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PERSONALITY FACTORS, AGE, AND AGGRESSIVE DRIVING: A VALIDATION USING  
A DRIVING SIMULATOR

by

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B.S. University of Central Florida, 1997

A dissertation submitted in partial fulfillment of the requirements  
for the degree of Doctor of Philosophy  
in the Department of Psychology  
in the College of Science  
at the University of Central Florida  
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Major Professor: Janan Al-Awar Smither

## **ABSTRACT**

Two studies were conducted to investigate the relationship between age, personality factors and aggressive driving behavior. In Study 1, 1122 volunteers completed an online survey that included questionnaires on demographic data, personality factors, and driving behavior. Personality factors were measured using the Revised Competitiveness Index, the Sensation Seeking Scale, the Big Five Inventory, and the Cook Medley Hostility Scale, whereas aggressive driving behavior was measured using the Aggressive Driving Behavior Scale (ADBS). The majority of the volunteers were female (786 versus 336), while ages ranged from 18 to 87. In Study 2, 98 volunteers from Study 1 were recruited to perform driving simulations on two scenarios. These volunteers consisted of 52 females and 46 males, with ages ranging from 18 to 83. Results from both studies produced positive correlations between aggressive driving behavior and competitiveness, sensation seeking, hostility, extraversion, and neuroticism, while negative correlations were obtained between aggressive driving behavior and age, agreeableness, conscientiousness, and openness. No significant correlation was obtained between gender and aggressive driving behavior. Most importantly, scores in the ADBS were positively correlated to a composite of scores measuring aggressive driving behavior in the simulator. This pattern of results not only validates the ADBS, but it also provides another mechanism to study aggressive driving behavior.

This work is dedicated to my family: Beverly, Carmen, José, Gloria, Icela and Tito. Their constant inspiration and unwavering support made this work possible!

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## TABLE OF CONTENTS

LIST OF FIGURES .....	vii
LIST OF TABLES .....	viii
CHAPTER 1: INTRODUCTION .....	1
CHAPTER 2: LITERATURE REVIEW .....	3
Personality and Driving Behavior.....	3
Age-Related Personality Changes and Driving Behavior.....	13
CHAPTER 3: METHOD .....	17
Study 1 .....	17
Participants.....	17
Materials .....	17
Procedure .....	19
Study 2 .....	19
Participants.....	19
Apparatus .....	20
Procedure .....	20
CHAPTER 4: RESULTS.....	23
Study 1 .....	23
Study 2 .....	36

CHAPTER 5: DISCUSSION.....	45
Study 1 .....	45
Study 2 .....	48
CHAPTER 6: CONCLUSION .....	54
Limitations of the Studies .....	56
Suggestions for Future Research .....	56
APPENDIX A: SURVEY INSTRUMENTS.....	58
APPENDIX B: FORMS .....	75
APPENDIX C: SCRIPTS .....	85
APPENDIX D: IRB DOCUMENTATION .....	90
REFERENCES .....	108

## LIST OF FIGURES

Figure 1: Number of Participants for Each Age Group .....	27
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## LIST OF TABLES

Table 1: Pearson Product-moment Correlations between Measures of Personality Factors, Age, and Aggressive Driving Behavior.....	24
Table 2: Coefficients for the Standard Multiple Regression of Personality Factors and Age on Aggressive Driving Behavior .....	25
Table 3: R, R <sup>2</sup> , and Adjusted R <sup>2</sup> for the Standard Multiple Regression of Personality Factors and Age on Aggressive Driving Behavior.....	26
Table 4: Pearson Product-moment Correlations between Measures of Personality Factors and Aggressive Driving Behavior for Young Adults .....	28
Table 5: Coefficients for the Standard Multiple Regression of Personality Factors on Aggressive Driving Behavior for Young Adults .....	29
Table 6: R, R <sup>2</sup> , and Adjusted R <sup>2</sup> for the Standard Multiple Regression of Personality Factors on Aggressive Driving Behavior for Young Adults .....	30
Table 7: Pearson Product-moment Correlations between Measures of Personality Factors and Aggressive Driving Behavior for Middle-age Adults.....	31
Table 8: Coefficients for the Standard Multiple Regression of Personality Factors on Aggressive Driving Behavior for Middle-age Adults.....	32
Table 9: R, R <sup>2</sup> , and Adjusted R <sup>2</sup> for the Standard Multiple Regression of Personality Factors on Aggressive Driving Behavior for Middle-age Adults.....	33
Table 10: Pearson Product-moment Correlations between Measures of Personality Factors and Aggressive Driving Behavior for Older Adults .....	34

Table 11: Coefficients for the Standard Multiple Regression of Personality Factors on Aggressive Driving Behavior for Older Adults .....	35
Table 12: R, R <sup>2</sup> , and Adjusted R <sup>2</sup> for the Standard Multiple Regression of Personality Factors on Aggressive Driving Behavior for Older Adults .....	36
Table 13: Frequency of Aggressive Driving Behaviors in the Simulator.....	37
Table 14: Intra-class Correlation Coefficients for Raters of Aggressive Driving Behaviors in Simulator.....	37
Table 15: Means and Standard Deviations for Simulator Behaviors Computed from Ratings by Police Officers .....	39
Table 16: Tests for Normality for Simulator Data.....	39
Table 17: Spearman’s rho Correlations between Sim Behavior Score and the ADBS .....	40
Table 18: Spearman’s rho Correlations between Personality Factors, Age, and Sim Behavior Score .....	41
Table 19: Frequency of Aggressive Driving Behavior for Young Adults.....	43
Table 20: Frequency of Aggressive Driving Behavior for Middle-age Adults .....	43
Table 21: Frequency of Aggressive Driving Behavior for Older Adults.....	44
Table 22: Spearman’s rho Correlation between Collisions and Accident Reports for the Last Three Years.....	44
Table 23: Total Number of Instances of Aggressive Behavior in Simulator by Age Group .....	50

## CHAPTER 1: INTRODUCTION

Driving plays an important role in our society. For most of us, driving represents freedom, control, and independence. We drive to the places we want or need to go, and for many of us, driving is either part of our job or the means to get to and from work. Unfortunately, the time we spend driving has become a stressful part of our daily routine as we become increasingly concerned about aggressive drivers. Indeed, 78% of respondents in the AAA Foundation's 2008 Traffic Safety Culture Index rated aggressive drivers as a serious or extremely serious traffic safety problem (AAA Foundation for Traffic Safety, 2008). The cost of this safety problem in terms of loss of life and damage to property is indicative of this level of concern: 56% of fatal crashes from 2003 through 2007 involved one or more driver actions typically associated with aggressive driving (AAA Foundation for Traffic Safety, 2009). Moreover, the cost of medical and administrative expenses as well as the cost to employers in loss of productivity can be considerable. And since no driver is immune to the negative effects of this type of behavior, any attempt to gain a better understanding of it is worth the effort. This understanding in turn can inform the design of strategies to mitigate this behavior. It should also be noted that in light of the demographic shift that is currently underway in this country, the increasing number of drivers 65 and older in our roadways that might be affected by this behavior has the potential to result in increases not only of the number of accidents, but also their morbidity and mortality.

The initial step in gaining an understanding of this behavior is to define as precisely as possible. Attempts to provide such a definition vary broadly and can range from definitions that include the whole spectrum of behaviors in which one driver can cause physical or emotional injury to another individual (e.g., tailgating and "road rage" behavior), to definitions based in

state laws, or the driver's intention. The present research adopts Harris and Houston (2010) approach to defining aggressive driving in which any reference to emotional or motivational states is avoided, and which allows the construct to be operationally defined as "the reported frequencies of specific driving behaviors" (p. 45). These behaviors are such that they can have a negative impact in the safety of the driver and/or those around him/her.

## **CHAPTER 2: LITERATURE REVIEW**

### **Personality and Driving Behavior**

A framework for understanding aggressive driving was put forth by two Canadian psychiatrists in a landmark study published over 60 years ago. Tillmann and Hobbs (1949) set out to establish that personality is the determining factor that makes certain individuals more accident-liable. These researchers examined the social behavior of two groups of taxi drivers: 20 high-accident drivers and 20 low-accident drivers. The former group was made up of aggressive individuals unable to tolerate authority, while the latter was found to be made up of serious, stable, and well-adjusted individuals. In an effort to increase the generalizability of this finding, Tillmann and Hobbs (1949) also analyzed the social behavior of 96 male drivers with four or more accidents on their record, and 100 accident-free drivers. The names of these drivers were submitted to various social and correctional agencies. The results were similar to those obtained with the taxi drivers, namely, social maladjustment was found with similar frequency in the general population with high accident record. Tillmann and Hobbs summarize their conclusion with the dictum “a man drives as he lives”.

This conclusion was corroborated by Broughton (2007) who investigated the relationship between the number of motoring and non-motoring offences on a sample of over 52,000 English drivers during the period of 1999-2003. Broughton (2007) found a strong correlation between the number of motoring and non-motoring offences. Specifically, he found that 2.5% of male drivers committed at least one primary non-motoring offence (i.e., violence against a person, sexual offences, burglary, robbery, theft of/from a vehicle, fraud & forgery, criminal damage, and drug offences), but 30.6% of this group committed at least one serious motoring offence (i.e., driving

while disqualified, dangerous driving, or drinking and driving). The correlation was stronger for females. Moreover, statistical modeling yielded the following results: comparisons between males who committed no non-motoring offences with males who committed between 4 and 8 non-motoring offences showed that the latter group committed on average 21 times as many serious motoring offences and 3.9 times as many other motoring offences. Again, this effect was found to be stronger for females.

Tillmann and Hobbs (1949) and Broughton (2007) have shown a correlation between social maladjustment and the tendency to drive aggressively. But, what is the real contribution of an individual's personality when it comes to aggressive driving? Do people with certain types of personalities tend to drive aggressively, or is there something about the activity of driving that elicits aggressive behavior even among otherwise mild-mannered individuals? What aspects of an individual's personality might play a role in aggressive driving? And furthermore, if personality does play a role in aggressive driving, is this behavior affected by changes in personality as the individual grows older? Attempts to answer these questions have been made by several researchers.

Personality traits (or dimensions) associated with assertiveness and acting on impulse are a priori reasonable candidates in the study of driving behavior. Renner and Anderle (2000) conducted a study in which they tried to elucidate the relationship between these variables. They found that traffic offenders scored higher on a measure of extraversion than individuals in a control group who had a clean driving record. Furthermore, the former group scored higher on venturesomeness than the latter group. Renner and Anderle (2000) defined extraversion as a personality dimension that describes individuals that are easy going, "who do not keep their

feelings as tightly under control as introverts do, who sometimes tend to act spontaneously and even aggressively, and are therefore less likely to comply with regulations” (p. 674). On the other hand, these researchers define venturesomeness as a personality dimension that implies “a tendency to act on the spur of the moment, to seek thrill and adventure, and to leave out of consideration possible consequences of behavior” (p.674). Renner and Anderle (2000) measured extraversion and venturesomeness using German translations of the Eysenck-personality-scales (EPS adult, Eysenck and Eysenck, 1991). The traffic offenders group included 96 individuals (81 males and 17 females), and the control group included 149 individuals (82 males and 67 females).

The study by Renner and Anderle (2000) sheds some light in our understanding of how certain personality traits are related to driving behavior in the context of compliance with established norms and rules (which includes aggressive driving). Other researchers have taken a more focused approach by looking at aggressive driving behavior and its personality correlates. For example, Lajunen and Parker (2001) studied the relationship between general aggressiveness, driver anger, and aggressive driving. These researchers surveyed 270 British drivers (171 males and 98 females) using a modified version of Deffenbacher’s Driving Anger Scale (DAS; Deffenbacher et al., 1994), the Buss and Perry’s Aggression Questionnaire (Buss and Perry, 1992), and the impulsiveness scale of the Eysenck’s Impulsiveness Questionnaire (Eysenck et al., 1985). Results showed that individuals that characterized themselves as verbally aggressive were more likely to get angered by other drivers’ reckless driving, and, furthermore, “the more they got angered the more likely an aggressive response was” (p. 252). Similarly, an

inclination to physical aggressiveness directly increased the likelihood of an aggressive response in the context of driving.

Another study focusing on a specific personality trait and aggressive driving is that of Krahé and Fenske (2002). These researchers studied the relationship between “macho personality” and aggressive driving. Following Mosher and Sirkin (1984), they defined macho personality as an exaggerated endorsement of the male stereotype which is acquired in early and middle childhood. This endorsement was found to correlate positively with aggression, impulsivity exhibition and play, and negatively with understanding, harm-avoidance, and cognitive structure as measured by the Personality Research Form (Jackson, 1974). Krahé and Fenske (2002) surveyed 154 men who completed two questionnaires (the Aggressive Driving Scale, and a Violence and Danger Scale) and questions about their personal background and details about the cars they owned. Their findings support the notion that “individual characteristics of the driver, such as macho personality and age, can predict driving aggression” (p. 27).

Similar to the macho personality just described, another personality trait having a self-concept component is narcissism. Schreer (2002) examined the relationship between this trait and aggressive driving behavior. In this study, narcissism, defined in the context of the theory of threatened egotism, is an attitude characterized by an inflated view of the self. Schreer (2002) surveyed 91 undergraduates (63 females and 28 males) at a small college in the northeast. The scales used include: the Rosenberg Self-Esteem Scale (Rosenberg, 1965), the Narcissistic Personality Inventory (NPI, Raskin & Terry, 1988), Driving Anger Scale (Deffenbacher et al., 1994), and a 12-item aggressive driving questionnaire created by the author to measure behaviors



frequently identified as indicators of aggressive driving (e.g., tailgating, cursing, making obscene gestures). Schreer (2002) found that inflated self-esteem predicted aggressive driving behavior better than low self-esteem. Furthermore, individuals who scored higher on the Exhibitionism component of the NPI reported higher levels of aggressive driving behavior, while Entitlement predicted such behavior for males only.

Krahé (2005) studied another personality dimension that has a self-concept component, namely, sex role orientation. Specifically, this researcher investigated the relationship between sex role orientation, dispositional aggressiveness, age, and annual mileage using a sample of 256 female drivers. These participants completed a German reconstruction of the Bem Sex Role Inventory (Bem, 1974), a German version of the Buss-Perry Aggression Questionnaire (Buss & Perry, 1992), and the Aggressive Driving Scale (Krahe & Fenske, 2002). Respectively, these questionnaires measured sex role orientation, trait aggressiveness, and driving aggression. Krahé (2005) found that aggressive behavior among women decreased as a function of age, but increased as function of annual mileage. Additionally, dispositional aggressiveness was a significant predictor of driving aggression. Specifically, it is the physical aggression component of dispositional aggressiveness that links trait aggressiveness to aggressive driving. (This finding corroborates the Lajunen and Parker (2001) finding.) As for the effect of sex role orientation on aggressive driving, Krahé (2005) did not show a link between masculinity and driving aggression, but there was evidence in support of a buffering effect of femininity on driving aggression. Finally, contrary to Lajunen and Parker (2001) this study showed a positive correlation between annual mileage and driving aggression.

A line of research on aggressive driving that takes a different orientation is exemplified by Moore and Dahlen (2008). Instead of trying to identify personality dimensions that exacerbate aggressive driving, these researchers were interested in investigating personality factors that might reduce this behavior. In particular, Moore and Dahlen (2008) examined the effects of two personality factors on the risk for aggressive driving, namely, trait forgiveness and consideration of future consequences. These researchers were interested in investigating “positive/protective” factors which might play a role in reducing an individual’s tendency to engage in aggressive driving. They hypothesized that an individual that scores high in trait forgiveness (i.e., a more forgiving person) will be more tolerant of other driver’s mistakes, and even rude behavior, and thus less likely to express driving anger aggressively. Similarly, an individual scoring high in consideration of future consequences of his/her behavior was hypothesized to be less likely to drive aggressively. They surveyed 316 undergraduate students at the University of Southern Mississippi using the DAS (Deffenbacher et al., 1994), the Driving Survey (Deffenbacher et al., 2000), the Driving Anger Expression Inventory (Deffenbacher et al., 2002), the Consideration of Future Consequences Scale (Strathman et al, 1994), and the Trait Forgiveness Scale (Berry and Worthington, 2001). Results of the study were consistent with the researchers’ predictions: trait forgiveness was inversely related to driving anger, aggressive and risky driving; and consideration of future consequences was inversely related to aggressive and risky driving.

The studies examined thus far have two salient features: (1) they have relied on the use archival data or data collected through self-reports, and (2) each study has looked at a narrow range of personality dimensions. Studies that have taken a different approach are examined below.

Ellison-Potter, Bell and Deffenbacher (2001) designed one of a few studies using a simulation to study aggressive driving. These researchers examined the effects of trait driving anger, aggressive stimuli, and anonymity on aggressive driving behavior in a simulated driving task. Using a computer-based driving simulation, these researchers found that situational variables such as anonymity and aggressive stimuli were better predictors of aggressive driving than dispositional variables such as trait anger (i.e., a predisposition to experience more frequent and intense state anger across a variety of driving situations).

Miles and Johnson (2003) studied the relationship between a wide range of personality dimensions and aggressive driving. Specifically, they investigated the relationship between personality, attitudes, beliefs, and aggressive driving. Specifically, these researchers attempted to identify personality characteristics, attitudes, and beliefs of people who drive aggressively. Drivers belonging to two groups were surveyed: a group of drivers with multiple traffic citations and a control group of undergraduate psychology students at a large southeastern university. A total of 48 participants made out the former group, while 93 participants were included in the latter. Personality characteristics were measured using the International Personality Item Pool (Goldberg, 1999) which was developed to tap into the “big five” personality factors (however, only three factors were of interest for this study, namely, conscientiousness, agreeableness, and neuroticism). Results showed that the two groups differed significantly in terms of driving behaviors, attitudes and beliefs, and type-A behavior pattern. There were no significant differences, however, in the personality characteristics of conscientiousness, agreeableness, and neuroticism.

Dahlen and associates conducted two studies that combined several personality dimensions in the study of aggressive driving. Dahlen and White (2006) studied the utility of combining trait driving anger (i.e., the tendency to become angry when encountering frustration and provocation on the road), sensation seeking, and the Big Five personality factors in predicting driving anger expression, and frequency of aggressive and risky driving behavior. These researchers surveyed 312 participants using the Driving Survey (Deffenbacher et al., 2000), the International Personality Item Pool (Goldberg, 1999), a modified version of the Sensation Seeking Scale (SSS; Zuckerman, 1994), and the DAS (Deffenbacher et al., 1994). In general, Dahlen and White (2006) found that openness, emotional stability, agreeableness, trait driving anger, and sensation seeking predicted driving behavior and outcomes independent of gender, age, and miles/week. More specifically, aggressive driving was predicted by lower scores in emotional stability (i.e., higher scores in neuroticism), and increased DAS and SSS scores.

Dahlen, Martin, Ragan, and Kuhlman (2005) investigated the combined effect of trait driving anger, sensation seeking, impulsiveness, and boredom proneness on driving behavior. These researchers surveyed 224 undergraduate students using the DAS (Deffenbacher et al., 1994), the Driving Anger Expression Inventory (Deffenbacher et al., 2002), the Driving Survey (Deffenbacher et al., 2000), the Arnett Inventory of Sensation Seeking (AISS; Arnett, 1994), the Barratt Impulsiveness Scale-Version 11 (BIS-11; Patton, Stanford, & Barratt, 1995), and the Boredom Proneness Scale (BPS; Farmer & Sundberg, 1996). This study found a moderate relationship between aggressive driving and both impulsiveness and external boredom (i.e.,

boredom due to the lack of external stimulation). It also found that sensation seeking predicted aggressive driving.

Similar to Dahlen and associates, Harris & Houston (2010) studied the combined effect of several personality dimensions on aggressive driving, but they also added situational variables to their analyses. These researchers investigated personality variables that included hostility, sensation seeking, and competitiveness. These dimensions were measured using the following scales, respectively: the Cook-Medley Hostility Scale (Cook and Medley, 1954), two subscales from the Form V of the Sensation Seeking Scale (Zuckerman, Eysenck, and Eysenck, 1978), and the Revised Competitiveness Index (Houston, Harris, McIntire, and Dientje, 2002). The dependent measure—aggressive driving—was measured using the Aggressive Driving Behavior Scale (ADBS; Houston, Harris, and Norman, 2003). Additionally, Harris and Houston (2010) developed a questionnaire to measure the relationship of situational conditions to two aggressive driving behaviors, namely, horn honking and tailgating (these behaviors reflect the two subscales of the ADBS: the former represented Conflict Behavior, while the latter represented the Speeding Scale). One-hundred and fifty-two undergraduates completed the questionnaires with a mean age of 19.70 (SD=1.07). Results showed a positive correlation between horn honking and hostility, boredom susceptibility, competitiveness, and being male, with only hostility and boredom susceptibility remaining as significant predictors in the multiple regression analysis. As for tailgating, the results showed a positive correlation with hostility, thrill and adventure seeking, boredom susceptibility, and competitiveness, with only the first three remaining significant predictors in the multiple regression analysis. Finally, Harris and Houston (2010) found a significant main effect for time pressure on horn honking with a marginal interaction

effect (i.e., although both men and women admitted to more honking when pressed for time, this situation was more pronounced among women). Similarly, for tailgating, i.e., both males and females reported that they were more likely to tailgate when pressed for time.

Schwebel, Severson, Ball, and Rizzo (2006) studied both the independent and combined effects of three personality traits (namely, sensation-seeking, conscientiousness, and anger/hostility) on risky driving behavior. These researchers collected data from 73 (41% male, 55% female, and 4% unknown sex, and ranging in age from 21 to 51) college students from introductory psychology courses at the University of Alabama at Birmingham. These participants completed seven questionnaires regarding their personalities and driving histories, and they also engaged in a virtual environment task set in a quiet, darkened room using a PC equipped with a steering wheel and accelerator/brake hardware peripherals, and designed to evaluate risk-taking driving behavior. The questionnaires included: the Simulator Sickness Questionnaire (SSQ; Kennedy et al. 1993), the Driving Habits Questionnaire (DHQ) developed and adapted by the authors, a short version of the Driving Behavior Questionnaire (DBQ; Parker et al., 1995), the Big Five Inventory (BFI; Benet-Martinez and John, 1998), the short form of the Adult Temperament Questionnaire (ATQ; Derreberry and Rothbart, 1984, 1988; Evans and Rothbart, 2007), the DAS, and the SSS-V (Zuckerman, 1994). Schwebel et al. (2006) found that sensation-seeking, conscientiousness, and angry/hostile behavior patterns each predicted risky driving on self-reports, and, like Dahlen et al. (2005), that these personality traits contribute incrementally to explain risky driving. However, no personality trait predicted risky driving in the simulator.

## **Age-Related Personality Changes and Driving Behavior**

Several of the findings discussed above (e.g., Dahlen and White (2006) finding that openness, emotional stability, and agreeableness predict driving behavior) inform the investigation of the relationship between age and aggressive driving. In particular, these findings suggest changes in personality associated with age might reflect in changes in driving behavior. The work of Terracciano and associates provide a starting place for such investigations. Terracciano, McCrae, Brant, and Costa (2005) studied age trends in the Big Five and their 30 facets assessed by the Revised NEO Personality Inventory (NEO-PI-R) in data obtained by the Baltimore Longitudinal Study of Aging (BLSA). Their goal was to “refine the description of age changes in the broad dimensions and specific facets of the five-factor model of personality” (p.493). The data analyzed were collected between September 1989 and July 2004 during regularly scheduled visits of 1,944 community-dwelling volunteers (977 men and 967 women) from the BLSA. Participants completed from 1 to 11 of the NEO-PI-R (a total of 5,027 assessments), and ages ranged from 20 to 96 years across the span of the study with most data obtained from participants older than 60. Terracciano et al. (2005) used hierarchical linear modeling techniques and found gradual personality changes in adulthood: neuroticism declines up to age 80, stability and then decline in extraversion, decline in openness, increase in agreeableness, and increase in conscientiousness up to age 70. Additionally, even though most facets showed age trends similar to the factor they define, there were interesting variations within domains: within neuroticism, impulsiveness showed a linear decline while the other facets showed curvilinear effects; within extraversion, assertiveness showed an increase from age 30 to 60 and excitement seeking showed a steady decline starting at age 30, while the other facets

showed a stability and steady decline; and within agreeableness, compliance showed the steepest increase relative to the other facets.

Schwebel and associates have conducted pioneering work in the investigation of the relationship of personality and driving behavior among older adults. Schwebel, Ball, Severson, Barton, Rizzo, and Viamonte (2007) investigated the role of personality in dangerous driving behavior in older adults. In particular, these researchers examined the role of sensation-seeking and temperamental control on crashes and reckless driving. One-hundred and one older adults, all age 75 or over, completed three questionnaires regarding their personalities and driving histories. The questionnaires included: a short version of the Driving Behavior Questionnaire (DBQ; Parker et al., 1995), the short form of the Adult Temperament Questionnaire (ATQ; Derreberry and Rothbart, 1984, 1988; Evans and Rothbart, 2006), and the SSS-V. The participants also engaged in a virtual environment task set in a quiet, darkened room using a PC equipped with a steering wheel and accelerator/brake hardware peripherals, and designed to evaluate risk-taking driving behavior. Schwebel et al. (2007) found that, albeit modestly, personality was a consistent correlate with risky driving behavior. In particular, sensation-seeking seemed to be most strongly related to violations and tickets, while temperamental control was related more broadly to several risky driving measures.

The present research attempts to remedy three major limitations found in the majority of the literature on the subject of aggressive driving, namely, the reliance on self-reports, the use of college students in most samples, and the almost exclusive use of retrospective correlational designs. On this latter point it is important to note the advantage of using a prospective design in



which personality factors are assessed first (here again, using self-report measures), and then observing driving behaviors on a driving simulator. Additionally, the present research will include undergraduate students from a major metropolitan university in the southeastern part of the country, as well as middle aged and elderly individuals. Finally, the present research also combines several variables related to aggressive driving, again a strategy that has been followed by very few researchers [see for example, Dahlen et al. (2005), Dahlen and White (2006) and Schwebel et al. (2006)]. Two studies are proposed: in the first, a survey that includes questionnaires that measure driving behavior, competitiveness, sensation seeking, the Big Five, and hostility will be administered; and in the second, driving behavior will be assessed using a driving simulator.

It should be noted that even though the foregoing review of the literature exemplifies several ways of defining “aggressive driving” (some focusing on emotional while others on cognitive aspects), the present research adopts Harris and Houston’s (2003) approach of measuring aggressive driving in a way that is void of any reference to emotional or motivational states, and in which consideration is given only to the frequency of specific driving behaviors. Thus, in light of this previous work on aggressive driving, and in attempt to furthering our understanding of aggressive driving behavior, the following hypotheses are proposed.

In the first study the following hypotheses will be tested:

- a) Younger drivers will report higher propensity to engage in aggressive driving behavior than middle-age and older adults;
- b) Drivers with low scores in openness, conscientiousness, and agreeableness will report a higher propensity to engage in aggressive driving behavior; and

- c) Drivers with high scores in neuroticism, extraversion, competitiveness, sensation seeking, and hostility will report a higher propensity to engage in aggressive driving behavior.

In the second study the following hypotheses will be tested:

- a) Drivers that report a higher propensity to engage in aggressive driving behavior on the ADDBS will engage in more instances of aggressive driving behavior in a driving simulator;
- b) Younger drivers will engage in more instances of aggressive driving behavior in the simulator than middle-age and older drivers;
- c) Drivers with low scores in openness, conscientiousness, and agreeableness will engage in more instances of aggressive driving behavior in the simulator; and
- d) Drivers with high scores in neuroticism, extraversion, competitiveness, sensation seeking, and hostility will engage in more instances of aggressive driving behavior in the simulator.

## CHAPTER 3: METHOD

### Study 1

#### Participants

Participants for this study were recruited from undergraduate psychology courses and from the staff at a large metropolitan university in Central Florida. Middle-age and older adults were also recruited from the community using flyers, electronic mail, and personal solicitations. All participants were licensed drivers.

Participants completed an online survey hosted by the SurveyMonkey® website. They accessed the site using a link that was provided by the experimenters. The survey consisted of six questionnaires and it was completed on the volunteers own time and with no supervision. The students received course credit in exchange for their participation. A total of 1122 volunteers accessed the site, but not all completed the survey in its entirety (only 1078 completed all questionnaires). The vast majority of the volunteers were female (786 versus 336), while ages ranged from 18 to 87 (*Mean* = 28 and *Median* = 21). The range for years holding a driver's license was less than a year up to 70 years (*Mean* = 10 and *Median* = 4).

#### Materials

The online survey consisted of the following questionnaires:

Demographic Information and Driving History

Driving Behavior Scale (Harris et al., 2009): A forty-item instrument designed to measure driving aggressiveness by asking the participant to indicate how often he/she engages in a particular type of driving behavior. Participants choose from 1 (Never) to 6 (Always) on a Likert scale, on items such as "*Make rude gestures at other drivers when they do*

*something I don't like*", *"Obey posted speed limits"*, and *"Maintain a safe distance when following other vehicles"*. (Aggressive Driving Behavior Scale is derived from this scale.)

Revised Competitiveness Index (Houston et al., 2002): A 14-item scale designed to measure competitiveness by asking participant to indicate his/her level agreement with statements such as *"I like competition"*, *"I find competitive situations unpleasant"*, and *"I don't enjoy challenging others even when I think they are wrong"*. Participants choose on a Likert scale from 1 (Strongly Disagree) to 5 (Strongly Agree).

Sensation Seeking Scale (Zuckerman et al., 1978): This instrument is comprised of two subscales: a) Thrill and Adventure Seeking Subscale, and b) Boredom Susceptibility Subscale. Each subscale uses 10 items and requires the participant to decide if a particular statement is true or false as it applies to him/her. Examples of the former subscale include statements such as *"I often wish I could be a mountain climber"* and *"I would like to go scuba diving"*, while the latter subscale include statements such as *"I get bored seeing the same old faces"* and *"I prefer friends who are excitingly unpredictable"*.

Big Five Inventory (John & Srivastava, 1999): A 44-item instrument designed to characterize the participant on the Big Five Personality Dimensions (Neuroticism, Agreeableness, Conscientiousness, Openness, and Extraversion). The participant is asked to decide his/her agreement as to how much particular characteristic applies to him/her using a scale from 1 (Disagree Strongly) to 5 (Agree Strongly). Examples of the characteristics

included in this instrument are: *“Does a thorough job”*, *“Can be tense”*, *“Values artistic, aesthetic experiences”*, *“Is outgoing, sociable”*, and *“Likes to cooperate with others”*.

Cook Medley Hostility Scale (Cook & Medley, 1954): A 50-item instrument that measures hostility by asking the participant to decide if a particular statement is true or false as it applies to him/her. Examples include statements such as *“I have often had to take orders from someone who did not know as much as I did”*, *“I am likely not to speak to people until they speak to me”*, and *“I am often inclined to go out of my way to win a point with someone who has opposed me”*.

Follow-up Study Authorization Form

### **Procedure**

Undergraduate students who volunteered for the study accessed the survey through the system used by the university’s Psychology Department to generate a research participation pool (SONA Systems). On the other hand, non-students, university staff, and faculty accessed the survey through the SurveyMonkey® website using an email sent by the experimenters which included a link to the site.

## **Study 2**

### **Participants**

Participants for this study were recruited through their involvement in Study 1. Over 110 participants in Study 1 agreed to participate in this study. However, after screening for motion sickness susceptibility (7 participants) and withdrawal due to simulator sickness (5 participants), only 98 completed the study. These volunteers consisted of 52 females and 46 males, with ages

ranging from 18 to 83 (*Mean* = 47 and *Median* = 50). The range for years holding a driver's license was less than a year up to 66 years (*Mean* = 25 and *Median* = 27).

### **Apparatus**

The simulator is an earlier version of the PatrolSim Series manufactured by L3 DPA. It uses three high resolution projectors projecting onto three screens located in front of the dashboard of a GM vehicle. An array of four computers control the operations of the device and allow the experimenter to choose from over 150 scenarios, choose variables such as weather conditions, sudden mechanical failure (e.g., flat tire, brake system failure, etc.), and different types of drivers interacting with the participant. A standard size, adjustable bucket seat with a seatbelt is attached to the dashboard with its steering wheel, brake and gas pedals from a Ford Crown Victoria that has an automatic transmission. The height, width, and depth of the apparatus are 80", 97", and 64", respectively. The simulator software also measures driving performance including speed, braking, and accelerating, and it has recording capabilities for full driving playback from many different viewpoints. The driving scenarios chosen for this study consisted of two freeway scenarios. Both scenarios occurred during the daytime with clear weather. The first scenario started at an entrance ramp to the freeway and it covered approximately 10 miles under moderate traffic, and ended on the shoulder of the freeway. The second scenario also started at an entrance ramp, but it only covered approximately 8 miles under heavy traffic and ended at a gas station after exiting the freeway.

### **Procedure**

Participants were pre-screened by the administration of the Motion History Questionnaire (MHQ; Kennedy et al., 2001) during a phone interview. Individuals with a predisposition to

motion sickness as predicted by their score on the MHQ were thanked for volunteering and excluded from further participation. The remaining volunteers were scheduled to participate in the study. Upon arrival to the laboratory, each participant was asked to complete an informed consent form, and to respond to a few questions regarding his or her driving routine. Following that, each participant was given a visual acuity test (a minimum visual acuity score of 20/40 with or without corrective lenses for both eyes was required for participation). Next, each participant was asked to complete the Simulator Sickness Questionnaire (SSQ) to establish baseline values, and, after receiving an explanation on the use of the driving simulator, he or she completed a practice session.

Once a participant indicated that he or she was comfortable using the simulator, the experiment started. The experiment consisted of two sessions separated by 5-minute breaks, with each session lasting 5-7 minutes. The SSQ was administered before and in-between experimental sessions. Instructions regarding simulator sickness were given before each session, and included the following statement: ***“If you start to feel uncomfortable at any point, just stop and I will come to get you. Do you have any questions?”*** Each session was recorded for later coding of aggressive behavior. At the end of the last session, participants completed the SSQ, and were also asked to complete an evaluation form. Finally, if the scores on the SSQ completed after the last session did not match the baseline values, participants were asked to continue to complete the SSQ at 15-minute intervals until their scores returned to their baseline value, after which time they were allowed to leave. (See appendices B and C.)

In both studies participants were informed that their responses would be kept in confidence, and that all recorded data would be assigned a code number instead of the participants' name. Furthermore, they were informed that the link between the code number and any identifiable information would be destroyed within six months following completion of the studies. Finally, participants were informed that they did not have to answer any question they did not want to answer, and that they had the right to withdraw at any time without penalty.



## CHAPTER 4: RESULTS

### Study 1

The relationship between aggressive driving behavior (as measured by the Aggressive Driving Behavior Scale—ABDS) and competitiveness, sensation seeking, extraversion, agreeableness, conscientiousness, neuroticism, openness, hostility, gender, and age was investigated using Pearson product-moment correlation coefficient. The analysis was performed using SPSS 21 CORRELATION, and SPSS 21 FREQUENCIES for evaluation of assumptions.

Preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity, and homoscedasticity. (Although the data from several measures exhibited slight variation from normality, no transformations were effected.) There was a positive correlation between reported aggressive driving behavior and competitiveness,  $r = .21$ ,  $n = 1120$ ,  $p < .001$ , sensation seeking (Thrill and Adventure),  $r = .24$ ,  $n = 1116$ ,  $p < .001$ , sensation seeking (Boredom Susceptibility),  $r = .28$ ,  $n = 1116$ ,  $p < .001$ , extraversion,  $r = .12$ ,  $n = 1097$ ,  $p < .001$ , neuroticism,  $r = .15$ ,  $n = 1097$ ,  $p < .001$ , and hostility,  $r = .35$ ,  $n = 1078$ ,  $p < .001$ . On the other hand, a negative correlation was observed between reported aggressive driving behavior and agreeableness,  $r = -.33$ ,  $n = 1097$ ,  $p < .001$ , conscientiousness,  $r = -.25$ ,  $n = 1097$ ,  $p < .001$ , openness,  $r = -.13$ ,  $n = 1097$ ,  $p < .001$ , and age,  $r = -.31$ ,  $n = 1119$ ,  $p < .001$ . Finally, no significant correlation was observed between aggressive driving behavior and gender,  $r = .03$ ,  $n = 1122$ ,  $p = .272$ . Table 1 displays these correlations (see also Figure 1).

Table 1: Pearson Product-moment Correlations between Measures of Personality Factors, Age, and Aggressive Driving Behavior

	Aggressive Driving Behavior		
	Pearson Correlation	Sig. (2-tailed)	N
Competitiveness Index	.206**	< .001	1120
SS Thrill and Adventure	.236**	< .001	1116
SS Boredom Susceptibility	.277**	< .001	1116
Extraversion	.121**	< .001	1097
Agreeableness	-.325**	< .001	1097
Conscientiousness	-.247**	< .001	1097
Neuroticism	.146**	< .001	1097
Openness	-.134**	< .001	1097
Cook-Medley Hostility Scale	.353**	< .001	1078
Gender	.033	.272	1122
Age	-.312**	< .001	1119

\*\*Correlation is significant at the 0.01 level (2-tailed).

\*Correlation is significant at the 0.05 level (2-tailed).

In order to explore the predictive ability of these personality factors and age on aggressive driving behavior, a multiple regression analysis was conducted. Specifically, a standard multiple regression was performed between reported aggressive driving behavior as the dependent variable and competitiveness, sensation seeking, extraversion, agreeableness, conscientiousness, neuroticism, openness, hostility, and age as the independent variables. The analysis was performed using SPSS 21 REGRESSION.

Table 2 displays the unstandardized regression coefficients ( $B$ ) and intercept, and the standardized regression coefficients ( $\beta$ ), and Table 3 displays the  $R$ ,  $R^2$ , and Adjusted  $R^2$ .  $R$  for the regression was significantly different from zero,  $F(10, 1070) = 37.90, p < .001$ .  $R^2$  for this model is .262 which represents that 26% of the variance in aggressive driving behavior is explained by the model.

Table 2: Coefficients for the Standard Multiple Regression of Personality Factors and Age on Aggressive Driving Behavior

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	3.270	.253		12.902	< .001
Competitiveness Index	.048	.027	.055	1.806	.071
SS Thrill and Adventure	.019	.007	.082	2.741	.006
SS Boredom Susceptibility	.026	.009	.087	2.818	.005
Extraversion	.131	.026	.151	5.050	< .001
Agreeableness	-.178	.036	-.161	-4.915	< .001
Conscientiousness	-.087	.035	-.077	-2.473	.014
Neuroticism	.020	.028	.021	.704	.481
Openness	-.122	.033	-.104	-3.658	< .001
Cook-Medley Hostility Scale	.011	.003	.145	4.351	< .001
Age	-.007	.001	-.165	-5.558	< .001

Only eight of the independent variables contributed significantly to the prediction of aggressive driving behavior, namely, sensation seeking-thrill and adventure, sensation seeking-boredom susceptibility, extraversion, agreeableness, conscientiousness, openness, hostility, and age. Furthermore, age, agreeableness, extraversion, and hostility make the strongest contribution in explaining aggressive driving behavior, while sensation seeking and conscientiousness make less of a unique contribution.

Table 3: R, R<sup>2</sup>, and Adjusted R<sup>2</sup> for the Standard Multiple Regression of Personality Factors and Age on Aggressive Driving Behavior

R	R Square	Adjusted R Square	Std. Error of the Estimate
.514 <sup>a</sup>	.264	.257	.60981

Predictors: (Constant), Age, Extraversion, SS Boredom Susceptibility, Neuroticism, Openness, Competitiveness Index, SS Thrill and Adventure, Conscientiousness, Agreeableness, Cook-Medley Hostility Scale

b. Dependent Variable: Aggressive Driving Behavior Scale

In practical terms these results suggest that individuals with personalities high in sensation seeking, extraversion, and hostility are more likely to report that they behave aggressively when driving. On the other hand, individuals with personalities low in agreeableness, conscientiousness, and openness are more likely to report that they behave aggressively when driving. Additionally, aggressive driving behavior is more likely from younger individuals, and equally likely from a female or male driver.

In order to investigate these relationships in more detail, and to eliminate the effect of the overrepresentation of young participants responders (858 vs. 139 vs. 82; see Figure 1), further analyses were conducted where the participants were broken down in age groups. Specifically, three age groups were identified: young (18 to 28), middle-age (33 to 57), and older adults (62 to 87), and the analyses were conducted for each group separately.

The correlation analysis conducted for the group of young adults yielded a positive correlation between reported aggressive driving behavior and competitiveness,  $r = .17$ ,  $n = 858$ ,  $p < .001$ , sensation seeking (Thrill and Adventure),  $r = .14$ ,  $n = 854$ ,  $p < .001$ , sensation seeking (Boredom Susceptibility),  $r = .28$ ,  $n = 854$ ,  $p < .001$ , extraversion,  $r = .13$ ,  $n = 839$ ,  $p < .001$ , neuroticism,  $r = .09$ ,  $n = 839$ ,  $p < .01$ , and hostility,  $r = .27$ ,  $n = 829$ ,  $p < .001$ . On the other

hand, a negative correlation was observed between reported aggressive driving behavior and agreeableness,  $r = -.30, n = 839, p < .001$ , conscientiousness,  $r = -.18, n = 839, p < .001$ , and openness,  $r = -.11, n = 839, p < .01$ . Table 4 displays these correlations.

Figure 1: Number of Participants for Each Age Group

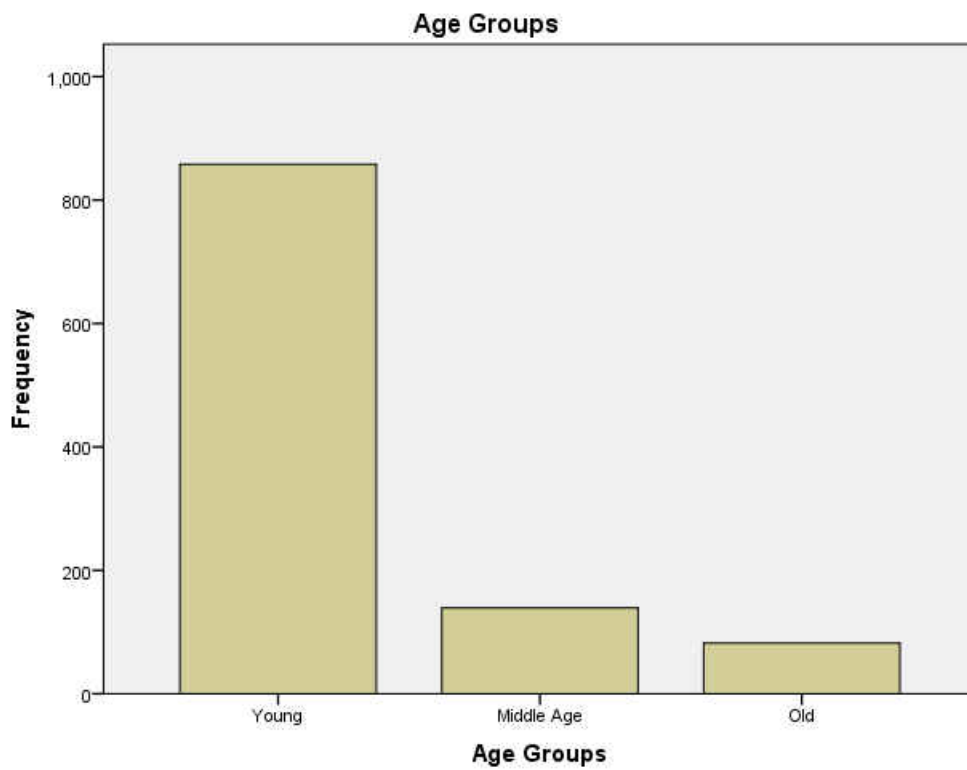


Table 4: Pearson Product-moment Correlations between Measures of Personality Factors and Aggressive Driving Behavior for Young Adults

		Aggressive Driving Behavior Scale
Competitiveness Index	Pearson Correlation	.171**
	Sig. (2-tailed)	< .001
	N	858
SS Thrill and Adventure	Pearson Correlation	.137**
	Sig. (2-tailed)	< .001
	N	854
SS Boredom Susceptibility	Pearson Correlation	.281**
	Sig. (2-tailed)	< .001
	N	854
Extraversion	Pearson Correlation	.132**
	Sig. (2-tailed)	< .001
	N	839
Agreeableness	Pearson Correlation	-.297**
	Sig. (2-tailed)	< .001
	N	839
Conscientiousness	Pearson Correlation	-.181**
	Sig. (2-tailed)	< .001
	N	839
Neuroticism	Pearson Correlation	.090**
	Sig. (2-tailed)	.009
	N	839
Openness	Pearson Correlation	-.105**
	Sig. (2-tailed)	.002
	N	839
Cook-Medley Hostility Scale	Pearson Correlation	.273**
	Sig. (2-tailed)	< .001
	N	829

\*\*Correlation is significant at the 0.01 level (2-tailed).

In order to explore the predictive ability of these personality factors on aggressive driving behavior for the young drivers, a multiple regression analysis was conducted. Specifically, a standard multiple regression was performed between aggressive driving behavior as the

dependent variable and competitiveness, sensation seeking, extraversion, agreeableness, conscientiousness, neuroticism, openness, and hostility as the independent variables. The analysis was performed using SPSS 21 REGRESSION.

Table 5 displays the unstandardized regression coefficients ( $B$ ) and intercept, and the standardized regression coefficients ( $\beta$ ), and Table 6 displays the  $R$ ,  $R^2$ , and Adjusted  $R^2$ .  $R$  for the regression was significantly different from zero,  $F(9, 818) = 20.97, p < .001$ .  $R^2$  for this model is .187 which represents that 19% of the variance in aggressive driving behavior is explained by the model.

Table 5: Coefficients for the Standard Multiple Regression of Personality Factors on Aggressive Driving Behavior for Young Adults

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	3.202	.290		11.036	<.001
Competitiveness Index	.040	.031	.045	1.279	.201
SS Thrill and Adventure	.018	.008	.076	2.227	.026
SS Boredom Susceptibility	.034	.011	.113	3.022	.003
Extraversion	.150	.031	.174	4.818	<.001
1 Agreeableness	-.201	.043	-.182	-4.695	<.001
Conscientiousness	-.086	.042	-.074	-2.071	.039
Neuroticism	.019	.034	.019	.554	.579
Openness	-.127	.040	-.107	-3.176	.002
Cook-Medley Hostility Scale	.010	.003	.122	3.239	.001

a. Dependent Variable: Aggressive Driving Behavior Scale

Table 6: R, R<sup>2</sup>, and Adjusted R<sup>2</sup> for the Standard Multiple Regression of Personality Factors on Aggressive Driving Behavior for Young Adults

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.433 <sup>a</sup>	.187	.179	.63673

a. Predictors: (Constant), Cook-Medley Hostility Scale, Extraversion, SS Thrill and Adventure, Conscientiousness, Openness, Neuroticism, Competitiveness Index, SS Boredom Susceptibility, Agreeableness

b. Dependent Variable: Aggressive Driving Behavior Scale

Similar to what we saw in the previous analysis, only seven of the independent variables contributed significantly to the prediction of aggressive driving behavior, namely, sensation seeking-thrill and adventure, sensation seeking-boredom susceptibility, extraversion, agreeableness, conscientiousness, openness, and hostility. Furthermore, agreeableness, extraversion, and hostility make the strongest contribution in explaining aggressive driving behavior, while sensation seeking and conscientiousness make less of a unique contribution.

Another set of analyses were conducted for the middle-age group. In this case, there was a positive correlation between reported aggressive driving behavior and sensation seeking (Boredom Susceptibility),  $r = .25$ ,  $n = 138$ ,  $p < .01$ , neuroticism,  $r = .24$ ,  $n = 137$ ,  $p < .01$ , and hostility,  $r = .48$ ,  $n = 132$ ,  $p < .001$ . On the other hand, a negative correlation was observed between reported aggressive driving behavior and agreeableness,  $r = -.34$ ,  $n = 137$ ,  $p < .001$ , and conscientiousness,  $r = -.30$ ,  $n = 137$ ,  $p < .001$ . No significant correlation was observed between reported aggressive driving behavior and competitiveness,  $r = .05$ ,  $n = 138$ ,  $p = .56$ , sensation seeking (Thrill and Adventure),  $r = .15$ ,  $n = 138$ ,  $p = .09$ , extraversion,  $r = -.07$ ,  $n = 137$ ,  $p = .43$ , and openness,  $r = -.10$ ,  $n = 137$ ,  $p = .24$ . Table 7 displays these correlations.



Table 7: Pearson Product-moment Correlations between Measures of Personality Factors and Aggressive Driving Behavior for Middle-age Adults

		Aggressive Driving Behavior Scale
Competitiveness Index	Pearson Correlation	.050
	Sig. (2-tailed)	.560
	N	138
SS Thrill and Adventure	Pearson Correlation	.146
	Sig. (2-tailed)	.088
	N	138
SS Boredom Susceptibility	Pearson Correlation	.252**
	Sig. (2-tailed)	.003
	N	138
Extraversion	Pearson Correlation	-.068
	Sig. (2-tailed)	.430
	N	137
Agreeableness	Pearson Correlation	-.336**
	Sig. (2-tailed)	.000
	N	137
Conscientiousness	Pearson Correlation	-.302**
	Sig. (2-tailed)	.000
	N	137
Neuroticism	Pearson Correlation	.235**
	Sig. (2-tailed)	.006
	N	137
Openness	Pearson Correlation	-.102
	Sig. (2-tailed)	.237
	N	137
Cook-Medley Hostility Scale	Pearson Correlation	.480**
	Sig. (2-tailed)	.000
	N	132

\*\*Correlation is significant at the 0.01 level (2-tailed).

\*Correlation is significant at the 0.05 level (2-tailed).

The predictive ability of these personality factors on aggressive driving behavior for the middle-age drivers was also explored using a multiple regression analysis. Specifically, a

standard multiple regression was performed between reported aggressive driving behavior as the dependent variable and competitiveness, sensation seeking (Boredom Susceptibility), agreeableness, conscientiousness, neuroticism, and hostility as the independent variables.

Table 8 displays the unstandardized regression coefficients ( $B$ ) and intercept, and the standardized regression coefficients ( $\beta$ ), and Table 9 displays the  $R$ ,  $R^2$ , and Adjusted  $R^2$ .  $R$  for the regression was significantly different from zero,  $F(5, 126) = 9.60, p < .001$ .  $R^2$  for this model is .28 which represents that 28% of the variance in aggressive driving behavior is explained by the model.

Table 8: Coefficients for the Standard Multiple Regression of Personality Factors on Aggressive Driving Behavior for Middle-age Adults

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.751	.486		5.655	<.001
SS Boredom Susceptibility	.011	.023	.040	.464	.643
Agreeableness	-.002	.086	-.003	-.026	.979
1 Conscientiousness	-.190	.076	-.225	-2.510	.013
Neuroticism	-.053	.067	-.072	-.791	.431
Cook-Medley Hostility Scale	.029	.007	.448	4.343	<.001

a. Dependent Variable: Aggressive Driving Behavior Scale

Table 9: R, R<sup>2</sup>, and Adjusted R<sup>2</sup> for the Standard Multiple Regression of Personality Factors on Aggressive Driving Behavior for Middle-age Adults

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.525 <sup>a</sup>	.276	.247	.48951

a. Predictors: (Constant), Cook-Medley Hostility Scale, Conscientiousness, SS Boredom Susceptibility, Neuroticism, Agreeableness

b. Dependent Variable: Aggressive Driving Behavior Scale

The outcome of the regression for the middle-age group indicates that there are only two significant predictors of aggressive driving behavior, namely, conscientiousness and hostility. The latter making twice as strong a unique contribution as the former.

Finally, a set of analyses were conducted for the older adults group. Here the correlation analysis indicated that there was a positive correlation between reported aggressive driving behavior and competitiveness,  $r = .27, n = 81, p < .05$ , sensation seeking (Thrill and Adventure),  $r = .32, n = 82, p < .01$ , sensation seeking (Boredom Susceptibility),  $r = .23, n = 82, p < .05$ , neuroticism,  $r = .30, n = 79, p < .01$ , and hostility,  $r = .28, n = 7, p < .05$ . On the other hand, a negative correlation was observed between reported aggressive driving behavior and agreeableness,  $r = -.30, n = 79, p < .01$ . No significant correlation was observed between reported aggressive driving behavior and extraversion,  $r = .12, n = 79, p = .29$ , conscientiousness,  $r = -.18, n = 79, p = .12$ , and openness,  $r = .01, n = 79, p = .91$ . Table 10 displays these correlations.

Table 10: Pearson Product-moment Correlations between Measures of Personality Factors and Aggressive Driving Behavior for Older Adults

		Aggressive Driving Behavior Scale
Competitiveness Index	Pearson Correlation	.266*
	Sig. (2-tailed)	.016
	N	81
SS Thrill and Adventure	Pearson Correlation	.324**
	Sig. (2-tailed)	.003
	N	82
SS Boredom Susceptibility	Pearson Correlation	.225*
	Sig. (2-tailed)	.042
	N	82
Extraversion	Pearson Correlation	.121
	Sig. (2-tailed)	.288
	N	79
Agreeableness	Pearson Correlation	-.304**
	Sig. (2-tailed)	.006
	N	79
Conscientiousness	Pearson Correlation	-.177
	Sig. (2-tailed)	.118
	N	79
Neuroticism	Pearson Correlation	.304**
	Sig. (2-tailed)	.007
	N	79
Openness	Pearson Correlation	.013
	Sig. (2-tailed)	.906
	N	79
Cook-Medley Hostility Scale	Pearson Correlation	.280*
	Sig. (2-tailed)	.014
	N	77

\*Correlation is significant at the 0.05 level (2-tailed).

\*\*Correlation is significant at the 0.01 level (2-tailed).

The predictive ability of these personality factors on aggressive driving behavior for the older drivers was also explored using a multiple regression analysis. Specifically, a standard

multiple regression was performed between reported aggressive driving behavior as the dependent variable and competitiveness, sensation seeking (Thrill and Adventure), sensation seeking (Boredom Susceptibility), agreeableness, neuroticism, and hostility as the independent variables.

Table 11 displays the unstandardized regression coefficients (*B*) and intercept, and the standardized regression coefficients ( $\beta$ ), and Table 12 displays the *R*, *R*<sup>2</sup>, and Adjusted *R*<sup>2</sup>. *R* for the regression was significantly different from zero,  $F(6, 69) = 5.80, p < .001$ . Adjusted *R*<sup>2</sup> for this model is .28 which represents that 28% of the variance in aggressive driving behavior is explained by the model.

Table 11: Coefficients for the Standard Multiple Regression of Personality Factors on Aggressive Driving Behavior for Older Adults

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.992	.845		1.175	.244
SS Boredom Susceptibility	.049	.022	.231	2.245	.028
Agreeableness	-.051	.143	-.043	-.359	.721
Neuroticism	.216	.084	.284	2.567	.012
Cook-Medley Hostility Scale	.007	.008	.092	.854	.396
Competitiveness Index	.128	.084	.180	1.521	.133
SS Thrill and Adventure	.061	.027	.257	2.279	.026

a. Dependent Variable: Aggressive Driving Behavior Scale

Table 12: R, R<sup>2</sup>, and Adjusted R<sup>2</sup> for the Standard Multiple Regression of Personality Factors on Aggressive Driving Behavior for Older Adults

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.579 <sup>a</sup>	.335	.278	.48124

a. Predictors: (Constant), SS Thrill and Adventure, Neuroticism, SS Boredom Susceptibility, Cook-Medley Hostility Scale, Competitiveness Index, Agreeableness

b. Dependent Variable: Aggressive Driving Behavior Scale

The outcome of the regression for the older adults group indicates that there are only three significant predictors of aggressive driving behavior, namely, sensation seeking (Thrill and Adventure), sensation seeking (Boredom Susceptibility), and neuroticism. The strength of the three factors in terms of a unique contribution was similar (i.e., Beta value).

## Study 2

In this study, behaviors displayed while driving a simulator were observed and recorded. These behaviors included: honking, tailgating, making obscene gestures at other drivers, yelling, flashing headlights at slower drivers, speeding (exceeding the speed limit by at least 15 mph), passing other vehicles on the shoulder, changing lanes without signaling, failing to slow down at a highway construction zone, and collisions. Participants did not exhibit several of these behaviors (namely, making obscene gestures at other drivers, yelling, and flashing headlights at other drivers), so these were not included in the analyses. For the remaining behaviors, frequencies were recorded for honking, tailgating, passing other vehicles on the shoulder, changing lanes without signaling, and collisions, while speeding and failing to slow down at a highway construction zone were recorded dichotomously (i.e., yes or no). These frequencies are displayed in Table 13.

Table 13: Frequency of Aggressive Driving Behaviors in the Simulator

Simulator Behavior	N	Sum
Speeding	98	43
Honking	98	8
Tailgating	98	193
Lane Change	98	440
Shoulder Passing	98	62
Road Conditions	98	55
Collisions	98	74
Valid N (listwise)	98	

The simulator behaviors were recorded by three observers using video recordings of the simulation sessions. Inter-rater reliability between observers was estimated by computing intra-class correlation coefficients (ICC; Shrout & Fleiss, 1979) for all seven recorded behaviors. The coefficients obtained from these analyses ranged from .975 to 1.000 (see Table 14).

Table 14: Intra-class Correlation Coefficients for Raters of Aggressive Driving Behaviors in Simulator

Simulator Behavior	Intra-class Correlation	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Honking	.988	.983	.991	80.423	97	194	< .001
Tailgating	.977	.967	.984	46.716	97	194	< .001
Changing Lanes without Signaling	.996	.995	.998	296.593	97	194	< .001
Passing on the Shoulder	.999	.998	.999	716.726	97	194	< .001

Simulator Behavior	Intra-class Correlation	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Speeding	1.000	1.000	1.000		97		
Failing to Slow Down at Construction Site	.975	.965	.982	39.668	97	194	< .001
Collisions	.999	.998	.999	700.354	97	194	< .001

Two-way mixed effects model where people effects are random and measures effects are fixed.

In order to compute a composite score for each participant, a weight was assigned to each of the following behaviors: honking, tailgating, passing other vehicles on the shoulder, changing lanes without signaling, speeding, and failing to slow down at a highway construction. The individual weights were determined through a pilot study in which 22 police officers at a major university in Central Florida assigned each behavior a value from 0 to 20 where 0 indicated not at all aggressive, and 20 indicated extremely aggressive (the form used was a modified version of the NASA TLX used to measure workload; see Appendix B). These officers receive the same law enforcement training and perform the same duties as their counterparts at the city, county, and state levels. The averages were computed for each behavior and were then used as the weights. Table 15 displays the mean and standard deviations for each behavior. For analysis purposes this variable was named “Sim Behavior Score”. Additionally, inter-rater reliability between the police officers was estimated by computing the intra-class correlation coefficient (ICC; Shrout & Fleiss, 1979) for all six recorded behaviors combined,  $ICC(3) = .78, \chi^2(5, n = 22) = 4.44, p = .001$ .



Table 15: Means and Standard Deviations for Simulator Behaviors Computed from Ratings by Police Officers

	N	Mean	Std. Deviation
Tailgating	22	14.59	3.41787
Honking	22	11.86	4.91156
Failing to Slow Down at Construction Site	22	12.59	4.77752
Passing on the shoulder	22	15.09	5.26361
Changing Lanes without Signaling	22	8.77	6.30896
Speeding	22	11.82	5.08627
Valid N (listwise)	22		

The relationship between the scores on the ADBS and the above composite scores on the driving simulator was investigated using the Spearman's rho correlation coefficient. Spearman's rho was used because, due to the small sample size, outliers were not removed, and because tests for normality indicated that only four of the eleven distributions were normally distributed (see Table 16). This analysis was performed using SPSS 21 CORRELATION. There was a positive correlation between scores on the ADBS and the Sim Behavior Score,  $r_s = .20$ ,  $n = 98$ ,  $p < .05$ . Table 17 displays this correlation.

Table 16: Tests for Normality for Simulator Data

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Agressive Driving Behavior Scale	.090	98	.047	.966	98	.011
Sim Behavior Scores	.211	98	.000	.704	98	.000
Competitiveness Index	.113	98	.004	.958	98	.003
SS Thrill and Adventure	.126	98	.001	.949	98	.001
SS Boredom Susceptibility	.153	98	.000	.919	98	.000
Extraversion	.070	98	.200*	.980	98	.142
Agreeableness	.114	98	.003	.941	98	.000

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Agressive Driving Behavior Scale	.090	98	.047	.966	98	.011
Conscientiousness	.076	98	.188	.981	98	.167
Neuroticism	.055	98	.200*	.983	98	.237
Openness	.082	98	.099	.980	98	.149
Cook-Medley Hostility Scale	.088	98	.058	.968	98	.016

\*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 17: Spearman's rho Correlations between Sim Behavior Score and the ADBS

		Aggressive Driving Behavior Scale	
		Correlation Coefficient	1.000
Spearman's rho	Aggressive Driving Behavior Scale	Sig. (2-tailed)	.
		N	98
		Correlation Coefficient	.200*
	Sim Behavior Weighted	Sig. (2-tailed)	.048
		N	98

\*Correlation is significant at the 0.05 level (2-tailed).

An analysis of the relationship between personality factors, age, and aggressive driving in the simulator (i.e., Sim Behavior Score) was also performed. This analysis revealed several positive correlations with Sim Behavior Score: competitiveness,  $r_s = .29$ ,  $n = 98$ ,  $p < .01$ , sensation seeking-thrill and adventure,  $r_s = .31$ ,  $n = 98$ ,  $p < .01$ , and hostility,  $r_s = .22$ ,  $n = 98$ ,  $p < .05$ . On the other hand, aggressive driving correlated negatively with agreeableness,  $r_s = -.20$ ,  $n = 98$ ,  $p < .05$ , and age,  $r_s = -.58$ ,  $n = 98$ ,  $p < .001$ . Table 18 displays these correlations.

Table 18: Spearman's rho Correlations between Personality Factors, Age, and Sim Behavior Score

		Sim Behavior Score	
Spearman's rho	Sim Behavior Score	Correlation Coefficient	1.000
		Sig. (2-tailed)	.
		N	98
Competitiveness Index		Correlation Coefficient	.294**
		Sig. (2-tailed)	.003
		N	98
SS Thrill and Adventure		Correlation Coefficient	.305**
		Sig. (2-tailed)	.002
		N	98
SS Boredom Susceptibility		Correlation Coefficient	.022
		Sig. (2-tailed)	.828
		N	98
Extraversion		Correlation Coefficient	.064
		Sig. (2-tailed)	.530
		N	98
Agreeableness		Correlation Coefficient	-.202*
		Sig. (2-tailed)	.046
		N	98
Conscientiousness		Correlation Coefficient	-.066
		Sig. (2-tailed)	.521
		N	98
Neuroticism		Correlation Coefficient	.187
		Sig. (2-tailed)	.065
		N	98
Openness		Correlation Coefficient	-.002
		Sig. (2-tailed)	.983
		N	98

		Sim Behavior Score
Cook-Medley Hostility Scale	Correlation Coefficient	.220*
	Sig. (2-tailed)	.030
	N	98
Age	Correlation Coefficient	-.581**
	Sig. (2-tailed)	.000
	N	98

\*\*Correlation is significant at the 0.01 level (2-tailed).

\*Correlation is significant at the 0.05 level (2-tailed).

Finally, a comparison of the top half scores on the ADBS with the bottom half (i.e., median split) revealed that the former group engaged in 61% (487 of 801) of the behaviors observed in the simulator trials. In other words, individuals with higher scores on the ADBS, displayed more instances of aggressive driving behavior in the simulator.

The total number of each aggressive driving behavior was calculated for each age group. These totals show that young drivers engage in more aggressive driving behaviors than middle-age adults which, in turn, engage in more aggressive driving behaviors than the older adults. Tables 19 through 21 display these totals.

Table 19: Frequency of Aggressive Driving Behavior for Young Adults

	N	Sum	Weighted Score
Speeding	34	28	330.96
Honking	34	4	47.44
Tailgating	34	140	2042.60
Changing Lanes without Signaling	34	224	1964.48
Passing on the Shoulder	34	36	543.24
Failing to Slow Down at Construction Site	34	26	327.34
Valid N (listwise)	34		
Totals		458	5256.06

Table 20: Frequency of Aggressive Driving Behavior for Middle-age Adults

	N	Sum	Weighted Score
Speeding	28	8	94.56
Honking	28	0	0
Tailgating	28	33	481.47
Changing Lanes without Signaling	28	135	1183.95
Passing on the Shoulder	28	25	377.25
Failing to Slow Down at Construction Site	28	14	176.26
Valid N (listwise)	28		
Totals		215	2313.49

Table 21: Frequency of Aggressive Driving Behavior for Older Adults

	N	Sum	Weighted Score
Speeding	29	4	47.28
Honking	29	3	35.58
Tailgating	29	13	189.67
Changing Lanes without Signaling	29	75	657.75
Passing on the Shoulder	29	1	15.09
Failing to Slow Down at Construction Site	29	10	125.90
Valid N (listwise)	29		
Totals		106	1071.27

It is interesting to note also that participants who reported higher numbers of accidents in the demographic survey also experienced a higher number of collisions in the simulator,  $r_s = .25$ ,  $n = 98$ ,  $p = .015$  (see Table 22).

Table 22: Spearman's rho Correlation between Collisions and Accident Reports for the Last Three Years

		Collisions
Spearman's rho	Collisions	Correlation Coefficient
		1.000
		Sig. (2-tailed)
		.
		N
		98
Accidents in 3 Years		Correlation Coefficient
		.245*
		Sig. (2-tailed)
		.015
	N	98

## CHAPTER 5: DISCUSSION

### Study 1

In this study, the relationship between aggressive driving behavior, age, gender, and several personality factors was investigated. The analyses performed indicated a negative relationship between reported aggressive driving behavior and age, agreeableness, conscientiousness, and openness. On the other hand, a positive relationship was obtained between reported aggressive driving behavior and competitiveness, sensation seeking, extraversion, neuroticism, and hostility. Gender was not found to significantly relate to reported aggressive driving behavior. The nature of the relationship between these variables was further investigated by performing a standard multiple regression where age, competitiveness, sensation seeking (thrill and adventure, and boredom susceptibility), hostility, extraversion, neuroticism, agreeableness, conscientiousness, and openness were entered as predictors of reported aggressive driving behavior. Additionally, the sample was broken down into three age groups (young, middle-age, and older adults), and statistical analyses were conducted on each group separately.

Three hypotheses were tested in this study: (a) younger drivers will report higher propensity to engage in aggressive driving behavior than middle-age and older adults; (b) drivers with low scores in openness, conscientiousness, and agreeableness will report a higher propensity to engage in aggressive driving behavior; and (c) drivers with high scores in neuroticism, extraversion, competitiveness, sensation seeking, and hostility will report a higher propensity to engage in aggressive driving behavior. These hypotheses were generally confirmed.

Hypothesis (a) was confirmed in that results from the multiple regression showed a negative relationship between reported aggressive driving and age. Thus, younger drivers reported a higher propensity to engage in aggressive driving behavior than middle-age and older adults. This finding is consistent with the belief by some that, in general, older drivers are more cautious. Furthermore, Wickens et al. (2011) suggest that because of their experience and maturity older adults are less likely to engage in aggressive driving behavior. This argument gets some support from Terracciano et al. (2005) research finding regarding personality changes associated with age that include declines in neuroticism and extraversion, and increases in agreeableness and conscientiousness. Additional empirical evidence for the present research finding has been provided by Vanlaar et al. (2008).

Hypothesis (b) was partially confirmed in that results from the multiple regressions conducted for each age group indicated that openness, conscientiousness, and agreeableness were significant predictors of reported aggressive driving for some age groups but not for others. Specifically, all these personality dimensions were significant predictors for young drivers, for middle-age adults only conscientiousness significantly predicted aggressive driving, and none of these personality dimensions was a significant predictor for older drivers. Thus, in our sample of young adults we found that individuals that reported a higher propensity to engage in aggressive driving behavior are individuals with less of a prosocial and communal orientation (agreeableness), less able to abide by socially prescribed impulse control (conscientiousness), and more likely to be rigid and less likely to be creative (openness). The intuitive appeal of this finding is hard to argue against; indeed, one would expect an individual who is community oriented, compliant with socially prescribed norms, and open-minded to be less likely to engage



in behavior that might pose a threat to public safety. A similar finding was reported by Harris and Houston (2010), Harris et al. (in press), and Dahlen et al. (2012). However, this pattern was not observed in either the sample of middle-age or in the sample of older adults (only in the former group individuals that are less likely to abide by socially prescribed impulse control reported a higher propensity to engage in aggressive driving behavior). It appears that the small sample size for these two age groups did not capture enough variability on these personality dimensions (as was the case with the young adults sample) to discern the relationship between them and aggressive driving behavior. Furthermore, given Terracciano et al. (2005) findings suggesting that conscientiousness and agreeableness increase with age, we can expect that both the middle-age and older adults would report a lower propensity to engage in aggressive driving than young adults. More research with bigger simple sizes is needed to answer these questions.

Similarly, hypothesis (c) was partially confirmed in that results from the multiple regressions conducted for each age group indicated that sensation seeking (Thrill and Adventure), sensation seeking (Boredom Susceptibility), extraversion, neuroticism, and hostility were significant predictors of reported aggressive driving for some age groups but not for others. Specifically, sensation seeking (Thrill and Adventure), sensation seeking (Boredom Susceptibility), extraversion, and hostility were significant predictors of reported aggressive driving for young drivers; hostility was a significant predictor for middle-age adults; and sensation seeking (Thrill and Adventure), sensation seeking (Boredom Susceptibility), and neuroticism were significant predictors for older adults. Thus, in our sample of young adults individuals that reported a higher propensity to engage in aggressive driving behavior are also individuals that try to avoid boredom, enjoy pursuing thrill and adventure, are energetic and

assertive, and tend to be hostile toward others. Here again one's intuition appears to be corroborated: most of us would expect an individual who requires sensory experiences high in intensity, is assertive, and has hostile tendencies to be more likely to behave aggressively when driving. A similar finding was reported by Harris and Houston (2010) and Harris et al. (in press). However, this pattern was not observed in either the sample of middle-age or in the sample of older adults: only middle-age individuals with hostile tendencies are more likely to drive aggressively, while older drivers who are low in emotional stability (neuroticism), try to avoid boredom, enjoy pursuing thrill and adventure are more likely to drive aggressively. As suggested above, it appears that here also the small sample size for these two age groups did not capture enough variability on these personality dimensions (as was the case with the young adults sample) to discern the relationship between them and aggressive driving behavior. Again, further research is needed to clarify this situation.

Finally, even though it was not hypothesized, no relationship was observed between gender and aggressive driving. This finding was also reported by Hennessy & Wiesenthal (2005). Furthermore, anecdotal evidence to this situation is not hard to come by as more and more people note that in their own experiences female drivers behave as aggressively as males these days. The author is certainly one of them!

## **Study 2**

In this study, behaviors displayed while using a driving simulator were observed and recorded for 98 of the volunteers that participated in Study 1. As noted above, the frequency of several behaviors was recorded and analyzed: honking, tailgating, speeding (exceeding the speed limit by at least 15 mph), passing other vehicles on the shoulder, changing lanes without

signaling, failing to slow down at a highway construction zone, and collisions. Several hypotheses were then tested: (a) drivers that report a higher propensity to engage in aggressive driving behavior on the ADBS will display more instances of aggressive driving behavior in a driving simulator; (b) younger drivers will display more instances of aggressive driving behavior in the simulator than middle-age and older drivers; (c) drivers with low scores in openness, conscientiousness, and agreeableness will engage in more instances of aggressive driving behavior in the simulator; and (d) drivers with high scores in neuroticism, extraversion, competitiveness, sensation seeking, and hostility will engage in more instances of aggressive driving behavior in the simulator.

In order to test hypothesis (a), a correlation analysis was conducted between ADBS scores and Sim Behavior Scores. A significant positive correlation was obtained ( $r_s = .20, p < .05$ ), and thus, as expected, individuals with high scores in the ADBS committed more instances of aggressive driving behaviors in the driving simulator. This result was also confirmed by looking at the percentage of instances of aggressive driving behavior in the simulator. In this case, when the sample was split in half (median split) on the basis of scores on the ADBS, the half containing the top scores in the ADBS accounted for 61% (487 out of 801) of instances of aggressive driving in the simulator.

Hypothesis (b) was confirmed in that the correlation analysis indicated a negative relationship between Sim Behavior Scores and age. Thus, as expected, younger drivers displayed more instances of aggressive driving behavior in the simulator than middle-age and older adults. In fact, young drivers (18 – 26 years of age) committed 59% percent (458 out of 779) of instances of aggressive driving behaviors in the simulator, while middle-age (38 – 58 years of

age) and older (63 – 83 years of age) drivers committed, 27% (215 out of 779) and 14% (106 out of 779), respectively (see Table 23). Furthermore, a considerable difference emerges when these totals are weighted based on the ratings provided by the police officers, i.e., 5256.06 versus 2313.49 versus 1071.27 for young, middle-age, and older adults, respectively (see Tables 19 through 21 above).

This finding is consistent the results in Study 1 where younger drivers reported a higher propensity to report that they engaged in aggressive driving behavior than middle-age and older adults.

Table 23: Total Number of Instances of Aggressive Behavior in Simulator by Age Group

Age Group	Instances of Aggressive Behaviors in Simulator	Percentages
Young	458	59
Middle-age	215	27
Older adults	106	14

Hypothesis (c) was partially confirmed in that the correlation analysis indicated a negative relationship between Sim Behavior Scores and agreeableness, but there was no significant correlation between Sim Behavior Scores and either conscientiousness or openness. Again, as expected, individuals with high frequency of aggressive behavior in the simulator had lower scores in the agreeableness measure. However, a similar pattern of results was not

obtained for conscientiousness and openness. There are two possible explanations for this unexpected outcome. First, it is possible that the influence of both conscientiousness and openness on the behaviors observed in the simulator is not as strong as the influence of agreeableness. This may be corroborated through the beta weights on the multiple regression conducted in Study 1 where the beta weight of agreeableness was considerably higher than the beta weight of conscientiousness and openness. Furthermore, these propensities may be moderated in the artificial environment of the driving simulator, where no serious consequences will come about from behaving in an “atypical” manner. Secondly, a higher number of observable behaviors in a simulator might be needed to capture the influence of certain variables that operate in a more subtle manner in the area of aggressive driving. Further research is needed to ascertain the validity of these explanations.

Hypothesis (d) was also partially confirmed in that there was a positive correlation between Sim Behavior Scores and competitiveness, sensation seeking-thrill and adventure, and hostility, but there was no significant correlation between the Sim Behavior Scores and sensation seeking-boredom susceptibility, extraversion, and neuroticism. Thus, the expectation that individuals displaying a high frequency of aggressive behaviors in the simulator having high scores in the competitiveness, sensation seeking-thrill and adventure, and hostility measures was met. But that was not the case with a similar expectation relating aggressive behaviors in the simulator with sensation seeking-boredom susceptibility, extraversion, and neuroticism. A plausible explanation for this situation involves contextual considerations. That is, the artificiality of the simulator task (and environment) might have mitigated the tendency of an energetic and assertive individual (extraversion) to behave aggressively. Similarly, the

artificiality and the relatively “safe” laboratory environment (as opposed to a typical highway) might not have elicited feelings of anxiety, nervousness, and tension (neuroticism) or the “need to escape” from a low-sensory situation (sensation seeking-boredom susceptibility) that could bring about aggressive behavior. Again, further research is needed to ascertain the validity of these explanations.

Finally, it should be noted that there was concordance between the number of accidents participants reported in the demographic questionnaire for the last 3 years and the frequency of collisions in the simulator. Specifically, individuals reporting being involved in a higher number of accidents in the last 3 years also recorded a higher number of collisions in the simulator. This appears to be an area where the use of simulation can be useful in enhancing safety in the roads. For example, driving simulators could be used to gauge the potential for accident involvement of new drivers, and then make recommendations or implement targeted training. Again, further research is needed in this area.

The foregoing considerations suggest that there are four factors that appear to exert a robust influence on aggressive driving behavior, namely, age, hostility agreeableness, and sensation seeking (Thrill and Adventure). Age emerged as a significant predictor of aggressive driving and was one of the main contributors in explaining the variance on the ADBS in Study 1, and it was highly correlated to Sim Behavior Score in Study 2. The personality dimension of hostility was a significant predictor of aggressive driving for young and middle-age drivers, it was among the main contributors in explaining the variance on the ADBS, and it was significantly correlated to Sim Behavior Score. Likewise, sensation seeking (Thrill and

Adventure) was also a significant predictor of aggressive driving for young and older adults, and it was significantly correlated to Sim Behavior Score. Finally, agreeableness was also a significant predictor of for young adults and it was significantly correlated to Sim Behavior Score.

## CHAPTER 6: CONCLUSION

The outlook for the next several decades in terms of the human cost associated with aggressive driving behavior has the potential to present significant societal challenges. Studies conducted by the AAA Foundation have revealed that the majority of Americans rate aggressive driving as a serious traffic safety problem (AAA Foundation for Traffic Safety, 2008), and that aggressive driving might have played a role in more than half of fatal crashes in the 4-year span starting in 2003 through 2007 (AAA Foundation for Traffic Safety, 2009). The present research has attempted to shed some light on this troublesome phenomenon. By examining the results from the analysis of data obtained from self-reports and from behaviors in a driving simulator, the present research confirmed several findings from previous research. On the one hand, positive correlations were obtained between aggressive driving behavior and competitiveness, sensation seeking, hostility, extraversion, and neuroticism. On the other hand, negative correlations were obtained between aggressive driving behavior and age, agreeableness, conscientiousness, and openness.

The present research's contribution to the aggressive driving literature is threefold. First, the convergence of results from the two studies suggests that four factors appear to exert a critical influence on aggressive driving behavior, namely, age, agreeableness, sensation seeking-thrill and adventure, and hostility. Indeed, age was a significant predictor of reported aggressive driving and highly correlated to the Sim Behavior Scores. Similarly, hostility and sensation seeking (Thrill and Adventure) were significant predictors of reported aggressive driving, and were also significantly correlated with the Sim Behavior Scores. And finally, agreeableness was



also a significant predictor of reported aggressive driving, and it was significantly correlated with the Sim Behavior Scores.

Secondly, through the use of direct measurement of actual behaviors in a driving simulator, the present research validates Houston, Harris, and Norman's (2003) Aggressive Driving Behavior Scale. Specifically, the finding in Study 2 of a positive correlation between the ADBS and the Sim Behavior Scores is evidence of the ADBS' ability to measure aggressive driving behavior. Indeed, this relationship suggests that self-reported aggressive driving behavior using the ADBS is generally indicative of aggressive driving on a high fidelity simulator, and possibly on the road.

Thirdly, the present research provides another mechanism to study aggressive driving behavior, namely, the measuring of easily observable behaviors during a simulated task and environment. In spite of the "artificiality" inherent in a simulated task and environment, the results obtained in Study 2 suggest that this is a viable mechanism in the continued study of the relationship between personality factors and driving behavior.

Finally, it should be noted that the present research accomplished three critical goals identified by the author. These goals relate to three major methodological limitations of the majority of the literature on aggressive driving, namely, the reliance on self-reports, the use of college students in most samples, and the almost exclusive use of retrospective correlational designs. In Study 1, self-reports were obtained and in Study 2 participants were asked to drive through two scenarios in a simulator. Both studies recruited young college students and middle-age as well as older individuals. Lastly, a retrospective approach was used in Study 1 where personality measures were assessed, while a prospective approach was used in Study 2 where

participants were brought to the laboratory and their behavior was observed in the driving simulator.

### **Limitations of the Studies**

Several limitations to the present research should be noted. First, both studies were correlational studies and thus subject to the disadvantages associated with these types of studies. Most importantly, in spite of the support for the notion that age and several personality factors are strong predictors of aggressive driving behavior, further research is needed to establish cause-and-effect relationship between these variables.

Secondly, the pool of participants for the simulator study is best characterized as a convenience sample. These volunteers indicated their desire to participate in Study 2 after completing the online survey in Study 1, and they comprise approximately 10% of those completing the survey. Therefore, selection bias might have played a role in this sample's composition.

Lastly, demand characteristics in the simulation laboratory might have influenced the behaviors of the participants. Specifically, the simulator and the control equipment were in closed proximity creating a situation in which the experimenter sat next to the participant. The resulting "lack of privacy" might explain the fact that behaviors like making obscene gestures and yelling were not observed.

### **Suggestions for Future Research**

Despite the shortcomings associated with simulated environments noted above, driving simulators provide a convenient tool to study the relationship between aggressive driving behavior and situational and environmental factors (e.g., city versus rural versus highway

driving, traffic congestion, etc.). The manipulation of real-world scenarios involving aggressive driving is not a viable option, but simulated models of them are just a clever programmer away. Additionally, simulations provide a convenient way to design studies that might greatly increase our understanding of this phenomenon (e.g., factorial designs where participants are assigned to several levels of driving aggressiveness based on self-reports, and then their behavior in a simulator is measured.)

Gender differences should also be studied further. The aggressive driving literature is currently conflicted with studies supporting contradictory findings in this area: in addition to the present research, Hennessy & Wiesenthal (1997, 1999, and 2005) have reported no differences, while Vanlaar et al. (2008), Jonah (1997), and others have found gender differences in aggressive driving.

Finally, a comprehensive understanding of the relationship between aggressive driving and age could assist investigators in the development of interventions to mitigate this behavior among young drivers. Moreover, it is possible that interventions that are shown to be effective with young drivers might also be effective with drivers of all ages. And any decline in aggressive driving resulting from the implementation of these interventions, however small, might translate into significant improvements in safety for all drivers.

## **APPENDIX A: SURVEY INSTRUMENTS**

## DRIVING BEHAVIOR SCALE

**Instructions:** Using the response scale provided, indicate how often **you** engage in each of these driving behaviors. Circle the number that best represents your answer.

<b>How often do you engage in the following behaviors:</b>	<i>Never</i>	<i>Almost Never</i>	<i>Some- times</i>	<i>Fairly Often</i>	<i>Very Often</i>	<i>Always</i>
1. Turn on headlights at dusk	1	2	3	4	5	6
2. Drive while fatigued or drowsy	1	2	3	4	5	6
3. Decrease speed to accommodate poor weather conditions	1	2	3	4	5	6
4. Slow down in a construction zone	1	2	3	4	5	6
5. Make rude gestures at other drivers when they do something I don't like	1	2	3	4	5	6
6. Merge into traffic even when another driver tries to close the gap between vehicles	1	2	3	4	5	6
7. Avoid distractions while driving (loud music, intense conversation, etc.)	1	2	3	4	5	6
8. Obey posted speed limits in a school zone	1	2	3	4	5	6
9. Tap my brakes when another vehicle follows too closely	1	2	3	4	5	6
10. Obey posted speed limits	1	2	3	4	5	6
11. Use my mobile telephone while driving	1	2	3	4	5	6
12. Drive after I consume alcohol	1	2	3	4	5	6
13. Obey traffic signs	1	2	3	4	5	6

<b>How often do you engage in the following behaviors:</b>	<i>Never</i>	<i>Almost Never</i>	<i>Some- times</i>	<i>Fairly Often</i>	<i>Very Often</i>	<i>Always</i>
14. Honk when another driver does something inappropriate	1	2	3	4	5	6
15. Accelerate into an intersection when the traffic light is changing from yellow to red	1	2	3	4	5	6
16. Pay special attention when making turns	1	2	3	4	5	6
17. Yield when the right of way belongs to other drivers	1	2	3	4	5	6
18. Pull over to allow an emergency or law enforcement vehicles to pass	1	2	3	4	5	6
19. Break slowly enough to alert drivers behind me	1	2	3	4	5	6
20. Maintain a safe distance when following other vehicles	1	2	3	4	5	6
21. Follow a slower vehicle at less than a car length	1	2	3	4	5	6
22. Come to a complete stop at a stop sign	1	2	3	4	5	6
23. Use turn signals (blinkers) to notify other drivers of my intention to turn	1	2	3	4	5	6
24. Pass other vehicles using the right lane	1	2	3	4	5	6
25. Decrease speed to accommodate poor road conditions	1	2	3	4	5	6
26. Drive 15 miles per hour faster than the posted speed limit	1	2	3	4	5	6
27. Drive more cautiously to accommodate people or vehicles on the side of the road (e.g., slow down, move over)	1	2	3	4	5	6
28. Wear my seatbelt while driving	1	2	3	4	5	6

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<b>How often do you engage in the following behaviors:</b>	<i>Never</i>	<i>Almost Never</i>	<i>Some- times</i>	<i>Fairly Often</i>	<i>Very Often</i>	<i>Always</i>
29. Pay attention to traffic and my surroundings while driving	1	2	3	4	5	6
30. Speed up when another vehicle tries to overtake me	1	2	3	4	5	6
31. Follow the vehicle in front of me closely to prevent another vehicle from merging in front of me	1	2	3	4	5	6
32. Use mirrors and check blind spots when changing lanes	1	2	3	4	5	6
33. Pass in front of a vehicle at less than a car length	1	2	3	4	5	6
34. Weave in and out of lanes to overtake traffic	1	2	3	4	5	6
35. Dim high beam headlights when I approach other drivers	1	2	3	4	5	6
36. Make sure passengers, including children, are wearing seatbelts or appropriate restraints	1	2	3	4	5	6
37. Pay special attention when approaching intersections	1	2	3	4	5	6
38. Flash my high beams at slower vehicle so that it will get out of my way	1	2	3	4	5	6
39. Drive with extra care around pedestrians	1	2	3	4	5	6
40. Drive with extra care around bicyclist	1	2	3	4	5	6

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## OPINION SCALE

**Instructions:** Read each statement and decide if it is true as applied to you or false as applied to you. If a statement is true or mostly true, circle the “**T**”. If a statement is false or mostly false, circle the “**F**”. Remember to give your own opinion of yourself. Do not leave any questions unanswered if you can avoid it.

---

<b>Does the statement apply to you?</b>	<i>True</i>	<i>False</i>
1. I often wish I could be a mountain climber	T	F
2. I sometimes like to do things that are a little frightening	T	F
3. I would like to take up the sport of water skiing	T	F
4. I would like to take up surfboard riding	T	F
5. I would to learn how to fly an airplane	T	F
6. I would like to go scuba diving	T	F
7. I would like to try parachute jumping	T	F
8. I would like to dive off the high board	T	F
9. I would like to sail a long distance in a small but seaworthy sailing craft	T	F



10. I think I would enjoy the sensation of skiing very fast down a high mountain slope	T	F
11. I can't stand watching a movie I've seen before	T	F
12. I get bored seeing the same old faces	T	F
13. When you can predict almost everything a person will do and say, he or she must be a bore	T	F
14. I usually don't enjoy a movie or a play when I can predict what will happen in advance	T	F
15. Looking at someone's home movies or slides bores me tremendously	T	F
16. I prefer friends who are excitingly unpredictable	T	F
17. I get very restless if I have to stay around home for any length of time	T	F
18. The worst social sin is to be a bore	T	F
19. I like people who are sharp and witty even if they do sometimes insult others	T	F
20. I have no patience with dull or boring persons	T	F

---

## ATTITUDE QUESTIONNAIRE

**Instructions:** Using the response scale provided, indicate the degree to which you agree or disagree with each of the statements listed below. Circle the number that best represents your answer.

---

		<i>Strongly Disagree</i>	<i>Slightly Disagree</i>	<i>Neither Disagree Nor Agree</i>	<i>Slightly Agree</i>	<i>Strongly Agree</i>
1. I like competition.	1	2	3	4	5	
2. I am a competitive individual.	1	2	3	4	5	
3. I enjoy competing against an opponent.	1	2	3	4	5	
4. I don't like competing against other people.	1	2	3	4	5	
5. I get satisfaction from competing with others.	1	2	3	4	5	
6. I find competitive situations unpleasant.	1	2	3	4	5	
7. I dread competing against other people.	1	2	3	4	5	
8. I try to avoid competing with others.	1	2	3	4	5	
9. I often try to outperform others.	1	2	3	4	5	
10. I try to avoid arguments.	1	2	3	4	5	
11. I will do almost anything to avoid an argument.	1	2	3	4	5	

12. I often remain quiet rather than risk hurting another person.	1	2	3	4	5
13. I don't enjoy challenging others even when I think they are wrong.	1	2	3	4	5
14. In general, I will go along with the group rather than create conflict.	1	2	3	4	5

---

## PERSONALITY QUESTIONNAIRE

Instructions: Here are a number of characteristics that may or may not apply to you. For example, do you agree that you are someone who likes to spend time with others? Circle the number next to each statement to indicate the extent to which you agree or disagree with that statement.

<b>I am someone who...</b>	<i>Disagree Strongly</i>	<i>Disagree A Little</i>	<i>Neither Disagree Nor Agree</i>	<i>Agree A Little</i>	<i>Agree Strongly</i>
1. Is talkative	1	2	3	4	5
2. Tends to find fault with others	1	2	3	4	5
3. Does a thorough job	1	2	3	4	5
4. Is depressed, blue	1	2	3	4	5
5. Is original, comes up with new ideas	1	2	3	4	5
6. Is reserved	1	2	3	4	5
7. Is helpful and unselfish with others	1	2	3	4	5
8. Can be somewhat careless	1	2	3	4	5
9. Is relaxed, handles stress well	1	2	3	4	5

---

<b>I am someone who...</b>	<i>Neither</i>				
	<i>Disagree</i> <i>Strongly</i>	<i>Disagree</i> <i>A Little</i>	<i>Nor</i> <i>Agree</i>	<i>Agree</i> <i>A Little</i>	<i>Agree</i> <i>Strongly</i>
10. Is curious about many different things	1	2	3	4	5
11. Is full of energy	1	2	3	4	5
12. Starts quarrels with others	1	2	3	4	5
13. Is a reliable worker	1	2	3	4	5
14. Can be tense	1	2	3	4	5
15. Is ingenious, a deep thinker	1	2	3	4	5
16. Generates a lot of enthusiasm	1	2	3	4	5
17. Has a forgiving nature	1	2	3	4	5
18. Tends to be disorganized	1	2	3	4	5
19. Worries a lot	1	2	3	4	5
20. Has an active imagination	1	2	3	4	5
21. Tends to be quiet	1	2	3	4	5
22. Is generally trusting	1	2	3	4	5
23. Tends to be lazy	1	2	3	4	5

<b>I am someone who...</b>	<i>Neither</i>				
	<i>Disagree</i> <i>Strongly</i>	<i>Disagree</i> <i>A Little</i>	<i>Nor</i> <i>Agree</i>	<i>Agree</i> <i>A Little</i>	<i>Agree</i> <i>Strongly</i>
24. Is emotionally stable, not easily upset	1	2	3	4	5
25. Is inventive	1	2	3	4	5
26. Has an assertive personality	1	2	3	4	5
27. Can be cold and aloof	1	2	3	4	5
28. Perseveres until the task is finished	1	2	3	4	5
29. Can be moody	1	2	3	4	5
30. Values artistic, aesthetic experiences	1	2	3	4	5
31. Is sometimes shy, inhibited	1	2	3	4	5
32. Is considerate and kind to almost everyone	1	2	3	4	5
33. Does things efficiently	1	2	3	4	5
34. Remains calm in tense situations	1	2	3	4	5
35. Prefers work that is routine	1	2	3	4	5
36. Is outgoing, sociable	1	2	3	4	5
37. Is sometimes rude to others	1	2	3	4	5

---

<b>I am someone who...</b>	<i>Neither</i>				
	<i>Disagree</i> <i>Strongly</i>	<i>Disagree</i> <i>A Little</i>	<i>Nor</i> <i>Agree</i>	<i>Agree</i> <i>A Little</i>	<i>Agree</i> <i>Strongly</i>
38. Makes plans and follows through with them	1	2	3	4	5
39. Gets nervous easily	1	2	3	4	5
40. Likes to reflect, play with ideas	1	2	3	4	5
41. Has few artistic interests	1	2	3	4	5
42. Likes to cooperate with others	1	2	3	4	5
43. Is easily distracted	1	2	3	4	5
44. Is sophisticated in art, music, or literature	1	2	3	4	5

## COOK MEDLEY SCALE

**Instructions:** Read each statement and decide if it is true as applied to you or false as applied to you. If a statement is true or mostly true, circle the “**T**”. If a statement is false or mostly false, circle the “**F**”. Remember to give your own opinion of yourself. Do not leave any questions unanswered if you can avoid it.

---

<b>Does the statement apply to you?</b>	<i>True</i>	<i>False</i>
1. When I take a new job, I like to be tipped off on who should be gotten next to.	T	F
2. When someone does me a wrong, I feel I should pay him back if I can, just for the principle of the thing.	T	F
3. I prefer to pass by school friends, or people I know but have not seen for a long time, unless they speak to me first.	T	F
4. I have often had to take orders from someone who did not know as much as I did.	T	F
5. I think a great many people exaggerate their misfortunes in order to gain sympathy and help of others	T	F
6. It takes a lot of argument to convince most people of the truth.	T	F
7. I think most people would lie to get ahead.	T	F



- |  |   |   |
|--|---|---|
| 8. Someone has it in for me.   | T | F |
| 9. Most people are honest chiefly through fear of getting caught.  | T | F |
| 10. Most people will use somewhat unfair means to gain profit or an advantage rather than to lose it.                      | T | F |
| 11. I commonly wonder what hidden reason another person may have for doing something nice for me.                          | T | F |
| 12. It makes me impatient to have people ask my advice or otherwise interrupt me when I am working on something important. | T | F |
| 13. I feel I have often been punished without cause.   | T | F |
| 14. I am against giving money to beggars.  | T | F |
| 15. Some of my family have habits that bother and annoy me very much.  | T | F |
| 16. My relatives are nearly all in sympathy with me.   | T | F |
| 17. My way of doing things is apt to be misunderstood by others.   | T | F |
| 18. I don't blame anyone for trying to grab everything he can get in this world.   | T | F |
-

Does the statement apply to you?	<i>True</i>	<i>False</i>
19. No one cares much what happens to you.	T	F
20. I can be friendly with people who do things I consider wrong.	T	F
21. It is safer to trust nobody.	T	F
22. I do not blame a person for taking advantage of someone who lays himself open to it.	T	F
23. I have often felt that strangers were looking at me critically.	T	F
24. Most people make friends because friends are likely to be useful to them.	T	F
25. I am sure I am being talked about.	T	F
26. I am likely not to speak to people until they speak to me.	T	F
27. Most people inwardly dislike putting themselves out to help other people.	T	F
28. I tend to be on my guard with people who are somewhat more friendly than I had expected.	T	F
29. I have sometimes stayed away from another person because I feared doing or saying something I might regret afterwards.	T	F
30. People often disappoint me.	T	F
31. I like to keep people guessing what I'm going to do next.	T	F

- |  |   |   |
|--|---|---|
| 32. I frequently ask people for advice.  | T | F |
| 33. I am not easily angered.   | T | F |
| 34. I have often met people who were supposed to be experts who were no better than I.   | T | F |
| 35. I would certainly enjoy beating a crook at his own game.   | T | F |
| 36. It makes me feel like a failure when I hear of the success of someone I know well.   | T | F |
| 37. I have at times had to be rough with people who were rude or annoying.   | T | F |
| 38. People generally demand more respect for their own rights than they are willing to allow for others.                               | T | F |
| 39. There are certain people whom I dislike so much that I am inwardly pleased when they are catching it for something they have done. | T | F |
| 40. I am often inclined to go out of my way to win a point with someone who has opposed me.  | T | F |
| 41. I am quite often not in on the gossip and talk of the group I belong to.   | T | F |
| 42. The man who had the most to do with me when I was a child (such as my father, stepfather, etc.) was very strict with me.           | T | F |
| 43. I have often found people jealous of my good ideas, just because they had not thought of them first.                               | T | F |

- |   |   |   |
|---|---|---|
| 44. When a man is with a woman, he is usually thinking about things related to her sex.   | T | F |
| 45. I do not try to cover up my poor opinion or pity of a person so that he won't know how I feel.  | T | F |
| 46. I have frequently worked under people who seem to have things arranged so that they get credit for good work but are able to pass off mistakes onto those under them. | T | F |
| 47. I strongly defend my own opinions as a rule.  | T | F |
| 48. People can pretty easily change me even though I thought that my mind was already made up on a subject.   | T | F |
| 49. Sometimes I am sure that other people can tell what I am thinking.  | T | F |
| 50. A large number of people are guilty of bad sexual conduct.  | T | F |
-

## **APPENDIX B: FORMS**

## MOTION HISTORY QUESTIONNAIRE

(Perceived Susceptibility Composite per *Use of a Motion History Questionnaire to Predict Simulator Sickness*)

Developed by Robert S. Kennedy & colleagues under various projects. For additional information contact: Robert S. Kennedy, RSK Assessments, Inc., 1040 Woodcock Road, Suite 227, Orlando, FL 32803 (407) 894-5090

**Subject Number:** \_\_\_\_\_

**Date:** \_\_\_\_\_

1. How often would you say you get airsick?  
Always 3 Frequently 3 Sometimes 2 Rarely 1 Never 0
2. From your experience at sea, how often would you say you get seasick?  
Always 3 Frequently 3 Sometimes 2 Rarely 1 Never 0
3. In general, how susceptible to motion sickness are you?  
Extremely 3 Very 3 Moderately 2 Minimally 1 Not at all 0
4. If you were in an experiment where 50% of the subjects get sick, what do you think your chances of getting sick would be?  
Almost certainly would 3 Probably would 2 Almost probably would not 1 Certainly would not 0
5. Most people experience slight dizziness (not a result of motion) three to five times a year. The past year you have been dizzy:  
More than this 3 The same as 2 Less than 1 Never dizzy 0

**Score:** \_\_\_\_\_

**Appointment:** \_\_\_\_\_

### Notes:

- 1) Please remember that this is a screening tool to be used prior to bringing the participant to the laboratory (preferably, during a phone interview). Therefore, the participant will never see the questionnaire.
- 2) Scores of seven (7) or higher indicate a higher probability of experiencing motion sickness while using the simulator. Therefore, participants scoring seven or higher should be excluded from further participation.

## Simulator Sickness Questionnaire (SSQ)

Developed by Robert S. Kennedy & colleagues under various projects. For additional information contact:  
Robert S. Kennedy, RSK Assessments, Inc., 1040 Woodcock Road, Suite 227, Orlando, FL 32803 (407) 894-5090

**Subject Number:** \_\_\_\_\_ **Date:** \_\_\_\_\_

### PRE-EXPOSURE BACKGROUND INFORMATION

1. How long has it been since your last exposure in a simulator? \_\_\_\_\_ days  
How long has it been since your last flight in an aircraft? \_\_\_\_\_ days  
How long has it been since your last voyage at sea? \_\_\_\_\_ days  
How long has it been since your last exposure in a virtual environment? \_\_\_\_\_ days
2. What other experience have you had recently in a device with unusual motion?

### PRE-EXPOSURE PHYSIOLOGICAL STATUS INFORMATION

3. Are you in your usual state of fitness? (Circle one) YES NO  
If not, please indicate the reason:
4. Have you been ill in the past week? (Circle one) YES NO  
If "Yes", please indicate:
  - a) The nature of the illness (flu, cold, etc.):
  - b) Severity of the illness: Very Very  
Mild Severe
  - c) Length of illness: Hours / Days
  - d) Major symptoms:
  - e) Are you fully recovered? YES NO
5. How much alcohol have you consumed during the past 24 hours?  
\_\_\_\_\_ 12 oz. cans/bottles of beer \_\_\_\_\_ ounces wine \_\_\_\_\_ ounces hard liquor

6. Please indicate all medication you have used in the past 24 hours. If none, check the first line:
- a) NONE
  - b) Sedatives or tranquilizers
  - c) Aspirin, Tylenol, other analgesics
  - d) Anti-histamines
  - e) Decongestants
  - f) Other (specify):
7. a) How many hours of sleep did you get last night?    hours  
b) Was this amount sufficient? (Circle one)    YES    NO
8. Please list any other comments regarding your present physical state which might affect your performance on our test battery.



### Baseline (Pre) Exposure Symptom Checklist

Instructions: Please fill this out BEFORE you go into the virtual environment. Circle how much each symptom below is affecting you right now.

#	Symptom	Severity			
		None	Slight	Moderate	Severe
1.	General discomfort	None	Slight	Moderate	Severe
2.	Fatigue	None	Slight	Moderate	Severe
3.	Boredom	None	Slight	Moderate	Severe
4.	Drowsiness	None	Slight	Moderate	Severe
5.	Headache	None	Slight	Moderate	Severe
6.	Eye strain	None	Slight	Moderate	Severe
7.	Difficulty focusing	None	Slight	Moderate	Severe
8a.	Salivation increased	None	Slight	Moderate	Severe
8b.	Salivation decreased	None	Slight	Moderate	Severe
9.	Sweating	None	Slight	Moderate	Severe
10.	Nausea	None	Slight	Moderate	Severe
11.	Difficulty concentrating	None	Slight	Moderate	Severe
12.	Mental depression	None	Slight	Moderate	Severe
13.	“Fullness of the head”	None	Slight	Moderate	Severe
14.	Blurred Vision	None	Slight	Moderate	Severe
15a.	Dizziness with eyes open	None	Slight	Moderate	Severe
15b.	Dizziness with eyes closed	None	Slight	Moderate	Severe
16.	*Vertigo	None	Slight	Moderate	Severe
17.	**Visual flashbacks	None	Slight	Moderate	Severe
18.	Faintness	None	Slight	Moderate	Severe
19.	Aware of breathing	None	Slight	Moderate	Severe
20.	***Stomach awareness	None	Slight	Moderate	Severe
21.	Loss of appetite	None	Slight	Moderate	Severe
22.	Increased appetite	None	Slight	Moderate	Severe
23.	Desire to move bowels	None	Slight	Moderate	Severe
24.	Confusion	None	Slight	Moderate	Severe
25.	Burping	None	Slight	Moderate	Severe
26.	Vomiting	None	Slight	Moderate	Severe
27.	Other				

\* Vertigo is experienced as loss of orientation with respect to vertical upright.

\*\* Visual illusion of movement or false sensations of movement, when not in the simulator, car, or aircraft.

\*\*\* Stomach awareness is usually used to indicate a feeling of discomfort which is just short of nausea.

**STOP HERE! The test director will tell you when to continue.**

## POST 00 Minutes Exposure Symptom Checklist

Instructions: Circle how much each symptom below is affecting you right now.

#	Symptom	Severity			
		None	Slight	Moderate	Severe
1.	General discomfort	None	Slight	Moderate	Severe
2.	Fatigue	None	Slight	Moderate	Severe
3.	Boredom	None	Slight	Moderate	Severe
4.	Drowsiness	None	Slight	Moderate	Severe
5.	Headache	None	Slight	Moderate	Severe
6.	Eye strain	None	Slight	Moderate	Severe
7.	Difficulty focusing	None	Slight	Moderate	Severe
8a.	Salivation increased	None	Slight	Moderate	Severe
8b.	Salivation decreased	None	Slight	Moderate	Severe
9.	Sweating	None	Slight	Moderate	Severe
10.	Nausea	None	Slight	Moderate	Severe
11.	Difficulty concentrating	None	Slight	Moderate	Severe
12.	Mental depression	None	Slight	Moderate	Severe
13.	“Fullness of the head”	None	Slight	Moderate	Severe
14.	Blurred Vision	None	Slight	Moderate	Severe
15a.	Dizziness with eyes open	None	Slight	Moderate	Severe
15b.	Dizziness with eyes closed	None	Slight	Moderate	Severe
16.	*Vertigo	None	Slight	Moderate	Severe
17.	**Visual flashbacks	None	Slight	Moderate	Severe
18.	Faintness	None	Slight	Moderate	Severe
19.	Aware of breathing	None	Slight	Moderate	Severe
20.	***Stomach awareness	None	Slight	Moderate	Severe
21.	Loss of appetite	None	Slight	Moderate	Severe
22.	Increased appetite	None	Slight	Moderate	Severe
23.	Desire to move bowels	None	Slight	Moderate	Severe
24.	Confusion	None	Slight	Moderate	Severe
25.	Burping	None	Slight	Moderate	Severe
26.	Vomiting	None	Slight	Moderate	Severe
27.	Other				

\* Vertigo is experienced as loss of orientation with respect to vertical upright.

\*\* Visual illusion of movement or false sensations of movement, when not in the simulator, car or aircraft.

\*\*\* Stomach awareness is usually used to indicate a feeling of discomfort which is just short of nausea.

### POST-EXPOSURE INFORMATION

1. While in the virtual environment, did you get the feeling of motion (i.e., did you experience a compelling sensation of self motion as though you were actually moving)? (*Circle one*)

YES                      NO                      SOMEWHAT

2. On a scale of 1 (POOR) to 10 (EXCELLENT) rate your performance in the virtual environment:

3. a. Did any unusual events occur during your exposure? (*Circle one*)    YES    NO  
b. If YES, please describe

## Psychology Research Experience Evaluation Form for Participants

Please complete this form to evaluate your experience as a participant in the **Personality Factors and Driving Behavior** Study conducted by José Vázquez (Researcher).

Today's Date: \_\_\_\_\_

This is important to our educational efforts and the feedback you provide will aid in the evaluation and possible modification of the research participation experience.

Your answers will be kept anonymous. When you have completed this form, please email it back to me.

For each question, please circle the statement that best indicates your response.

Do you clearly understand the purpose of this study?

The researcher did not explain the purpose. I did not receive a written or oral explanation of the study.	The researcher explained the purpose or gave me a written explanation of the study, but did not give me a way to ask further	The researcher explained the purpose, gave me a chance to ask questions, and answered the questions I had.	The researcher explained the purpose, gave me a chance to ask questions, and answered the questions I had, and made sure I
---	--	--	--

	questions.		understood the purpose and implications of the study.
--	------------	--	---

Were you treated with courtesy and respect?

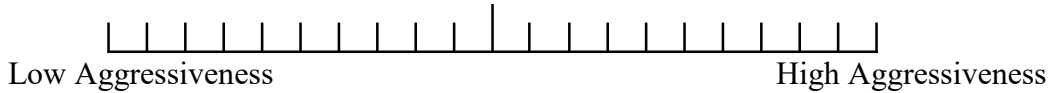
The researcher <b>did not</b> treat me with courtesy and respect.	The researcher treated me with <b>some</b> courtesy and respect.	The researcher treated me with an <b>acceptable level</b> of courtesy and respect.	The researcher treated me with a <b>great deal</b> of courtesy and respect.
---	--	--	---

Additional comments (please add another page if necessary):

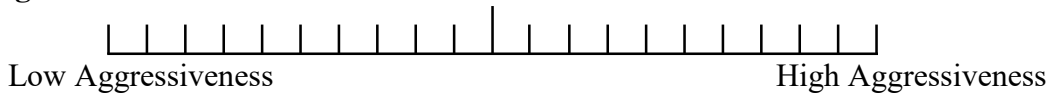
## Driving Behavior Rating Sheet

Please evaluate the level of aggressiveness for each of the following activities by putting an “X” on each of the six scales at the point which matches your estimation. Please consider your responses carefully and consider each scale individually.

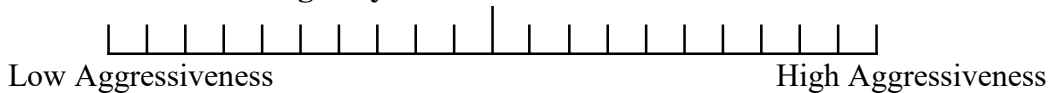
### Tailgating



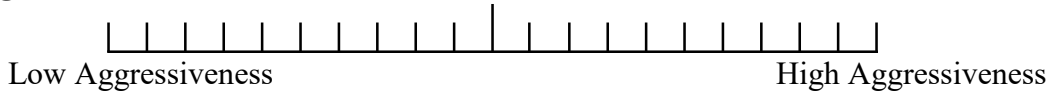
### Honking



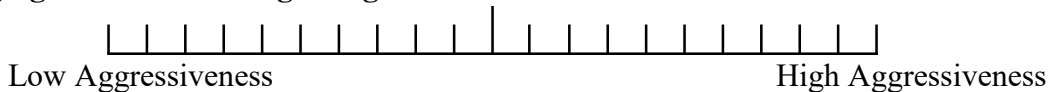
### Failure to slow down on a highway construction zone



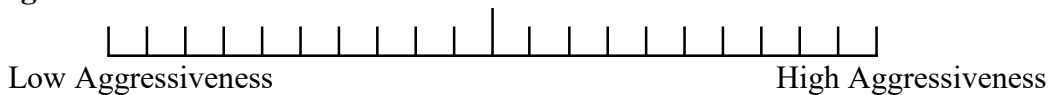
### Passing other vehicles on the shoulder



### Changing Lanes without signaling



### Speeding



## **APPENDIX C: SCRIPTS**

## **Personality Factors and Driving Behavior**

### **Debriefing**

Driving plays an important role in our society. For most of us, driving represents freedom, control, and independence. We drive to the places we want or need to go, and for many of us driving is either part of our job, or the means to get to and from work. Unfortunately, the time we spend driving has become a stressful part of our daily routine as we become increasingly concerned about the behavior of other drivers. Indeed, 78% of respondents in the AAA Foundation's 2008 Traffic Safety Culture Index rated aggressive drivers as a serious or extremely serious traffic safety problem (AAA Foundation for Traffic Safety, 2008). The cost of this safety problem in terms of loss of life and damage to property is indicative of this level of concern: 56% of fatal crashes from 2003 through 2007 involved one or more driver actions typically associated with aggressive driving (AAA Foundation for Traffic Safety, 2009). The outlook for next two decades in terms of the human cost associated this driving behavior in our graying society is rather grim, and, thus, any attempt try to gain a better understanding of it is worth the effort.

The purpose of this study is to examine the effects of personality, age, and time pressure on driving behavior. The general strategy to achieve this goal is one that attempts to remedy three major limitations found in some of the literature on the subject of driving behavior, namely, the reliance on self-reports, the use of college students in most samples, and the almost exclusive use of retrospective correlational designs. On this latter point, it is important to note the advantage of using a prospective design in which personality factors are assessed first (using self-report measures that were obtained in a previous study), and then observing driving



behaviors on a driving simulator. Additionally, the present research will include undergraduate students of a major metropolitan university in the southeastern part of the country, as well as middle aged and elderly individuals from adjacent communities. Finally, the present research combines several variables related to driving behavior, again a strategy that has been followed by very few researchers.

Finally, I would ask you to please refrain from discussing your experience with other potential participants as this might affect their behavior, if they decide to participate in the study. Do you have any questions about driving behavior and/or either phase of the study (i.e., survey or simulator)? Thanks again for your participation!

## Script for Simulator Study

### Procedure

1. Meet the participant at pre-determined location and introduce yourself. Make sure to thank him/her for participating in the follow up study.
2. Have the participant sit at the table in Room 305 and tell him/her:

***“Before we go to the Simulator Room there are two forms and a quick test you will need to complete. First there is the Informed Consent form. If you could take a moment please to read it over, and sign it agreeing to in the study.”***

2. Administer the Informed Consent
3. Upon completion of the IC, ask the following questions:

***“Do you currently drive?”***

***“In an average week, how many days to you drive? \_\_\_\_\_ days per week.”***

***“We now need to do a brief vision test.”***

4. Administer the test

***“Before we go to Simulator Room, I need you to complete another questionnaire, this one is called the Simulator Sickness Questionnaire.”***

5. Examine the responses to the SSQ and establish a baseline
6. Go to the Driving Simulator Room and have the participant sit on the driver’s seat. Allow him/her to adjust the seat and the steering wheel. When the participant is comfortably seated, give the following instructions:

***“First, there will be a practice session to get you accustomed to operating the driving simulator. This will be followed by two timed trial sessions. Simply follow the instructions (visual or verbal) once the simulation begins, and drive as you normally would until you are instructed otherwise. If you start to feel uncomfortable at any point, just stop and I will come to get you. Do you have any questions?”***

7. Load Scenario **TTsen27freeway**, turn off collisions feature, and start the practice run. Allow participant to practice until he/she feels comfortable with the simulator.
8. Upon completion of practice session, tell the participant:

***“I need you to complete the SSQ again before we can proceed.”***

9. Administer the SSQ, examine it and either stop experiment or continue. If the decision is to continue, tell the participant:

***“This next portion will be the timed trials. The participant with the fastest time will win a \$50 Best Buy gift certificate, so try to finish the course as quickly as possible. Also try to do so with as few accidents as possible. If you start to feel uncomfortable at any point, just stop and I will come to get you. Do you have any questions?”***

10. Start recording, load up Scenario **ICEAT105**, and start Session 1.
11. Upon completion of Session 1, administer SSQ, and **save the recording of the session**. Briefly examine the SSQ, and decide whether to continue or stop. If the decision is to continue, ask participant if he/she wants to take a break (if needed you can take the participant to the lounge and provide some ginger ale).
12. Start Session 2 by giving the following instructions:

***“This timed trial will be like the previous one. Remember if you start to feel uncomfortable at any point, just stop and I will come to get you. Do you have any questions?”***

13. Load up Scenario **ICEAT106**, and run it.
14. Upon completion of Session 2, administer SSQ, and **save the recording of the session**. Give the participant the following instructions:

***“We will now go back to Room 305 where I am going to ask you to complete one final form, and wait a few minutes before going home.”***

15. Bring the participant back to Room 305. Briefly examine the SSQ, and compare to baseline. Administer debriefing and evaluation form, and have participant wait until his/her SSQ score matches baseline value before dismissal.

**Remember to thank him/her for participating in the study as he/she is dismissed.**

## **APPENDIX D: IRB DOCUMENTATION**



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## Approval of Human Research

From: **UCF Institutional Review Board #1  
FWA00000351, IRB00001138**

To: **Jose Vazquez Perez**

Date: **January 06, 2010**

Dear Researcher:

On 1/6/2010, the IRB approved the following modifications/human participant research until 12/8/2010 inclusive:

Type of Review: Submission Response for UCF Initial Review Submission Form  
Project Title: Personality factors and driving behavior  
Investigator: Jose Vazquez Perez  
IRB Number: SBE-09-06479  
Funding Agency:  
Grant Title:  
Research ID: N/A

The Continuing Review Progress Report must be submitted by November 1, 2010, which is 8 weeks prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at <https://iris.research.ucf.edu>.

If continuing review approval is not granted before the expiration date of 12/8/2010, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

The IRB determined that participants' medical records *<must be flagged to indicate participation in the study and provide the source of more information on the study/are not to be flagged>*.

On behalf of Joseph Bielitzki, DVM, UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 01/06/2010 10:09:21 AM EST



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## Approval of Human Research

From: **UCF Institutional Review Board #1  
FWA00000351, IRB00001138**

To: **Jose Vazquez Perez**

Date: **November 19, 2010**

Dear Researcher:

On 11/17/2010, the IRB approved the following human participant research until 11/16/2011 inclusive:

Type of Review: IRB Continuing Review Application Form  
Project Title: Personality factors and driving behavior  
Investigator: Jose Vazquez Perez  
IRB Number: SBE-09-06479  
Funding Agency:  
Grant Title:  
Research ID: N/A

The Continuing Review Application must be submitted 30 days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at <https://iris.research.ucf.edu>.

If continuing review approval is not granted before the expiration date of 11/16/2010, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Joseph Bielitzki, DVM, UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 11/19/2010 09:20:43 AM EST



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## Approval of Human Research

From: **UCF Institutional Review Board #1  
FWA00000351, IRB00001138**

To: **Jose Vazquez Perez**

Date: **November 02, 2011**

Dear Researcher:

On 10/26/2011, the IRB approved the following human participant research until 10/25/2012 inclusive:

Type of Review: IRB Continuing Review Application Form  
Project Title: Personality factors and driving behavior  
Investigator: Jose Vazquez Perez  
IRB Number: SBE-09-06479  
Funding Agency:  
Grant Title:  
Research ID: N/A

At the time of Continuing Review, the full board determined that your study meets Expedited, Category #7, and in the future can be reviewed as an Expedited study. The Continuing Review Application must be submitted 30 days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at <https://iris.research.ucf.edu>.

If continuing review approval is not granted before the expiration date of 10/25/2012, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., CF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 11/02/2011 12:39:59 PM EST



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## Approval of Human Research

From: **UCF Institutional Review Board #1  
FWA00000351, IRB00001138**

To: **Jose Vazquez Perez**

Date: **October 16, 2012**

Dear Researcher:

On 10/16/2012, the IRB approved the following human participant research until 10/15/2013 inclusive:

Type of Review: IRB Continuing Review Application Form  
Project Title: Personality factors and driving behavior  
Investigator: Jose Vazquez Perez  
IRB Number: SBE-09-06479  
Funding Agency:  
Grant Title:  
Research ID: N/A

The Continuing Review Application must be submitted 30 days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at <https://iris.research.ucf.edu>.

If continuing review approval is not granted before the expiration date of 10/15/2013, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Sophia Dziegielewska, Ph.D., L.C.S.W., UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 10/16/2012 09:22:21 AM EDT

A handwritten signature in black ink that reads 'Joanne Muratori'.





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### Acknowledgment of Study Closure

From : **UCF Institutional Review Board #1**  
**FWA00000351, IRB00001138**

To : **Jose Vazquez Perez**

Date : **September 30, 2013**

Dear Researcher:

On 9/30/2013 the IRB conducted an administrative review of the FORM: Study Closure Request that you submitted in iRIS. The study has been closed within the system.

This report is in regards to:

Type of Review: Study Closure  
 Project Title: Personality factors and driving behavior  
 Investigator: Jose Vazquez Perez  
 IRB Number: SBE-09-06479  
 Funding Agency:  
 Grant Title:  
 Research ID: N/A

As part of this action:

The research is permanently closed to enrollment.  
 All participants have completed all research-related interventions. Collection of private identifiable information is completed. Analysis of private identifiable information is completed.

Thank you for notifying the IRB of this modification.

On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., UCF IRB Chair, this letter is

signed by: Signature applied by Joanne Muratori on 09/30/2013 05:03:51 PM

EDT

Submission Reference Number: 018736



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## Approval of Human Research

From: **UCF Institutional Review Board #1  
FWA00000351, IRB00001138**

To: **Jose Vazquez Perez**

Date: **February 23, 2010**

Dear Researcher:

On 2/23/2010, the IRB approved the following modification to human participant research until 12/08/2010 inclusive:

Type of Review: Submission Response for IRB Addendum and Modification Request Form

Modification Type: In the Informed Consent, the purpose statement is revised from "aggressive driving" to "driving behavior."

Project Title: Personality factors and driving behavior

Investigator: Jose Vazquez Perez

IRB Number: SBE-09-06479

Funding Agency:

Grant Title:

Research ID: N/A

The Continuing Review Application must be submitted 30 days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at <https://iris.research.ucf.edu>.

If continuing review approval is not granted before the expiration date of 12/08/2010, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Joseph Bielitzki, DVM, UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 02/23/2010 09:02:24 AM EST

A handwritten signature in black ink that reads "Joanne Muratori". The signature is written in a cursive style with a large, looping initial "J" and a distinct "M".



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## Approval of Human Research

From: **UCF Institutional Review Board #1  
FWA00000351, IRB00001138**

To: **Jose Vazquez Perez**

Date: **September 23, 2010**

Dear Researcher:

On 9/23/2010, the IRB approved the following human participant research until 9/22/2011 inclusive:

Type of Review: UCF Initial Review Submission Form  
Project Title: Personality factors and driving behavior (Simulator Study)  
Investigator: Jose Vazquez Perez  
IRB Number: SBE-10-07107  
Funding Agency:  
Grant Title:  
Research ID: N/A

The Continuing Review Application must be submitted 30 days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at <https://iris.research.ucf.edu>.

If continuing review approval is not granted before the expiration date of 9/22/2011, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Joseph Bielitzki, DVM, UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 09/23/2010 02:33:39 PM EDT



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## Approval of Human Research

From: **UCF Institutional Review Board #1  
FWA00000351, IRB00001138**

To: **Jose Vazquez Perez**

Date: **July 28, 2011**

Dear Researcher:

On 7/28/2011, the IRB approved the following human participant research until 7/27/2012 inclusive:

Type of Review: IRB Continuing Review Application Form  
Project Title: Personality factors and driving behavior (Simulator Study)  
Investigator: Jose Vazquez Perez  
IRB Number: SBE-10-07107  
Funding Agency:  
Grant Title:  
Research ID: N/A

The Continuing Review Application must be submitted 30 days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at <https://iris.research.ucf.edu>.

If continuing review approval is not granted before the expiration date of 7/27/2012, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Kendra Dimond Campbell, MA, JD, UCF IRB Interim Chair, this letter is signed by:

Signature applied by Joanne Muratori on 07/28/2011 01:33:48 PM EDT



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## Approval of Human Research

From: **UCF Institutional Review Board #1  
FWA00000351, IRB00001138**

To: **Jose Vazquez Perez**

Date: **June 27, 2012**

Dear Researcher:

On 6/27/2012, the IRB approved the following human participant research until 6/26/2013 inclusive:

Type of Review: IRB Continuing Review Application Form  
Project Title: Personality factors and driving behavior (Simulator Study)  
Investigator: Jose Vazquez Perez  
IRB Number: SBE-10-07107  
Funding Agency:  
Grant Title:  
Research ID: SBE-10-07107

The Continuing Review Application must be submitted 30 days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at <https://iris.research.ucf.edu>.

If continuing review approval is not granted before the expiration date of 6/26/2013, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 06/27/2012 09:25:12 AM EDT



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## Approval of Human Research

From: **UCF Institutional Review Board #1  
FWA00000351, IRB00001138**

To: **Jose Vazquez Perez**

Date: **July 03, 2013**

Dear Researcher:

On 7/3/2013, the IRB approved the following human participant research until 07/02/2014 inclusive:

Type of Review: IRB Continuing Review Application Form  
Project Title: Personality factors and driving behavior (Simulator Study)  
Investigator: Jose Vazquez Perez  
IRB Number: SBE-10-07107  
Funding Agency:  
Grant Title:  
Research ID: SBE-10-07107

The scientific merit of the research was considered during the IRB review. The Continuing Review Application must be submitted 30 days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at <https://iris.research.ucf.edu>.

If continuing review approval is not granted before the expiration date of 07/02/2014, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Sophia Dziegielewska, Ph.D., L.C.S.W., UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 07/03/2013 04:20:16 PM EDT



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## Approval of Human Research

From: **UCF Institutional Review Board #1  
FWA00000351, IRB00001138**

To: **Jose Vazquez Perez**

Date: **June 27, 2011**

Dear Researcher:

On 6/27/2011, the IRB approved the following minor modification to human participant research until 09/22/2011 inclusive:

Type of Review: IRB Addendum and Modification Request Form  
Modification Type: Mr. Drea Fekety added to the study as a research assistant  
Project Title: Personality factors and driving behavior (Simulator Study)  
Investigator: Jose Vazquez Perez  
IRB Number: SBE-10-07107  
Funding Agency:  
Grant Title:  
Research ID: N/A

The Continuing Review Application must be submitted 30 days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at <https://iris.research.ucf.edu>.

If continuing review approval is not granted before the expiration date of 09/22/2011, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Kendra Dimond Campbell, MA, JD, UCF IRB Interim Chair, this letter is signed by:

Signature applied by Joanne Muratori on 06/27/2011 11:53:47 AM EDT





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## Approval of Human Research

From: **UCF Institutional Review Board #1  
FWA00000351, IRB00001138**

To: **Jose Vazquez Perez**

Date: **November 19, 2010**

Dear Researcher:

On 11/19/2010, the IRB approved the following minor modification to human participant research until 09/22/2011 inclusive:

Type of Review: IRB Addendum and Modification Request Form  
Modification Type: Edward Gray added to study as a research associate  
Project Title: Personality factors and driving behavior (Simulator Study)  
Investigator: Jose Vazquez Perez  
IRB Number: SBE-10-07107  
Funding Agency:  
Grant Title:  
Research ID: N/A

The Continuing Review Application must be submitted 30days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at <https://iris.research.ucf.edu>.

If continuing review approval is not granted before the expiration date of 9/22/2011, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Joseph Bielitzki, DVM, UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 11/19/2010 12:10:00 PM EST

A handwritten signature in black ink that reads "Joanne Muratori". The signature is written in a cursive style with a large initial "J" and a distinct "M".



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## Approval of Human Research

From: **UCF Institutional Review Board #1  
FWA00000351, IRB00001138**

To: **Jose Vazquez Perez**

Date: **August 05, 2011**

Dear Researcher:

On 8/5/2011, the IRB approved the following minor modification to human participant research until 07/27/2012 inclusive:

Type of Review: IRB Addendum and Modification Request Form  
Modification Type: Revised Informed Consent form approved for use – participants will be videotaped from behind while taking part in research activities, not audiotaped.

Project Title: Personality factors and driving behavior (Simulator Study)  
Investigator: Jose Vazquez Perez  
IRB Number: SBE-10-07107  
Funding Agency:  
Grant Title:  
Research ID: N/A

The Continuing Review Application must be submitted 30 days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at <https://iris.research.ucf.edu>.

If continuing review approval is not granted before the expiration date of 07/27/2012, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Kendra Dimond Campbell, MA, JD, UCF IRB Interim Chair, this letter is signed by:

Signature applied by Joanne Muratori on 08/05/2011 02:56:19 PM EDT



University of Central Florida Institutional Review Board  
Office of Research & Commercialization  
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## Approval of Human Research

From: **UCF Institutional Review Board #1  
FWA00000351, IRB00001138**

To: **Jose Vazquez Perez**

Date: **December 06, 2011**

Dear Researcher:

On December 6, 2011, the IRB approved the following modifications until 07/27/2012 inclusive:

Type of Review: IRB Addendum and Modification Request Form  
Modification Type: Addition of Samantha Staab as a research assistant  
Project Title: Personality factors and driving behavior (Simulator Study)  
Investigator: Jose Vazquez Perez  
IRB Number: SBE-10-07107  
Funding Agency: None

The Continuing Review Application must be submitted 30 days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at <https://iris.research.ucf.edu>.

If continuing review approval is not granted before the expiration date of 07/27/2012, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Sophia Dziegielewska, Ph.D., L.C.S.W., CF IRB Chair, this letter is signed by:

A handwritten signature in black ink that reads 'Jamie M. Turchin'.

IRB Coordinator



University of Central Florida Institutional  
 Review Board  
 Office of Research & Commercialization  
 12201 Research Parkway, Suite 501  
 Orlando, Florida 32826-3246  
 Telephone: 407-823-2901, 407-882-2012 or  
 407-882-2276  
[www.research.ucf.edu/compliance/irb.html](http://www.research.ucf.edu/compliance/irb.html)

### Acknowledgment of Study Closure

**From : UCF Institutional Review Board #1  
 FWA00000351, IRB00001138**

**To : Jose Vazquez Perez**

**Date : October 10, 2013**

Dear Researcher:

On 10/10/2013 the IRB conducted an administrative review of the FORM: Study Closure Request that you submitted in iRIS. The study has been closed within the system.

This report is in regards to:

Type of Review:	Study Closure
Project Title:	Personality factors and driving behavior (Simulator Study)
Investigator:	Jose Vazquez Perez
IRB Number:	SBE-10-07107
Funding Agency:	
Grant Title:	
Research ID:	SBE-10-07107

As part of this action:

The research is permanently closed to enrollment. All participants have completed all research-related interventions. Collection of private identifiable information is completed. Analysis of private identifiable information is completed.

Thank you for notifying the IRB of this modification.

On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., UCF IRB Chair, this letter is

signed by: Signature applied by Joanne Muratori on 10/10/2013 12:04:55 PM EDT

Submission Reference Number: 018829

## REFERENCES

AAA Foundation for Traffic Safety (2008). *2008 Traffic Safety Culture Index*. Washington, DC;

AAA Foundation for Traffic Safety:

<http://www.aaafoundation.org/pdf/2008TSCIndexFinalReport.pdf>

AAA Foundation for Traffic Safety (2009). *Aggressive Driving: Research Update*. Washington, DC; AAASFoundation.org:

<http://www.aaafoundation.org/pdf/AggressiveDrivingResearchUpdate2009.pdf>

Arnett, J. (1994). Sensation seeking: a new conceptualization and a new scale. *Personality and Individual Differences, 16*, 289–296.

Ball, K., Owsley, C., Stalvey, B., Roenker, D. L., & Graves, M. (1998). Driving avoidance, functional impairment, and crash risk in older drivers. *Accident Analysis and Prevention, 30*, 313-322.

Bem, S.L. (1974). The measurement of psychological androgyny. *Journal of Consulting and Clinical Psychology, 42*, 155-162.

Benet-Martinez, V. & John, O. (1998). Los Cinco Grandes across cultures and ethnic groups: Multitrait-multimethod analyses of the Big Five in Spanish and English. *Journal of Personality and Social Psychology, 75*, 729-750.

Berry, J.W. & Worthington, E. (2001). Forgiveness, relationship quality, stress while imagining relationship events, and physical and mental health. *Journal of Counseling Psychology, 48*, 447-455.

Broughton, J. (2007). The correlation between motoring and other types of offence. *Accident Analysis and Prevention, 39*, 274-283.

- Buss, A., & Perry, M. (1992). The aggression questionnaire. *Journal of Personality and Social Psychology, 63* (3), 452-459.
- Cook, W., & Medley, D. (1954). Proposed hostility and pharisaic-virtue scales for the MMPI. *Journal of Applied Psychology, 238*, 414-418.
- Dahlen, E.R., Martin, R.C., Ragan, K., & Kuhlman, M.M. (2005). Driving anger, sensation seeking, impulsiveness, and boredom proneness in the prediction of unsafe driving. *Accident Analysis and Prevention, 37*, 341-348.
- Dahlen, E.R., & White, R.P. (2006). The Big Five factors, sensation seeking, and driving anger in the prediction of unsafe driving. *Personality and Individual Differences, 41*, 903-915.
- Dahlen, E. R., Edwards, B. D., Tubré, T., Zyphur, M. J., & Warren, C. R. (2012). Taking a look behind the wheel: An investigation into the personality predictors of aggressive driving. *Accident Analysis and Prevention, 45*, 1-9.
- Deffenbacher, J., Doob, L., Miller, N., Mowrer, O., & Sears, R. (1994). Development of a driving anger scale. *Psychological Reports, 74*, 83-91.
- Deffenbacher, J. L., Huff, M. E., Lynch, R. S., Oetting, E. R., & Salvatore, N. F. (2000). Characteristics and treatment of high-anger drivers. *Journal of Counseling Psychology, 47*, 5-17.
- Deffenbacher, J.L., Lynch, R.S., Oetting, E.R., & Swaim, R.C. (2002). The driving anger expression inventory: a measure of how people express their anger on the road. *Behavior Research and Therapy, 40*, 717-737.

- Derryberry, D. & Rothbart, M. K. (1984). Emotion, attention and temperament. In: Izard, C. E., Kagan, J., & Zajonc, R. B. (Editors) *Emotions, Cognition, and Behavior*, Cambridge University Press, New York, 132-166.
- Derryberry, D. & Rothbart, M. K. (1988). Arousal, affect, and attention as components of temperament. *Journal of Personality and Social Psychology*, *55*, 958-966.
- Ellison-Porter, P., Bell, P., & Deffenbacher, J. (2001). The effects of trait anger, anonymity, and aggressive stimuli on aggressive driving behavior. *Journal of Applied Social Psychology*, *31* (2), 431-443.
- Evans, D. E. & Rothbart, M. K. (2007). Developing a model for adult temperament. *Journal of Research in Personality*, *41*, 868-888.
- Eysenck, H.J., & Eysenck, S.B.G. (1991). *Manual of the Eysenck Personality Scales (EPS Adult)*. Hodder and Stoughton, London.
- Eysenck, S., Pearson, P., Easting, G., & Allsopp, J. (1985). Age norms for impulsiveness, venturesomeness and empathy in adults. *Personality and Individual Differences*, *6*, 613-619.
- Farmer, R., & Sundberg, N. D. (1986). Boredom proneness—The development and correlates of a new scale. *Journal of Personality Assessment*, *50*, 4-17.
- Goldberg, L. R. (1999). A broad-bandwidth, public domain, personality inventory measuring the lower-level facets of several five-factor models. In I. Mervielde, I. Deary, F. De Fruyt, & F. Ostendorf (Eds.), *Personality psychology in Europe* (pp. 7–28). Tilburg, The Netherlands: Tilburg University Press.



- Harris, P.B., & Houston, J.M. (2010). Recklessness in context: Individual and situational correlates to aggressive driving. *Environment and Behavior*, 42 (1), 44-60.
- Harris, P. B., Houston, J. M., Skelton, & A. D., Sachau, D. (2009). Driving Behavior Scale. In *Both sides of the road: Developing a measure of positive and negative driving practices*. Environmental Design Research Association, Kansas City, MO.
- Harris, P. B., Houston, J. M., Vazquez, J. A., Smither, J. A., Sachau, D. A., & Harms, A. (submitted for publication). The Prosocial and Aggressive Driving Inventory (PADI): A self-report measure of safe and unsafe driving behaviors.
- Houston, J. M., Harris, P. B., McIntire, S., & Dientje, F. (2002). Revising the competitiveness index using factor analysis. *Psychological Reports*, 90, 31-34.
- Houston, J.M., Harris, P.B., & Norman, M. (2003). The Aggressive Driving Behavior Scale: Developing a self-report measure of unsafe driving practices. *North American Journal of Psychology*, 5, 269-278.
- Hennessy, D.A., & Wiesenthal, D.L. (1997). The relationship between traffic congestion, driver stress, and direct versus indirect coping behaviors. *Ergonomics*, 40, 348-361.
- Hennessy, D.A., & Wiesenthal, D.L. (1999). Traffic congestion, driver stress, and driver aggression. *Aggressive Behavior*, 25, 409-423.
- Hennessy, D.A., & Wiesenthal, D.L. (2005). Driving vengeance and willful violations: Clustering of problem driving attitudes. *Journal of Applied Social Psychology*, 35 (1), 61-79.
- Houston, J. M., Harris, P. B., & Norman, M. (2003). The Aggressive Driving Behavior Scale: Developing a self-report measure of unsafe driving practices. *North American Journal of*

- Psychology*, 5, 269-278.
- Houston, J. M., Harris, P. B., McIntire, S., & Dientje, F. (2002). Revising the competitiveness index using factor analysis. *Psychological Reports*, 90, 31-34.
- Jackson, D.N. (1974). *Personality Research Form—Form E*. Goshen, NY: Research Psychologists Press.
- John, O. P., & Srivastava, S. (1999). The Big Five trait taxonomy: History, measurement, and theoretical perspectives. In L. A. Pervin & O. P. John (Eds.), *Handbook of personality theory and research* (pp. 102-138). New York: Guilford Press.
- Jonah, B. A. (1997). Sensation seeking and risky driving: A review and synthesis of the literature. *Accident Analysis and Prevention*, 29, 651-665.
- Kennedy, R. S., Lane, N. E., Berbaum, K. S., Lilienthal, M. G. (1993). Simulator sickness questionnaire: An enhanced method for quantifying simulator sickness. *International Journal of Aviation Psychology*, 3, 203-220.
- Kennedy, R. S., Lane, N. E., & Grizzard, M. C. (2001). Use of a Motion History Questionnaire to predict simulator sickness. *Proceedings of the Sixth Driving Simulation Conference*, 79-89.
- Krahé, B. (2005). Predictors of women's aggressive driving behavior. *Aggressive Behavior*, 31, 537-546.
- Krahé, B., & Fenske, I. (2002). Predicting aggressive driving behavior: The role of macho personality, age, and power of car. *Aggressive Behavior*, 28, 21-29.

- Lajunen, T., & Parker, D. (2001). Are aggressive people aggressive drivers? A study of the relationship between self-reported general aggressiveness, driver anger and aggressive driving. *Accident Analysis and Prevention*, *33*, 243-255.
- Miles, D. E., & Johnson, G. L. (2003). Aggressive driving behaviors: Are there psychological and attitudinal predictors? *Transportation Research Part F*, *6*, 147-161.
- Moore, M. & Dahlen, E.R. (2008). Forgiveness and consideration of future consequences in aggressive driving. *Accident Analysis and Prevention*, *40*, 1661-1666.
- Mosher, D.L., & Sirkin, M. (1984). Measuring a macho personality constellation. *Journal of Research in Personality*, *18*, 150–163.
- Parker, D., Reason, J. T., Manstead, A.S.R., & Stradling, S. G. (1995). Driving errors, driving violations and accident involvement. *Ergonomics*, *38*, 1036-1048.
- Patton, J.H., Standford, M.S., & Barratt, E.S., 1995. Factor structure of the Barratt impulsiveness scale. *Journal of Clinical Psychology*, *51*, 768–774.
- Raskin, R., & Terry, H. (1988). A principal-components analysis of the Narcissistic Personality Inventory and further evidence of its construct validity. *Journal of Personality and Social Psychology*, *54*, 890-902.
- Renner, W., and Anderle, Franz-Georg (2000). Venturesomeness and extraversion as correlates of juvenile drivers' traffic violations. *Accident Analysis and Prevention*, *32*, 673–678.
- Rosengberg, M. (1965). *Society and the adolescent self-image*. Princeton, NJ: Princeton University Press.
- Scheer, G.E. (2002). Narcissism and aggression: Is inflated self-esteem related to aggressive driving? *North American Journal of Psychology*, *4* (3), 333-342.

- Schwebel, D.C. , Severson, J., Ball, K.K., & Rizzo, M. (2006). Individual difference factors in risky driving: The roles of anger/hostility, conscientiousness, and sensation-seeking. *Accident Analysis and Prevention*, 38, 801-810.
- Schwebel, D.C., Ball, K.K., Severson, J., Barton, B.K., Rizzo, M., & Viamonte, S.M. (2007). Individual difference factors in risky driving among older adults. *Journal of Safety Research*, 38, 501-509.
- Shrout, P. E, & Fleiss, J. L. (1979). Intraclass Correlations: Uses in assessing rater reliability. *Psychological Bulletin*, 86 (2), 420-428.
- Strathman, A., Gleicher, F., Boninger, D., & Edwards, C.S. (1994). The consideration of future consequences: weighing immediate and distant outcomes of behavior. *Journal of Personality and Social Psychology*, 66, 742-752.
- Terracciano, A., McCrae, R. R., Brant, L. J., & Costa, P. T. (2005). Hierarchical linear modeling analyses of the NEO-PI-R Scales in the Baltimore Longitudinal Study of Aging. *Psychology and Aging*, 20 (3), 493-506.
- Tillmann, W.A., & Hobbs, G.E. (1949). The accident-prone automobile driver. *The American Journal of Psychiatry*, 106, 321-331.
- Vanlaar, W., Simpson, H., Mayhew, D., & Robertson, R. (2008). Aggressive driving : A survey of attitudes, opinions and behaviors. *Journal of Safety Research*, 39, 375-381.
- Wickens, C. M., Mann, R. E., Stoduto, G., Ialomiteanu, A, & Smart, R. G. (2011). Age group differences in self-reported aggressive driving perpetration and victimization. *Transportation Research*, 14, 400-412.

Zuckerman, M. (1994). Behavioral Expressions and Biosocial Bases of Sensation Seeking.

Cambridge; New York: University of Cambridge Press.

Zuckerman, M., Eysenck, S. B., & Eysenck, H. J. (1978). Sensation seeking in England and

America: Cross-cultural, age, and sex comparisons. *Journal of Consulting and Clinical Psychology, 46*, 139-149