
Table 8

*Summary of Hierarchical Multiple Regressions: Incremental Validity (N=411)*

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Table 8 (continued).

### Verbally Aggressive Expression

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### Physically Aggressive Expression

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Table 8 (continued).

Using the Vehicle for Aggressive Expression

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Adaptive/Constructive Expression

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* $p < .05$ ** $p < .01$

*Note:* DAS = Driving Anger Scale; DSP = Driver Stress Profile; SSS = Sensation Seeking Scale.
The DSP also explained an additional 9.1% of the variance in risky driving, with three of the four DSP subscales contributing: Impatience, Competitiveness, and Punishing. The DSP also predicted verbally aggressive driving anger expression, physically aggressive driving anger expression, use of the vehicle for aggressive expression, and constructive driving anger expression, accounting for 13.8%, 28.3%, 27.5%, and 3.1% of the variance beyond the Driving Anger Scale and Sensation Seeking Scale, respectively. Verbally aggressive driving anger expression was predicted by the Anger and Punishing subscales, physically aggressive expression was predicted by all four DSP subscales, and use of the vehicle for aggressive expression was predicted by Anger, Competitiveness, and Punishing. None of the DSP subscales were significant predictors of constructive/adaptive driving anger expression.
CHAPTER IV
DISCUSSION

The purpose of this study was to explore the validity of Larson’s (1996) Driver Stress Profile (DSP), a brief self-report instrument designed to assess four important components of driving behavior. Exploratory factor analysis revealed a latent structure similar to that reported previously by Blanchard and colleagues (2000); however, the present findings support some minor changes in the DSP structure. Using subscales created from the present factor analysis, evidence of convergent and discriminant validity was obtained through comparisons with measures of similar and dissimilar constructs. Moreover, hierarchical multiple regressions provided evidence of the revised DSP’s utility in predicting minor motor vehicle accidents, risky and aggressive driving, and driving anger expression, independent of respondent gender and average miles driven per week. Furthermore, results showed that the revised DSP offered incremental validity over the Driving Anger Scale and the Sensation Seeking Scale in the prediction of risky and aggressive driving behavior. While additional work on the DSP is needed, the present study lends compelling evidence to support its utility in the assessment of driving behavior.

The construct of anger has been shown to be one of the most robust predictors of driving behavior. Specifically, driving anger, a more context specific form of anger, has a large body of empirical support (Blanchard et al., 2000; Dahlen et al., 2005; Deffenbacher et al., 1994, 2000b, 2001, 2003a, 2003b; Lajuen & Parker, 2001). The DSP includes items to assess driving anger, and the present results suggest that this is indeed
what they are measuring. However, it is important to note that the anger factor supported in the present study was somewhat different from that described by Larson (1996).

The present study found support for a six-item Anger subscale ($\alpha = .82$) composed four items from the original 10-item subscale and two of the items from the original Punishing subscale. The two punishing items are “Curse at other drivers” and “Complain to passengers about other drivers.” It is easy to see how these items could be assessing the expression of anger while driving. In fact, they are similar to items included on the Driving Anger Expression Inventory (Deffenbacher et al., 2002) to measure verbally aggressive driving anger expression. Thus, it makes conceptual sense that these items should load on this factor.

The new six-item Anger subscale was highly correlated with the Driving Anger Scale (DAS), the most frequently used measure of driving anger, supporting the convergent validity of the revised scale. In addition, the relationship between the Anger subscale and the DAS was significantly greater than the relationship between the Anger subscale and measures of similar but not identical constructs, including driving vengeance, competitiveness, and type A behavior. This evidence of discriminant validity, along with the relationship with driving anger, provides compelling evidence for the construct validity of the new Anger subscale. Moreover, hierarchical multiple regressions found that the Anger subscale predicted aggressive driving, risky driving, verbally aggressive driving anger expression, physically aggressive driving anger expression, and use of the vehicle for driving anger expression, independent of respondent gender and average miles driven/week. While clearly related to driving anger as assessed by the DAS, this subscale also predicted aggressive driving, verbally aggressive driving anger
expression, physically aggressive driving anger expression, and use of the vehicle for aggressive expression over and above the DAS and a measure of sensation seeking.

Considered in the context of the larger body of literature on driver behavior, the present findings provide additional support for the utility of driving anger in the prediction of a number of unsafe driving behaviors (Björklund, 2007; Blanchard et al., 2000; Dahlen et al., 2005; Deffenbacher et al., 2001, 2003a; Lajuen & Parker, 2001). The Anger subscale of the DSP, as revised in the present study, appears to be accurately measuring the construct of anger, specifically in the context of motor vehicle operation.

The construct of impatience has not garnered as much attention in the driving behavior literature as other constructs. However, some studies have suggested that impatience is indeed a relevant construct in the prediction of driving behavior (Karlberg, et al., 1998; Wong, Chung, & Huang, 2010). Although the literature exploring the relationship between impatience and driving behavior is lacking, the results from the current study provide some support for a 14-item Impatience subscale ($\alpha = .89$) in the DSP.

Factor analysis in the current study indicated a clear factor for the impatience construct that largely resembled the original Impatience subscale Larson (1996) developed for the DSP. All of Larson’s original items from the Impatience subscale were retained, and four items from his Anger subscale were added: “Get angry when multilane highway narrows,” “Get angry at malfunctioning stoplights,” “Get angry at traffic jams,” and “Get angry at your passengers.” The first three of these items appear to involve angry reactions at situations that would slow a driver, hindering his or her progress. Thus, it is easy to understand why they would load on the impatience factor. Additionally, the item
“Get angry at your passengers” appears to fit well within the domain of impatience. It is likely that impatience at passengers behavior is the initial variable that eventually results in anger, specifically if passengers are engaging in disruptive or distracting behavior. Similar questions loaded on a factor labeled “impatience” by Wong and colleagues (2010). Furthermore, in a study exploring driving anger among a sample of Swedish drivers, Björklund (2007) found that several drivers reported reacting aggressively when their progress was obstructed. He goes on to state “a finding that supports the idea of frustration as a precursor to aggression” (p. 1075). Therefore, although anger followed by aggression may ultimately result from feelings of impatience and frustration, it appears as though the original DSP anger questions which loaded onto the impatience scale in the current study seem to be tapping into an individual’s propensity of become impatient when progress in impeded as opposed to initial feelings of anger.

Convergent validity for the revised Impatience subscale was assessed by comparing it to the Student Jenkins Activity Survey (SJAS). Although the SJAS is an overall measure of Type A behavior, it was selected for its inclusion because it was one of the few instruments available that assesses time urgency and impatience. Moreover, the SJAS has been used frequently in the literature when assessing Type A behavior, which includes the construct of impatience (Castro, De Pablo, Toro, & Valdes, 1999; Perry, 1986; Perry & Baldwin, 2000). The revised Impatience subscale of the DSP was positively correlated with the SJAS, offering support for convergent validity. However, the strength of the correlation between the DSP Impatience subscale and the SJAS was not greater than the correlations between the Impatience subscale and the DAS, DVQ, and HCA. Although these findings do not sustain the hypothesis that the discriminant
validity of the DSP impatience subscale would be supported, it would be premature to completely discount the impatience subscale for lack of validity. The most likely explanation for these results may reside in the design of the SJAS, specifically the SJAS was not designed to be a pure measure of impatience. After all, it was designed to measure a variety of coronary-prone behaviors and contains items assessing competitiveness and hostility, as well as impatience. As stated previously in this manuscript it is not surprising that the internal consistency of the SJAS is fairly low, with alphas of .40 to .72 reported in the literature (Yarnold et al., 1986), given its purpose of assessing the broad Type A behavior pattern. However, there is evidence of excellent temporal stability, with two-week test-retest reliabilities ranging from .90 to .96 and three-month test-retest reliabilities from .74 to .86 (Yarnold et al., 1986).

The revised DSP Impatience subscale provided a significant contribution in the prediction of aggressive driving behavior, risky driving behavior, physically aggressive expression while driving, and using the vehicle for aggressive expression, independent of gender and average miles driven. In addition, Impatience contributed to the prediction of aggressive driving behavior, risky driving behavior, and physically aggressive expression while driving over and above the DAS and SSS, two robust predictors of problematic driving behavior. These findings are encouraging and suggest that additional research on the potential role of impatience in understanding driver behavior may be warranted. Despite evidence that impatience and time urgency are associated with near misses (Karlberg et al., 1998) and that impatient drivers may be somewhat less aware of their surroundings (Wong et al., 2010), research on impatience has been scarce. Perhaps the
availability of an instrument like the DSP will help by providing researchers with an effective means of assessing impatience along with other important constructs.

Overall, results of the current study found clear support for an impatience factor in the DSP. Additionally, the revised Impatience subscale of the DSP appears to be a contributing factor in the overall predictive validity of the DSP. However, the construct validity of this subscale remains unclear. It is correlated with Type A behavior, as it should be. However, it remains to be determined whether it can be considered a relatively pure measure of impatience.

The present study found support for a nine-item competing factor on the DSP, identical to Larson’s (1996) original subscale except that one item was dropped due to an insufficient loading: “Compete with other cars in traffic jams.” The revised Competing subscale ($\alpha = .94$) was positively correlated with the Hypercompetitiveness Scale, providing evidence of convergent validity. Additionally, the Competing subscale was more highly correlated with hypercompetitiveness than with driving anger or Type A behavior, providing evidence of discriminant validity. However, the relationship between Competing and hypercompetitiveness was not significantly stronger than the one between Competing and driving vengeance. Thus, evidence of discriminant validity was mixed. Perhaps there is a relationship between these constructs that has not yet been explored and that could uncover a competitive aspect to driving vengeance.

The revised Competing subscale contributed to the predictive validity of the DSP. Specifically, Competing predicted risky driving behavior, physically aggressive expression of anger while driving, and using the vehicle for aggressive expression when controlling for gender and average miles driven. Furthermore, the Competing subscale
contributed to the prediction of risky driving behavior, physically aggressive expression of anger while driving, and using the vehicle for aggressive expression above and beyond the combination of two well supported predictors of these driving behaviors, specifically the DAS and the SSS. These results were consistent with previous studies of competitiveness and driving behavior (e.g., Galovski & Blanchard, 2002; Harris & Houston, 2010) and help to make the case that this dimension of driver personality should be part of a comprehensive assessment of aggressive drivers.

The results of the current study provide empirical support for a competitiveness factor on the DSP. Although there is a lack of research exploring the construct of competitiveness in isolation and driving behavior it appears that the current findings of the competitiveness factor are in line with what literature does exist. Specifically, competitiveness, as measured by the revised Competing subscale of the DSP, is related to problematic driving behavior. Thus the inclusion of this subscale in the DSP appears to be appropriate and promising for the multi-predictor instrument.

The present study found support for a punishing factor, and the revised eight-item Punishing subscale ($\alpha = .86$) was identical to that of Larson (1996) minus two items that were moved to the Anger subscale based on their loadings. These items were “Curse at other drivers” and “Complain to passengers about other drivers.” The first is quite similar to an item found on the Driving Anger Expression Inventory (Deffenbacher et al., 2002) and appears to be as relevant to anger as punishing others. The second item appears to be a way of expressing anger to a third party and may have little relevance to punishing other drivers. Thus, the revised Punishing subscale appears to be a better representation of punishing behavior than the original.
The convergent validity of the revised Punishing subscale was assessed through comparison correlation with the Driving Vengeance Questionnaire (DVQ; Wiesenthal et al., 2000). These measures were correlated, providing support for convergent validity. Support for discriminant validity was more mixed. As predicted, the revised Punishing subscale was more highly correlated with the DVQ than with measures of hypercompetitiveness and Type A behavior. However, the difference in relationships of Punishing to the DVQ and to driving anger was not significant. In fact, these relationships were identical. Although this is not the expected outcome, it appears that there may be some overlap between the constructs of anger and vengeance. Vengeance or punishing behavior appears to be the result of anger, and is most likely closely related to anger expression. Correlations in the current study show a significant positive relationship between the driving anger and driving vengeance. Therefore, it seems reasonable that the DSP Punishing subscale would be related to driving anger too. Furthermore, it appears that previous research has found a significant correlation between vengeance and anger, but also has demonstrated that anger and vengeance account for unique variance of participant responses to hypothetical vengeance situations (Stuckless et al., 1995).

The revised Punishing contributed to the predictive ability of the DSP, specifically in the prediction of aggressive driving behavior, risky driving behavior, verbally aggressive expression while driving, physically aggressive expression while driving, and using the vehicle for aggressive expression when holding gender and miles driven constant. Additionally, Punishing predicted aggressive driving behavior, risky driving behavior, verbally aggressive expression while driving, physically aggressive
expression while driving, and using the vehicle for aggressive expression, above and beyond the combination of well established predictors. These findings were consistent with previous research regarding punishing or vengeance (e.g., Hennessy & Wiesenthal, 2002, 2005).

Overall, the current study found promising results and support for a punishing factor in the DSP. Due to the lack of a true measure of punishment, it is problematic to assume that the revised Punishing subscale of the DSP is actually measuring punishing behavior. However, punishing behavior appears to be related to vengeance, which was supported in the current study. Therefore, the Punishing subscale seems to be measuring some form of vengeance/punishing behavior while driving. Additionally, there appears to be some correlation between the constructs of punishing and anger; however, there was clear evidence in the current study to support two separate factors for these constructs.

Limitations

There were noteworthy limitations regarding internal validity. First, the current study relied exclusively on self-report survey data. While appropriate given the present research questions, this does raise certain questions about the accuracy of the information reported. For instance, self-report surveys may leave respondents more vulnerable to bias in reporting, due to factors such as social desirability, poor question wording, and cultural differences in interpreting the meaning of questions. Another limitation involved the difficulty in assessing two constructs of interest, impatience and punishing. Psychometrically sound and relatively pure measures of impatience are simply not available. The alternative used in the present study, the Student Jenkins Activity Survey, assessed impatience only as part of the broader Type A behavior construct. Similarly,
absence of a pure measure of punishing behavior led the researcher to utilize a measure of a comparable construct of vengeance. Although these measures appear to be related to the constructs of interest in the current study they may not be truly measuring the constructs of interest. Additionally, length of the combined measures may have been a limitation, in that participants may have become fatigued during administration thus decreasing effort toward the end of the survey. Finally, the inability to randomize the order of the measures may have resulted in possible order effects.

Limitations also included threats to external validity. First, the average age of participants was 21, meaning that the 18 to 53 age range was heavily skewed toward younger participants. Not only were drivers under 18 not included, but older drivers were not well represented. This means that two of the groups with the highest risk for motor vehicle accident involvement (i.e., young drivers and older drivers) were not represented in this study. Second, participants were undergraduate students recruited from a rural southern university. The degree to which the present sample compares with college students in other regions or with non-college samples is unknown. Additionally, given the rural area in which data were collected, results may not generalize to more urban communities. There may be several differences between rural and urban communities that may affect driving behavior, such as traffic, number of drivers on the road, and length of commutes. Third, the present sample was predominately female (72%). Given that gender differences are commonly reported in the literature on risky and aggressive driving (Begg & Langley, 2001; Hemenway & Solnick, 1993; Lonczak et al., 2007; Miller & Cervantes, 1997; Ozkan & Lajunen, 2005; Sarkar & Andreas, 2004; Smith & Heckert, 1998), results may not generalize well to male drivers.
Implications and Future Research

The present study provided support for the validity of a revised Driver Stress Profile in predicting unsafe driving behavior. Using exploratory factor analysis (EFA) to assess the latent structure of the DSP, a four factor structure similar to that posited by Larson (1996) emerged. Although Blanchard and colleagues (2000) had previously used EFA, their analyses were limited by an insufficient sample size and lack of detail in describing their analytic procedures. Therefore, confirmatory factor analysis was deemed to be premature pending an appropriate EFA. The merit of this decision was supported by the present study in that our EFA produced a somewhat different structure.

Based on the results of the present study, the next step in the continued development of the DSP should involve a test of the revised factor structure. Confirmatory factor analysis could be used to compare the structure obtained here with that suggested by Larson (1996). Confirming the factor structure would increase the degree of confidence researchers and clinicians could place in the DSP.

Tentatively, the revised DSP appears to be a viable multi-component measure of unsafe driving behavior, which may provide many benefits to researchers. Several organizations, such as AAA and the state of Maryland have made the DSP available to the public, citing it as a tool for assessing unsafe driving behavior; however, without sufficient psychometric data, the information provided may be misleading. Through clarification of the factor structure in the present study, and assessment of the reliability and validity of the DSP more accurate information may be provided to individuals and gathered from organizations using the DSP.
An important direction for future research would be to validate the DSP using a more representative population of participants. Seeking to collect data from outside of the college population would be beneficial in attempting to generalize findings. Specifically, collaboration with other professionals across the country, as well as in different nations would allow for greater depth in subject recruitment in such areas as gender, age, and environment thus addressing some of the limitations of the current study.

Because age is known to affect driving behavior (Begg & Langley, 2001; Hemenway & Solnick, 1993; Williams, 2003), it will be important for future research to access participants of a wider age range. Besides age, variables such as geographic location, urban density, and race/ethnicity may be worth examining. It is recommended that the examination of potential urban/rural differences be given priority based on evidence that such differences may lead to different forms of driving behavior (Jamson, Lai, & Jamson, 2010; Nordfjaern, Jorgensen, & Rundmo, 2010). Future studies may want to consider snowball sampling, where participants would be asked to recruit additional participants from the general population, thus providing a more diverse sample.

Furthermore, demonstrating support for a multi-component measure of driving behavior may encourage further exploration in integrating several known predictors of unsafe driving behavior into a single multi-predictor assessment tool. There remain several individual predictors of unsafe driving behavior, such as sensation seeking, considerations of future consequences, and forgiveness which could add greater predictive strength to the DSP or could be combined into a separate multi-construct measure. This would be useful since incorporating several predictors of unsafe driving behavior into a single measure may save time, as single measures that include multiple
constructs of driving behavior may make the process of prediction more efficient as opposed to using numerous single construct measures.

Although there is a need, especially in the early stages of a research program, for the use of single predictors, continuing to rely on single predictors may limit scientific progress, prevention efforts, thus reducing assessment efficiency. Combining multiple predictors may make it possible to explain greater proportion of the variance in unsafe driving and accident-related outcomes, resulting in improved identification and comprehension of unsafe driving behavior. Additionally, the creation of measures that integrate multiple constructs could reduce the need for numerous questionnaires, leading to briefer administration times, thus improving efficiency. Improved identification of individual differences associated with unsafe driving on multiple dimensions may assist in identifying at-risk drivers, contributing to preventative strategies and helping clinicians more effectively treat these individuals.

The present study also has implications for clinicians and those in the applied accident prevention field. For instance, having a multi-factor measure of aggressive driving behavior may be useful in prevention efforts. This may be especially helpful with younger driver, since data suggest that 16-19 are more likely of being involved in a motor vehicle accident as compared to older drivers (IIHS, 2008). Using measures such as the DSP may be an efficient way to assess problematic personality traits which could potentially influence driving behavior. Interventions could then be designed based on the identified traits. For instance, use of the DSP in driver’s education programs intended for high school students may be an opportune time for the identification of possible problematic driving behavior. From the standpoint of prevention early assessment, such
as mentioned above, could provide a snapshot of young drivers, at which point interventions could be designed in order to address problem characteristics prior to young drivers getting behind the wheel of an automobile.

The current study may also have implications for remediation efforts. For example, clinicians who may be working with drivers who have a history of aggressive or risky driving behavior could use the DSP or similar multi-construct measures in order to identify personality factors associated with the problematic driving behavior. Once these personality factors and problem behaviors are identified treatment could focus on addressing these areas. Furthermore, measures such as the DSP could be utilized in the legal system in order to direct remediation efforts for individuals with a history of motor vehicle offenses, giving way to more focused intervention strategies as opposed to solely punitive measures.

Benefits from instruments such as the DSP could also extend in to the field of applied research. For instance, the DSP and like measures could be utilized as screening tools, as well as pre post measures for research studies aimed at developing treatments and interventions for unsafe driving behavior. Additionally, profiles of unsafe driving behavior could be developed using measures such as the DSP, which may guide the development of different treatment protocols depending on the type of profile identified. Therefore, given the lack of use of the DSP in current research on driving behavior and the possibilities for applied application, the DSP appears to have unrestricted potential in both the research and applied disciplines of driving behavior. The current study aims at clarifying the questions of validity and reliability of the DSP in an effort to lend
credibility to this instrument, and make a case for increasing its use in the study of driving behavior.

Human factors continue to play the largest role in motor vehicle accidents and continue to be the focus of most psychological research conducted in this area (GAO, 2003). The greater the predictability and control of human behavior in relationship to unsafe driving behavior, the greater the impact that science will have on saving human lives as well as benefiting the economy. The present findings suggest that the DSP is a feasible, multi-component measure for assessing several problematic behaviors, specifically anger, impatience, competitiveness, and punishing. Not only were these four factors supported in the present analysis, but evidence from the present study demonstrated that the DSP is effective in the prediction of unsafe driving behavior and anger expression while driving. Ongoing efforts should be made to further streamline the assessment tools that will continue to facilitate prediction and prevention of unsafe driving behavior. Through the development of more efficient measures such as the DSP research, prevention, and intervention efforts may continue to evolve toward greater accuracy and effectiveness.
APPENDIX A

THE UNIVERSITY OF SOUTHERN MISSISSIPPI

AUTHORIZATION TO PARTICIPATE IN RESEARCH PROJECT

Consent is hereby given to participate in the study entitled: Further Validation of The Larson Driver Stress Profile

**Purpose**: This study is being conducted to investigate the psychometric properties and utility of a multifactor measure of driving behavior.

1. **Description of Study**: Participation will involve completing several brief questionnaires asking about your feelings, attitudes, and behaviors. It is important that you read the instructions on each questionnaire carefully, as similar looking questionnaires may have different instructions. Please answer every item. This study should take no more than 1 hour and will be worth 2 research credits.

2. **Benefits**: Although you will receive no direct benefit from participation in this study, your participation will help us to improve our understanding of factors associated with driving behavior.

3. **Risks**: There are no foreseeable risks to participating in this study. Your participation in this study is entirely voluntary, and you may withdraw anytime. Other options will be provided by your course instructor for non-participants and for those who do not meet the criteria for the study. All questionnaires are self-report and noninvasive. If you feel that completing these questionnaires has resulted in emotional distress, please stop and notify the researcher. If you appear visibly distressed during this project, you may be asked to discontinue participation and discuss your concerns with the researcher. You should be aware that The University of Southern Mississippi has no mechanism to provide compensation for subjects who may incur injuries as a result of participating in research projects. However, efforts will be made to make available the facilities and professional skills at the University. If you should decide at a later date that you would like to discuss your concerns, please contact the principle investigator, Michael Moore, M.A., or one of the several local agencies, such as:

   University Counseling Center
   200 Kennard Washington Hall
   Phone: (601) 266-4829

   Community Counseling and Assessment Clinic
   Owings-McQuagge Hall Rm. 202
   Phone: (601) 266-4601

   Pine Belt Mental Healthcare Resources
   Phone: (601) 544-4641

4. **Confidentiality**: These questionnaires are intended to be anonymous and you are asked not to provide your name on any of the forms you will be completing, except for this consent form. The information you provide will be kept strictly confidential. Names on this consent form will not be associated with questionnaires in any way. If significant new information relating to this study becomes known which may relate to your willingness to continue to take part in this study, you will be given this information.
5. **Alternative Procedures:** I understand that I may discontinue participation in this study at any time without consequence.

6. **Subject’s Assurance:** Whereas no assurance can be made concerning results that may be obtained (since results from investigational studies cannot be predicted), the researchers will take every precaution consistent with the best scientific practice. Participation in this project is completely voluntary and subjects may withdraw from this study at any time without penalty or prejudice. Questions concerning this research should be directed to Michael Moore, M.A. at (601) 266-4543 or Eric Dahlen, Ph.D. at (601) 266-4608. This project and this consent form have been reviewed by the Human Subjects Review Committee, which ensures that research projects involving human subjects follow federal regulations. Any questions or concerns about rights as a research participant should be directed to the Chair of the Institutional Review Board, University of Southern Mississippi, Box 5147, Hattiesburg, MS 39406.

7. **Signatures:** In conformance with the federal guidelines, the signature of the subject or parent or guardian must appear on all written consent documents. The University also requires that the date and the signature of the person explaining the study to the subject appear on the consent form.

I have read and understand the information stated, am at least 18 years of age, and I willingly sign this consent form. My signature also acknowledges that I have received, on the date signed, a copy of this document containing two pages.

______________________________
(Subject name printed)

______________________________    __________
(Subject signature)                        Date

______________________________    __________
(Investigator signature)                       Date
APPENDIX B

DEMOGRAPHIC QUESTIONNAIRE

Please fill in the blank or check the response that applies to you

1. How old are you? ______

2. What is your gender?
   ___Male
   ___Female

1. What is your racial/ethnic background?
   ___American Indian/Alaskan Native
   ___Asian/Pacific Islander
   ___Black (Non-Hispanic)
   ___Hispanic
   ___White (Non-Hispanic)
   ___Other ____________________ (please specify)

2. How many years have you been driving? ______

3. On average, how many miles do you drive a week? ______

4. On average, how many highway and/or interstate miles do you drive a week? ______
APPENDIX C

IRB APPROVAL FORM

THE UNIVERSITY OF SOUTHERN MISSISSIPPI

Institutional Review Board
118 College Drive #5147
Hattiesburg, MS 39406-0001
Tel: 601.266.6820
Fax: 601.266.5509
www.usm.edu/irb

HUMAN SUBJECTS PROTECTION REVIEW COMMITTEE
NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Human Subjects Protection Review Committee in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the “Adverse Effect Report Form”.
- If approved, the maximum period of approval is limited to twelve months. Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: 29071305
PROJECT TITLE: Further Validation of the Larson Driver Stress Profile
PROPOSED PROJECT DATES: 07/01/09 to 08/31/09
PROJECT TYPE: Dissertation or Thesis
PRINCIPAL INVESTIGATORS: Michael Moore
COLLEGE/DIVISION: College of Education & Psychology
DEPARTMENT: Psychology
FUNDING AGENCY: N/A
HSPRC COMMITTEE ACTION: Expedited Review Approval
PERIOD OF APPROVAL: 08/03/09 to 08/02/10

[Signature]
Lawrence A. Hosman, Ph.D.
HSPRC Chair

[Signature]
Date
8-6-09
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