INFORMATION TO USERS

This manuscript has been reproduced from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps.

Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.

ProQuest Information and Learning
300 North Zeeb Road, Ann Arbor, MI 48106-1346 USA
800-521-0600

UMI[®]

**Hostile Attributional Biases, Driving Anger, and Roadway Aggression among
University Students: Application of a Model of Affective Aggression**

By

Daniel Antonowicz

**A thesis submitted to
the Faculty of Graduate Studies and Research
at Carleton University in partial fulfillment of the requirements
for the degree of
Doctor in Philosophy.
Department of Psychology**

Carleton University

Ottawa, Ontario

August, 2001

Copyright 2001 Daniel Antonowicz

**National Library
of Canada**

**Acquisitions and
Bibliographic Services**

**395 Wellington Street
Ottawa ON K1A 0N4
Canada**

**Bibliothèque nationale
du Canada**

**Acquisitions et
services bibliographiques**

**395, rue Wellington
Ottawa ON K1A 0N4
Canada**

Your file Votre référence

Our file Notre référence

The author has granted a non-exclusive licence allowing the National Library of Canada to reproduce, loan, distribute or sell copies of this thesis in microform, paper or electronic formats.

The author retains ownership of the copyright in this thesis. Neither the thesis nor substantial extracts from it may be printed or otherwise reproduced without the author's permission.

L'auteur a accordé une licence non exclusive permettant à la Bibliothèque nationale du Canada de reproduire, prêter, distribuer ou vendre des copies de cette thèse sous la forme de microfiche/film, de reproduction sur papier ou sur format électronique.

L'auteur conserve la propriété du droit d'auteur qui protège cette thèse. Ni la thèse ni des extraits substantiels de celle-ci ne doivent être imprimés ou autrement reproduits sans son autorisation.

0-612-67010-4

Canada

The undersigned recommend to the
Faculty of Graduate Studies and Research
Acceptance of the thesis:

"Hostile Attributional Biases, Driving Anger, and Roadway Aggression among
University Students: Application of a Model of Affective Aggression"

submitted by

Daniel Antonowicz

in Partial fulfillment of the requirements for
the degree of Doctor of Philosophy

Chair
External Examiner
Thesis Supervisor

Carleton University
August, 2001

Abstract

Despite the fact that media accounts of roadway aggression have proliferated in recent years (Ferguson, 1998), little scholarly attention has been devoted to driving anger and roadway aggression and the role that hostile attributional biases play in their development. The present study sought to address this gap by employing a modified version of Geen's (1990) general model of affective aggression to examine driving anger and roadway aggression. This modified model suggests that the process begins with an interpersonal provocation to which an individual may attribute hostile intent. The model then proposes that these hostile attributional biases may lead to anger and those that cope poorly with anger will engage in roadway aggression. Given the limited research conducted on roadway aggression, it was decided that both driving and general paths to roadway aggression would be investigated via path analysis in order to increase our knowledge base. The driving paths entailed examining variables such as hostile attributional biases in driving situations (ambiguous and hostile), anger while driving, and coping with driving anger. In contrast, the general paths involved examining variables such as hostile attributional biases in general situations (ambiguous and hostile), general anger, and impulsivity. A battery of self-report measures was administered in the present study to 218 male and female university students. The results of this study provided support for the application of an adapted version of Geen's model of affective aggression

in the examination of roadway aggression. While support was found for driving pathways leading to roadway aggression only partial support was revealed for general pathways. The present study also contributed to the literature by examining the role of mediating factors in the occurrence of roadway aggression. This has been a largely neglected area in the study of aggression in general. The implications of these findings were discussed in terms of the development of anger management programs for drivers and screening drivers for these programs. The results of this study require replication in other student samples and in community samples with larger age ranges.

Acknowledgements

I would like to thank my co-advisors Drs. Adelle Forth and Ian Shields for their guidance and patience in supervising this dissertation. In addition, I would like to express my gratitude to Dr. Roberta Russell, Director of the Research and Statistics Division of the Department of Justice Canada, Dr. Ivan Zinger, and my colleagues at the Department of Justice for their encouragement and support during the final stages of the completion of the dissertation. Last but not least, I would like to thank my parents for the support they provided throughout my academic career.

Table of Contents

Abstract.....	iii
Acknowledgements.....	v
List of Tables.....	ix
List of Figures.....	xii
List of Appendices.....	xiii
List of Acronyms.....	xv
Introduction.....	1
Review of Roadway Aggression Literature.....	3
Descriptive Studies of Roadway Aggression.....	3
Roadway Aggression Field Studies.....	14
Theoretical Models of Aggression.....	25
Hostile Attributional Biases in General and Driving	
Situations.....	29
General Anger and Driving Anger.....	35
Impulsivity and Driving Anger Coping.....	38
Roadway Aggression.....	39
Rationale and Purpose of Present Study.....	39
Hypotheses.....	45
Pilot Study	
Method.....	47

Participants	47
Scale.....	47
Attributions in General Situations Scale.....	47
Procedure.....	48
Results.....	50
Discussion.....	50
Main Study	
Method.....	53
Participants.....	53
Scales.....	53
Driving Anger Scale (DAS).....	53
Trait Anger Scale (TAS).....	54
Attributions in Driving Situations Scale (ADSS).....	54
Attributions in General Situations Scale (AGSS).....	55
Barratt Impulsiveness Scale (BIS-11).....	55
Paulhus Deception Scales (PDS).....	55
Driving Vengeance Questionnaire (DVQ).....	56
Driving Anger Expression Inventory (DAEI).....	56
Roadway Aggression Scale (RAS).....	59
Procedure.....	59
Design.....	60

Results.....	61
Discussion.....	111
Prevalence of Roadway Aggression.....	112
Driving-Related Paths to RoadwayAggression.....	116
General Paths to Roadway Aggression.....	119
Contributions to Research Literature and Implications.....	121
Study Limitations and Future Research.....	123
References.....	127
Appendices.....	139

List of Tables

Table 1:	Percentage of Participants Engaging in Horn Honking in the Field Studies.....	15
Table 2:	Intercorrelations among the ADSS subscales, Anger Arousal, and AGSS subscales: Pilot Study.....	51
Table 3:	Internal Consistencies of Scales in Main Study: Overall Sample.....	62
Table 4:	Intercorrelations among the ADSS subscales, Anger Arousal, and AGSS subscales – Cross-Validation in Main Study.....	64
Table 5:	Means and Standard Deviations of all Scales in Main Study by Gender.....	67
Table 6:	Percentage of Males and Females Engaging in the 11 Types Aggression	69
Table 7:	Intercorrelations among RAS items for Males.....	71
Table 8:	Intercorrelations among RAS items for Females.....	72
Table 9:	Intercorrelations among Predictor Variables after Partialling out Control Variables for Males.....	74
Table 10:	Intercorrelations among Predictor Variables after Partialling out Control Variables for Females.....	75

Table 11:	Correlations between all Measures, RAS, and Control Variables for Males.....	77
Table 12:	Correlations between all Measures, RAS, and Control Variables for Females.....	79
Table 13:	Correlations between all Measures, DVQ, and Control Variables for Males.....	81
Table 14:	Correlations between all Measures, DVQ, and Control Variables for Females.....	83
Table 15:	Summary of Hierarchical Regression Analysis for Driving and General Variables Predicting RAS in Males: General Variables Entered First.....	95
Table 16:	Summary of Hierarchical Regression Analysis for Driving and General Variables Predicting DVQ in Males: General Variables Entered First.....	97
Table 17:	Summary of Hierarchical Regression Analysis for Driving and General Variables Predicting RAS in Females: General Variables Entered First.....	99
Table 18:	Summary of Hierarchical Regression Analysis for Driving and General Variables Predicting DVQ in Females: General Variables Entered First.....	101

Table 19:	Summary of Hierarchical Regression Analysis for Driving and General Variables Predicting RAS in Males: Driving Variables Entered First.....	103
Table 20:	Summary of Hierarchical Regression Analysis for Driving and General Variables Predicting DVQ in Males: Driving Variables Entered First.....	105
Table 21:	Summary of Hierarchical Regression Analysis for Driving and General Variables Predicting RAS in Females: Driving Variables Entered First.....	107
Table 22:	Summary of Hierarchical Regression Analysis for Driving and General Variables Predicting DVQ in Females: Driving Variables Entered First.....	109

List of Figures

Figure 1:	Model of variables and processes in affective aggression.....	27
Figure 2:	Measures used to assess hypothesized driving paths in the affective aggression model.....	43
Figure 3:	Measures used to assess hypothesized general paths in the affective aggression model.....	44
Figure 4:	Results of the path analysis delineating the driving paths found to be statistically significant in predicting roadway aggression as measured by the RAS.....	88
Figure 5:	Results of the path analysis delineating the driving paths found to be statistically significant in predicting roadway aggression as measured by the DVQ.....	89
Figure 6:	Results of the path analysis delineating the general paths found to be statistically significant in predicting roadway aggression as measured by the RAS.....	92
Figure 7:	Results of the path analysis delineating the general paths found to be statistically significant in predicting roadway aggression as measured by the DVQ.....	93

List of Appendices

Appendix A: Attributions in General Situations Scale.....	140
Appendix B: Attributions in Driving Situations Scale.....	148
Appendix C: Telephone Recruitment Script for Pilot Study.....	156
Appendix D: Informed Consent Form for Pilot Study.....	158
Appendix E: Debriefing Form for Pilot Study.....	161
Appendix F: Driving Anger Scale.....	163
Appendix G: Trait Anger Scale.....	166
Appendix H: Barratt Impulsiveness Scale.....	169
Appendix I: Paulhus Deception Scale.....	172
Appendix J: Driving Vengeance Questionnaire.....	176
Appendix K: Driving Anger Expression Inventory.....	181
Appendix L: Roadway Aggression Scale.....	185
Appendix M: Telephone Recruitment Script for Main Study.....	188
Appendix N: Informed Consent Form for Main Study.....	190
Appendix O: Debriefing Form for Main Study.....	193
Appendix P: Results of the path analysis delineating the driving paths found to be non-significant in predicting roadway aggression as measured by the RAS.....	195

Appendix Q: Results of the path analysis delineating the driving paths	
found to be non-significant in predicting roadway	
aggression as measured by the DVQ.....	197
Appendix R: Results of the path analysis delineating the general paths	
found to be non-significant in predicting roadway	
aggression as measured by the RAS.....	199
Appendix S: Results of the path analysis delineating the general paths	
found to be non-significant in predicting roadway	
aggression as measured by the DVQ.....	201

List of Acronyms

ADSS-A	Attributions in Driving Situations Scale – Ambiguous
ADSS-H	Attributions in Driving Situations Scale – Hostile
DAS	Driving Anger Scale
DACS	Driving Anger Coping Scale
AGSS-A	Attributions in General Situations Scale – Ambiguous
AGSS-H	Attributions in General Situations Scale – Hostile
TAS	Trait Anger Scale
BIS-11	Barratt's Impulsiveness Scale
DVQ	Driving Vengeance Questionnaire
RAS	Roadway Aggression Scale
NDAEXPS	Negative Driving Anger Expression Scale
PDS-IM	Paulhus Deception Scales - Impression Management
PDS-SDE	Paulhus Deception Scales - Self-Deceptive Enhancement

Hostile Attributional Biases, Driving Anger, and Roadway Aggression among University Students: Application of a Model of Affective aggression

Introduction

Human aggression is considered to be a major social problem and its control continues to be a focus of many agencies and individuals (Tulloch, 1991). While an abundance of research attention has been devoted to human aggression in order to understand and manage the problem, roadway aggression has been a neglected topic in the academic literature (Novaco, 1991, 1992). Despite the fact that a pioneering study on roadway aggression was conducted by Parry (1968) a number of years ago, little research has subsequently been conducted on this phenomenon (see Novaco, 1991).

Recent years have witnessed increased media attention devoted to this phenomenon with the occurrence of a few highly publicized incidents of roadway aggression (Ferguson, 1988; Novaco, 1991). Media attention has generally focused on the most extreme forms of roadway aggression such as physical assault, assault with the vehicle as a weapon, and shootings. Extreme aggressive actions, however, are rare occurrences, considering the number of people who travel by car on a daily basis (Novaco, 1991). More common manifestations of roadway aggression have been reported such as aggressive tailgating, headlight flashing, horn honking, obscene gestures, blocking other vehicles, and verbal

abuse that may have an effect on a greater number of drivers (Adler, 1997; Novaco, 1991, 1992). While society may not be as concerned about mild forms of roadway aggression, Goldstein (1999) suggested that the presence of multiple forms of mild aggression may increase the risk for more serious aggression. Goldstein (1999) found some empirical support for the escalation potential of these behaviors in the general aggression literature.

The academic research community has shown renewed interest in studying this phenomenon in recent years (Deffenbacher, Oetting, & Lynch, 1994; Novaco, 1991, 1992). However, with the exception of Novaco (1991), no explanatory models have been proposed to account for roadway aggression. Novaco (1991) has suggested that the concept of disinhibition or the weakening of restraints against harm-doing may be crucial to understanding roadway aggression. The disinhibition of aggression is seen to result from multiple influences associated with physiological arousal, traffic context (i.e., impedance), anonymity and aggressive scripts.

The present study focused on one of these disinhibitors: anger arousal while driving. According to Novaco (1991), although anger is neither necessary nor sufficient for aggression, the role of anger as an activator of aggression has been demonstrated (e.g., Berkowitz, 1989; Novaco, 1986).

A model of affective aggression was employed in the present study to examine the relationship between hostile attributional bias, anger and roadway aggression in university students. The literature on roadway aggression will be reviewed followed by a description of the affective aggression model and the rationale and purpose of the present study.

Review of Roadway Aggression Literature

As previously mentioned, little scholarly attention has been paid to roadway aggression over the years. There is, however, a growing body of literature that provides some preliminary insights on this subject. The following section will review (1) surveys examining the prevalence of the various manifestations of roadway aggression, and (2) field studies of roadway aggression.

Descriptive Studies of Roadway Aggression

A small set of studies have examined the prevalence of the various manifestations of roadway aggression over different time frames. This section will review the results of these nine studies of roadway aggression which have been conducted in the United Kingdom, Canada, and the United States. All nine studies used a self-report approach; five studies administered paper and pencil questionnaires, two studies were interview-based, and it was unclear whether the remaining two were interview-based or paper and pencil based.

Comparing across these studies is difficult given that few methodological details were provided in many studies in order to allow adequate comparisons. Some studies did not report on how the samples were selected, the gender composition of the sample, the driving exposure of participants, whether data was gathered from interviews or paper and pencil questionnaires, or the wording of the actual questions. For instance, some studies examined roadway aggression in the past three months, past year, or ever in their lives which may influence the frequency of the behavior. There are also geographic and age differences in the samples examined in these studies that may further influence rates. Overall, all of these factors may serve to influence the rates of roadway aggression.

The following behaviors will be examined: (1) shooting/threatening another driver with a gun; (2) physically fighting with another driver; (3) bumping, ramming, or deliberately driving at another driver; (4) following or chasing another driver; (5) deliberately obstructing, blocking, or cutting other drivers off; (6) tailgating another driver; (7) obscene, rude, hostile, or angry gestures; (8) swearing, verbally abusing, or verbally arguing with another driver; (9) flashing headlights in annoyance; and (10) honking horn in annoyance. In some cases, it was indicated in the studies that both genders were examined; however, separate results were not always reported. This section will report separate results by gender where they

are available. Furthermore, a number of these studies surveyed more than one type of roadway aggression and for the sake of brevity the sample size and time period examined will only be described the first time the study is mentioned.

Shooting/threatening another driver with a gun.

In the only study to date that has examined the extent of this form of roadway aggression, Novaco (1991) found that this behavior occurred rather infrequently. Novaco (1991) examined 412 traffic violators (228 males and 184 females) in California who were attending traffic school to clear their offense without having to pay a fine and who did not commit a serious driving offense or have multiple violations. His study found that less than one percent of respondents admitted to shooting at another driver ever and one percent admitted to threatening another driver with a gun ever.

Physically fighting with another driver.

Another form of roadway aggression that has been examined is physical fights among drivers. Rates of physical fighting among drivers were found to be relatively low as all five studies found rates of less than 10%. In one of the earliest studies of roadway aggression, Parry (1968) administered questionnaires to 382 drivers (279 males and 103 females) ranging in age from 17 to 70 who were drawn from three samples of drivers in the United Kingdom. The samples consisted of (a) every tenth

vehicle stopped at a chosen spot, (b) registered voters, and (c) individuals who completed questionnaires left at public libraries and factory canteens. Parry (1968) found that 9% of males and 1% of females had been in a physical fight with another driver ever. Antonowicz and Valliant (1998) found lower rates in males but similar rates in females in a questionnaire-based survey of 100 university students (37 males and 63 females) in Ontario, Canada (males 3% vs. females 2%). This Canadian study examined students who had driven 100 kilometres or more in the past month and inquired about roadway aggression in the past three months. The smaller gender differences found by Antonowicz and Valliant (1998) may be a function of the shorter time frame examined in their study (three months versus ever).

The other three studies did not provide separate results for males and females. Marsh and Collett (1986) and Novaco (1991) each found a rate of 8%. The study by Marsh and Collett (1986) involved a survey of drivers in Scotland who were between the ages of 17 and 35. However, no other details were provided. The other study by Joint (1995) found that less than 1% of their respondents had been involved in a physical fight with another driver in the Automobile Association's (AA) survey of 526 drivers in the United Kingdom which inquired about roadway aggression perpetrated in the past 12 months. Unfortunately, few study details were provided by Marsh and Collett (1986) and Joint (1995) such

as whether the surveys were telephone-based or questionnaire-based, how the samples were selected, and the gender composition.

Following or chasing another driver.

Six studies have examined the extent of chasing other drivers with rates ranging from 4% to over 40%. Rates for males ranged from 12% to over 40% whereas for females the range was 4% to 21%. The results are somewhat mixed as some studies found higher rates than others.

Novaco (1992), Parry (1968), and Turner et al. (1975) all found higher rates for males compared to females (40% vs. 21%, 27% vs. 12%, 12% vs. 4%, respectively). Novaco (1992) examined a university and a community sample in California but no other details were provided. Turner et al. (1975) surveyed 100 homes that were randomly selected in Salt Lake City, Utah. Fifty-nine (63%) of the questionnaires were returned (26 males and 27 females).

In the other three studies that did not distinguish between genders, Marsh and Collett (1986) and Novaco (1991) found comparable rates (25% and 31%, respectively) while Anderson et al. (1999) found a much lower rate (4%). Anderson et al. (1999) completed telephone interviews with a random sample of American adults ($n=1,513$). However, they did not indicate the time period in which the behaviors were examined and did not break the results down by gender.

Bumping, ramming, or deliberately driving at another driver.

Only three studies have examined this manifestation of roadway aggression with rates ranging from less than 1% to 7%. In one study, Parry (1968) found that 7% of males and 2% of females had deliberately driven at another vehicle in anger. In the other studies, Novaco (1991) found that 5% of respondents had bumped or rammed another driver while Anderson et al. (1999) found that less than 1% had deliberately hit another vehicle.

Deliberately obstructing, blocking, or cutting other drivers off.

Four studies examined this form of roadway aggression with rates ranging from 2% to 29%. EPIC-MRA (1997) interviewed 875 individuals (>18 years of age) across the United States and found that 10% of respondents admitted to blocking cars trying to pass at least some times while 7% admitted to blocking cars trying to change lanes. The authors, however, did not provide results broken down by gender or other methodological details. The study by Joint (1995) found comparable results as 5% of respondents had obstructed other drivers. Similarly, the study by Anderson et al. (1999) found that 9% had deliberately prevented other drivers from passing them and 2% tried to cut off another car on the road and the study by Antonowicz and Valliant reported that 10% of female respondents had cut another driver off in anger. However, Anderson et al. (1999) found a higher rate of respondents who admitted

keeping someone from entering their lane (20%) as did Antonowicz and Valliant (1998) who found that 27% of males had cut another driver off in anger.

Tailgating another driver.

The extent of tailgating in respondents has been examined by four studies with rates ranging from 6% to 47%. Joint (1995), EPIC-MRA (1997), and Anderson et al. (1999) each found relatively low rates (6%, 10%, and 14%, respectively) whereas Antonowicz and Valliant (1998) found that 47% of males and 32% of females had driven up close behind another driver in anger. The differences in the rates may be attributable to the nature of the questioning (i.e., "tailgating " vs. "driving close"). It may be that respondents are more willing to admit "driving close" vs. "tailgating".

Swearing, verbally abusing, or verbally arguing with another driver.

In terms of swearing at other drivers, it appears that this behavior is relatively common as rates ranged from 23% to 70%. In contrast to the Antonowicz and Valliant (1998) study which found higher rates for males in comparison to females (70% males vs. 57% females), Turner et al. (1975) found that females had higher rates (23% males vs. 41% females). The other study which examined swearing found a rate of 44% but did not examine gender differences (EPIC-MRA, 1997).

With respect to yelling at other drivers or engaging in verbal abuse and arguments, Antonowicz and Valliant (1998) found that 51% of males and 33% females had yelled at another driver while 8% of males and 6% of females had had a verbal argument with another driver. In another study, Joint (1995) found that 12% of respondents had verbally abused another driver.

Obscene, rude, hostile, or angry gestures.

A number of studies have examined gestures made by drivers toward other drivers with rates ranging from 11% to 59% indicating that there are some discrepancies across studies. In the two studies that provided gender results, Antonowicz and Valliant (1998) and Turner et al. (1975) each found that males had higher rates than females. Fifty-nine percent of males and 37% of females had engaged in this behavior in the Antonowicz and Valliant (1998) study while in the Turner et al. (1975) study 15% of males and 11% of females had perpetrated it. The other studies by Novaco (1991), Joint (1995), EPIC-MRA (1997) and Anderson et al. (1999) found the following rates: 34%, 22%, and 16%, respectively.

Flashing headlights in annoyance or anger.

Flashing headlights at other drivers in annoyance or anger has also been examined. Across four studies, the rates were found to range from 12% to 50%. Two studies found that males had higher rates of flashing their headlights in annoyance or anger than did females.

Antonowicz and Valliant (1998) found that 41% of males and 21% of females had flashed their headlights while Turner et al. (1975) found that 50% of males and 15% of females had engaged in this behavior. In the studies that did not report gender results separately, Joint (1995) found a rate of 45% while EPIC-MRA (1997) found a rate of 12%.

Honking horn in annoyance or anger.

A number of field studies have examined horn honking in response to a frustrating driving condition; however, they will be described in the next section on roadway aggression field studies. Only two studies have examined self-reported annoyance-motivated horn honking behavior in drivers. There is some discrepancy in the findings as Antonowicz and Valliant (1998) found that 70% of males and 57% of females honked their horn in anger whereas Novaco (1991) found that 12% engaged in this behavior.

Novaco (1991) found that annoyance-motivated horn-honking was not significantly correlated with the more serious acts of aggression such as throwing objects, bumping/ramming, threatening with a gun, shooting, and physical fighting. Further support was provided by Antonowicz and Valliant (1998) who did not find annoyance-motivated horn-honking to be related to physical fighting in males and females. Horn-honking was, however, significantly correlated with other "low grade" aggressive behaviors that are apt to occur in driving in Novaco's study. Strong

relationships were found with shouting or yelling at other drivers, abruptly cutting off other drivers, flashing high beams, deliberately riding someone's bumper, and giving obscene or provocative gestures. Along these lines, Antonowicz and Valliant (1998) found strong relationships with making angry gestures, swearing at or calling other drivers names, and yelling at other drivers in female respondents. In contrast, there were no such significant correlations for males. One possible explanation for the lack of significant findings for males in the Antonowicz and Valliant (1998) study is that only 37 males were examined. Future studies need to examine these relationships in larger samples of drivers in order to determine if these correlations remain consistent for males and females.

Summary.

A review of these studies indicated that there are a number of difficulties in comparing across studies such as methods employed, reporting issues, as well as geographic and age differences in the study samples. Despite this, an attempt was made to draw some limited conclusions.

While aggression is not likely a routine part of driving, various lines of evidence indicated that such behavior is not uncommon among American, British, and Canadian drivers. A review of the survey findings indicated that this behavior is relatively prevalent and it is perpetrated by both male and female drivers. While males had consistently higher rates

of roadway aggression in almost all studies, the rates for females were not that low.

The less serious manifestations such as tailgating, headlight flashing, and hostile gestures appear to be more prevalent than more serious manifestations such as shootings and assault. This was the case in surveys which compared multiple forms of roadway aggression (Antonowicz & Valliant, 1998; Joint, 1995; Turner et al., 1975).

There were, however, some discrepancies in the rates of roadway aggression across the studies. Antonowicz and Valliant (1998) consistently found higher rates of roadway aggression for a number of different manifestations compared to the rates in other studies. The higher rates may be a function of the small sample (37 males and 63 females) examined by Antonowicz and Valliant (1998). Most of the other studies examined much larger samples which may be more representative. Another possibility is that roadway aggression is more common in university-age students rather than in the general population where there is more age range. Wiesenthal, Hennessy, and Gibson (2000) found that those individuals who had less driving experience (0-6 years) expressed higher levels of vengeance while driving than more experienced drivers (6+ years).

The next section will review a series of related social psychological field studies that have attempted to conduct controlled manipulations of roadway aggression to enhance our understanding of this phenomenon.

Roadway Aggression Field Studies

A small set of studies inspired by the frustration-aggression research tradition and Berkowitz's work on aggressive cues (Berkowitz, 1993) has been conducted on roadway aggression. Research on the relationship between frustration and aggression stems from the publication of Frustration and Aggression by Dollard, Doob, Miller, Mowrer, and Sears (1939). Aggression was viewed as being a consequence of frustration. With the exception of Hauber (1980), who used several indices of driving aggression, all of these studies have employed horn honking as an index of aggression. Table 1 presents the percentage of participants in each field study that engaged in horn honking.

Table 1

Percentage of Participants Engaging in Horn Honking in the Field Studies

Field Study	Condition	% Honking
Doob & Gross (1968)	Low Status	84%
	High Status	50%
Deaux (1971)	Low Status	67%
	High Status	57%
Chase & Mills (1973)	Males	64%
	Females	54%
	Males	73%
	Females	69%
Baron (1976)		Comfort/Uncomfort
	Control	67% 90%
	Distraction	55% 89%
	Empathy	71% 57%
	Humor	63% 50%
	Sexual Arousal	50% 47%

Table 1 Continued

Field Study	Condition	% Honking
McDonald & Wooten (1988)	Humor	79%
	Aggression	64%
	Sexual Arousal	50%
	Controls	Unreported
Ellison et al. (1995)	Anonymous	Unreported
	Identifiable	
Turner et al. (1975a)		Low/High Visibility
	Rifle-Vengeance	77% 43%
	Rifle-Friendly	47% 29%
	Control	33% 21%
Turner et al. (1975b)	No Rifle	
	Male Driver	New/Old Car
	No Bumper Sticker	50% 56%
	Vengeance Sticker	33% 38%
	Female Driver	New Car
	No Bumper Sticker	80%
	Vengeance Sticker	50%

Table 1 Continued

Field Study	Condition	% Honking
Turner et al. (1975b)	Rifle	
Continued	Male Driver	New/Old Car
	No Bumper Sticker	30% 46%
	Vengeance Sticker	65% 14%
	Female Driver	Combined
	No Bumper Sticker	50%
	Vengeance Sticker	50%
Halderman & Jackson (1979)	Gun on Street Corner	Unreported
	Gun in Pickup	
	Control	

A study by Doob and Gross (1968) pioneered all the investigations that follow in this section. The paradigm they employed was adopted by a number of other studies. Doob and Gross (1968) experimentally created a frustrating condition by using a common traffic scenario (i.e., a car stopped at a traffic light which does not move when the light changes). The researchers varied the type of car which blocked drivers at an intersection and observed driver's horn honking response. Thirty-eight drivers (23 males and 15 females) were exposed to a low status car while 36 drivers (25 males and 11 females) were exposed to a high status car. Their results indicated that the low status car (i.e., older, less expensive model) elicited more aggression in the form of honking than did the high status car (newer, more expensive model). In addition, they found that males were more likely than females to honk in both status conditions.

Deaux (1971) replicated the conditions of the Doob and Gross (1968) study and extended it by manipulating the gender of the frustrator in addition to the status of the frustrating agent and the gender of the subject. In a study of 123 drivers (90 males and 33 females) in Dayton, Ohio, Deaux (1971) was unable, however, to replicate the results of the status effect found by Doob and Gross (1968) possibly due to the fact that she used cars in the high status condition that were presumably lower in status than those employed by Doob and Gross (1968). Rather, Deaux (1971) found effects for the gender of the frustrating driver as more

honking and shorter latency of honking occurred when the driver of the stopped car was a female. In another replication effort with 40 drivers (20 per status condition) in the Toledo, Ohio area, Chase and Mills (1973) did not find either sex of subject driver nor sex of target driver effects. They obtained a status effect, but it was opposite to that found by Doob and Gross (1968). Novaco (1991) suggested that regional variations might account for the discrepant findings since the Doob and Gross (1968) study was conducted in California while the other two studies were completed in Ohio.

In a related study, Baron (1976) examined 120 male drivers who were delayed at an intersection after the light turned green. When the light was red, experimental manipulations designed to lower the drivers' level of overt aggression were employed: (a) humor (a female confederate, dressed in normal conservative attire and wearing an outlandish clown mask, passed in front of the subject); (b) empathy (a female confederate, dressed conservatively but on crutches and with a bandaged left leg, passed in front of the subject); and (c) mild sexual arousal (a female confederate, dressed in a brief and revealing outfit, passed in front of the subject). In addition, two control groups were employed. In the first control condition, nothing occurred while the light was red; in the second condition, a female confederate dressed in normal conservative attire, passed in front of the subject (distraction group).

The results of their study indicated that individuals in the three experimental conditions were more hesitant to honk their horns at the confederate and showed fewer overt signs of aggression than subjects in two control groups not exposed to these conditions. It was also revealed that subjects' willingness to honk at the confederate was increased by uncomfortably warm ambient temperatures in the control conditions but not in the experimental conditions.

McDonald and Wooten (1987), however, argue that Baron (1976) may have used an inappropriate control for the distraction effect. They felt that having a person wearing a funny clown mask, a brief and revealing outfit, or hobbling along on crutches pass in front of a motorist may be even more distracting than having a person in normal conservative attire pass in front of a motorist. McDonald and Wooten (1987) sought to address this concern in their replication study with 56 male drivers by adding a condition that was as distracting as Baron's experimental conditions but which was not designed to lower the drivers' aggression level. In their humor condition, two female confederates, who were dressed casually (blue jeans and blouses) and who wore funny clown masks, crossed the intersection (at the crosswalk) in full view of the subject. In the sexual arousal condition, the procedure was identical except that the confederates wore brief and revealing outfits (short shorts and skimpy tops). In the aggression condition, the same two female

confederates, dressed casually, appeared to be having an altercation as they crossed the intersection. They pushed and shoved at each other, and then one appeared to chase the other down the street and out of sight. In the control condition, the confederates remained out of sight. All three treatment groups had longer horn honking latencies compared to the control condition. In addition, fewer drivers in the treatment groups honked at the confederate than those in the control condition. They concluded that the distraction hypothesis was responsible for the effects.

Ellison, Govern, Petri, and Figler (1995) also adopted this paradigm but in contrast to the other field studies they examined the relationship of anonymity and roadway aggression. Thirty subjects driving convertibles or 4x4s with the tops down (identifiable condition) were compared to 30 subjects who were driving convertibles or 4x4s with the tops up (anonymous condition). Horn honking behavior within a 12-second time period was assessed. Subjects in the anonymous condition displayed significantly shorter horn honking latencies, longer horn honking durations, and more frequent horn honks than did subjects in the identifiable condition. Pre-existing differences, however, in the personalities or moods of the subjects in the two conditions, reflected in putting their car tops down, may have been responsible for some or all of the observed effect.

Another set of studies was based on the notion that the presence of guns can, under certain circumstances, have a cuing, aggression-arousing effect on those exposed to it. Turner et al. (1975) examined this notion by incorporating some of Doob and Gross's (1968) procedures in two field experiments.

In the first study, they examined 92 male drivers and employed a pick-up truck for the stopped car and added aggressive cues by means of a rifle in a gun rack and a bumper sticker that read "vengeance" (versus one that said "friend"). They also manipulated victim visibility by either opening or closing a curtain in the pick-up truck's back window. They found that the rate of horn honking was significantly higher in the condition where the curtain was closed and both the rifle and the bumper sticker were present.

Since the rifle and the vengeance sticker were not independently manipulated (the sticker was not present without the rifle), Turner et al. (1975) conducted a second subsequent field experiment. In this study, they examined 137 male and 63 female drivers. The rear window was closed for all subjects in order to minimize inhibitory influences of victim visibility. Male drivers of older cars and female drivers were not used as subjects in the first study since they were expected to inhibit horn honking but were incorporated into this study. The combination of the rifle and the vengeance sticker increased horn honking for male drivers in new cars

while it was significantly lower for male drivers in older cars. There were no effects for females or for either the rifle or sticker alone. The researchers note different and newer pick-up trucks were used by the confederate victims. This may have accounted for the somewhat weaker results obtained in the second study. It is possible that subjects inhibited honking to victims in the newer trucks because the victims were perceived to be relatively high status.

Halderman and Jackson (1979) attempted to replicate Turner et al.'s (1975) results using a sample of 60 male drivers but found no effects for the presence of a rifle. Their study was conducted in Kansas using a pick-up truck with its driver hidden from view by a curtain. They did not manipulate the status or bumper sticker but added a condition in which a rifle was carried by a pedestrian. Their results, however, revealed that there were no differences in horn honking between the no rifle, rifle in gun rack, and pedestrian with rifle conditions. Halderman and Jackson (1979) suggested that the absence of effects could be attributed to the lessened cue value of a rifle in a rural community where guns are commonplace.

Hauber (1980) did not employ horn honking as the sole index of aggression. Instead, he conducted a study in the Netherlands that used several indices of driver aggression in relation to an experimentally created pedestrian crossing situation. An experimental confederate pedestrian entered a predetermined crossing for an approaching car.

The driver's behavior was subsequently scored by an inconspicuous observer as aggressive or non-aggressive based on whether they failed to stop, gesticulated/remarked at those in the crossing, or sounded their horn.

In the pedestrian crossing situation, the behavior of 25% of the drivers was judged to be aggressive. The results revealed that no significant differences emerged between male versus female drivers but there were effects for age. Younger men were found to be more aggressive than older women but younger women were more aggressive than were older men. Aggression occurred nearly twice as often when the pedestrian was male.

Summary.

The typical experiment reviewed in this section involved a confederate blocking traffic at a light or stop sign with aggression being typically measured as the frequency or latency of horn honking at the confederate. A review of these studies demonstrated that variations on the status of the slow to move car have led to mixed results. Some researchers found that low status vehicles elicit more aggressive honking while others have found that high status vehicles elicit more aggressive honking. Novaco (1991) indicated that the discrepant findings may be the result of researchers using different types of vehicles in different geographical regions. Similarly, the addition of aggressive cues to the

slow to move vehicles, such as a rifle or a bumper sticker displaying a "pro-revenge" message, have been found to elicit more aggressive horn honking by some researchers but not others. The lack of consistency in results may be attributable to the reduced cue effect of rifles in rural communities.

The use of horn honking as an index of aggression in these studies has also been criticized. Novaco (1991) indicated that the occurrence of horn honking can have multiple interpretations such as behavior intended as a signal without aggressive qualities. In addition, due to ethical considerations, these field studies are also limited in how much aggression they can elicit.

Theoretical Models of Aggression

According to Huesmann (1988), no one single factor will explain human aggression. Rather, it is most likely to occur when a number of predisposing and precipitating factors co-occur with environmental conditions favorable to aggression. Huesmann (1988) also adds that neurological, hormonal, or other physiological abnormalities stemming from genetic, perinatal, traumatic, or other causes undoubtedly play a role in many instances.

At the present time, there exist no theoretical models of roadway aggression from which to draw upon to utilize as a research framework. One theoretical model drawn from the general aggression literature which

may contribute to our understanding of this phenomenon is Geen's (1990) model of affective aggression (see Figure 1). A number of other anger and aggression models exist which overlap in terms of the inclusion of a component concerning hostile attribution biases or fundamental attribution error (Anderson, Deuser, & DeNeve, 1995; Dodge & Schwartz, 1997; Huesmann, 1988; Novaco & Welsh, 1989). Geen's model proposes that aggression is a product of one or more background variables and some eliciting condition in the immediate situation.

According to this model, background variables, which are necessary but not sufficient conditions for aggression, predispose the person to aggress.

Some background variables concern characteristics of the person which are always present such as genetic inheritance, biological make-up, and personality while others are momentary and are determined by present conditions such as stimulation from the mass media and expectations and demands from the social environment.

In Geen's model of affective aggression, both the person and the situation are thought to contribute to the experience of anger and aggression. The process is initiated with some form of provocation: this may include frustration, various forms of interpersonal provocation (e.g., physical attacks, verbal insults) and environmental stressors such as noise and heat. This model asserts that the individual is not responding

Figure 1. Model of variables and processes in affective aggression (adapted from Geen, 1990).

directly to the event, but rather to some cognitive depiction of the event. Geen utilizes Lazarus's notion of appraisal to represent the cognitive mediation of the provoking event (Lazarus & Folkman, 1984). The basic premise is that not all provocations will lead to aggression but that those that are seen as malicious are most likely to promote an aggressive response.

Berkowitz (1993) suggested that we are probably most likely to become aggressive when we think we have been deliberately wronged by someone. There are, undoubtedly, individual differences in how readily one will appraise another person's ambiguous actions as having hostile intent. Some people are easily provoked to violence because they tend automatically to interpret other people's ambiguous actions as being motivated by hostile intent. This tendency toward interpreting ambiguous social cues as provocative has been labeled a "hostile attributional bias" by Nasby, Hayden, and DePaulo (1979).

To the extent that the event or provocation is seen this way, the aversive conditions will promote anger arousal in the individual. According to Geen (1990), it is at this point that the contribution from the person is considered to be relevant. If aggression is likely to be a response, it must first exist in the individual's repertoire: behavioral responses of an aggressive type must have been previously acquired.

These behaviors are learned through various mechanisms such as imitation and observational learning.

It is proposed that a process of secondary appraisal takes place, whereby the individual evaluates his/her capacity to cope with this aversive situation. If other effective coping responses are available to the individual, aggression may not occur. As Tulloch (1991) indicated, however, provocation does not always lead to anger, and anger does not always lead to aggression. The following subsections will describe the key variables examined in the present study and their link to aggressive behavior. Variables pertaining to both driving-specific situations and general situations will be examined. Some researchers have speculated that individuals behave differently when they drive as opposed to other situations (Deffenbacher, 1999). Novaco (1991) suggested that this may be the case because driving offers multiple disinhibitory influences such as physiological arousal, anonymity, and opportunity to escape. To date, there does not appear to be any empirical research which has examined this issue.

Hostile Attributional Biases in General and Driving Situations

A number of researchers have found linkages between hostile attributional biases and aggressive behavior in school-age children, adolescents, and juvenile offenders, particularly when the intent is ambiguous (see Dodge & Schwartz, 1997). These biases were found in

both males and females. It is only recently, however, that more attention has been devoted to examine this bias in adults and its link to aggressive behavior. Despite the fact that each study used a somewhat different measure to assess hostile attributional bias, the results appear to suggest that this bias is related to aggressive behavior with the exception of the study by Copello and Tata (1990). Of these studies, one investigated a community-based sample of maritally violent males (non-adjudicated), three examined officially adjudicated offender samples, and three investigated the bias in university student samples.

Eckhardt, Barbour, and Davison (1998) explored differences between (1) maritally violent males ($n=31$), (2) maritally distressed non-violent males ($n=23$), and (3) maritally satisfied non-violent males ($n=34$). Participants were recruited from the community through newspaper and radio advertisements. Males were identified as being maritally violent if they self-reported at least four incidents of physical aggression against their wives in the past 12 months. Hostile attributional biases were assessed using the Articulated Thoughts in Simulated Situations paradigm (ATSS; Davison, Robins, & Johnson, 1983). Participants listened to anger-arousing audio-taped scenarios and imagined that they were part of the interactions. Three different scenarios were used: (1) a control scenario in which the source of frustration was another couple; (2) an overheard conversation between his partner and her friend, where she

expresses uncertainty about remaining in the marriage; and (3) a jealousy-provoking scenario where the husband comes home to find his partner talking and laughing with a male acquaintance. After listening to each scenario, participants were asked to articulate their thoughts. These thoughts were coded for hostile attributional biases by trained raters. The results indicated that maritally violent males articulated a significantly greater number of hostile attributional biases across all ATSS scenarios compared to other two groups.

Two studies compared psychopaths and non-psychopaths in offender samples with respect to hostile attributional bias. The two key dimensions that characterize psychopaths are (1) the interpersonal/affective dimension (i.e., selfish, callous) and (2) the social deviance (i.e., chronically unstable lifestyle) (Hare, 1991). There is a large body of literature that demonstrates that psychopaths are more violent than non-psychopaths (Hare, 1991). Blackburn and Lee-Evans (1985) and Serin (1991) both found that psychopaths were more likely to show hostile attributional biases when presented with hypothetical situations compared to non-psychopaths.

Blackburn and Lee-Evans (1985) examined male offender patients at a psychiatric security hospital. Psychopaths ($n=28$) were compared to non-psychopaths ($n=28$) on an adapted version of the Situations-Reactions Inventory of Hostility (Endler & Hunt, 1968). This self-report

measure is comprised of two classes of situations, labelled attack and frustration, and three classes of reaction – aggression, anger and arousal. Attack situations were defined as challenges to physical or psychological well-being while frustration situations were defined as thwarting of some anticipated goal or reward. The results indicated that psychopaths generally rated their reactions as more intense compared to non-psychopaths but differed significantly from their counterparts only in their response to situations involving attack and not frustration. These results suggest that psychopaths more readily interpret provocation or threats from others as unwarranted attack (i.e., hostile attributional bias).

In the other study, Serin (1991) examined hostile attributional biases in an incarcerated male offender sample. Three groups of offenders were compared: (1) non-violent non-psychopaths ($n=21$), (2) violent non-psychopaths ($n=45$), and (3) violent psychopaths ($n=21$). Hostile attributional biases were assessed using an interview-based approach with six hypothetical situations. The hypothetical situations were potentially frustrating and were presented in such a manner that the intention of the provocateur was neither clearly malicious nor accidental. Overall, there were no group differences with respect to hostile attributional biases across all vignettes. However, the vignettes successfully produced attributional differences between groups when the depicted situations were very provocative.

Mixed support for this link was found in a study of adult male offenders by Copello and Tata (1990). They presented unambiguous and ambiguous sentences to three groups: (1) violent offenders ($n=9$), (2) non-violent offenders ($n=9$), and (3) non-offenders (control) ($n=9$). The results revealed that both offender groups were significantly more likely to select violence threatening interpretations of ambiguous sentences compared to the control group. No differences were, however, found between the two offender groups. This may indicate that both groups are characterized by this bias but non-violent offenders may control the urge to respond with violent behavior. The small sample size in this study limits the generalizability of these findings.

Support for hostile attributional bias in adults was also found in a study of 172 male and female university students by Epps and Kendall (1995). Hostile attributional biases were assessed using a questionnaire-based approach with 21 hypothetical scenarios being presented to participants (seven hostile situations, seven ambiguous situations, and seven neutral situations). They found a significant relationship between self-reported attributed hostility on hypothetical scenarios and self-reported anger/aggression. Epps and Kendall (1995) further found that this bias was not limited to the interpretation of ambiguous interactions; the bias was also present in clearly hostile interactions. No differences were found between males and females.

These results were confirmed in a study of 167 male and female university students by Dill, Anderson, Anderson, and Deuser (1997). These researchers used three videotaped social interactions (one non-aggressive video, one ambiguously aggressive video, and one aggressive video) that were personally irrelevant (i.e., the participants were not personally involved). Participants were asked to rate the interactions using aggression-related adjectives. The results indicated that aggressive personality (i.e., general factor based on three aggression-related measures) was positively related to hostile perceptions across all interactions including neutral interactions. Unfortunately, no gender breakdown was provided.

Further support was found by Flores (1999) who examined 62 male university students. Flores constructed three short vignettes depicting ambiguous situations that could be construed as provoking or aggressive. Participants were asked to write down why they thought that the event took place. These responses were then scored by raters according to whether or not participants perceived the situations as aggressive. Higher levels of aggression (i.e., trait aggression) were associated with more hostile attributions.

Given that hostile attributional biases in adults in general have not received extensive empirical scrutiny, it is not surprising that research

specifically examining hostile attributional biases in driving situations is virtually non-existent.

General Anger and Driving Anger

According to Geen's model these biases may subsequently lead to anger arousal. Anger is an emotion that almost everyone reports experiencing several times a week (Averill, 1983) and it has been related to a number of negative outcomes such as cardiovascular disease (Siegman & Smith, 1994). While some empirical evidence exists in support of the link between general anger and aggression both in clinical and non-clinical populations (Dodge, 1991; Novaco, 1994; Spielberger, 1988), Eckhardt, Barbour, and Stuart (1998) did not uncover consistent findings demonstrating that maritally violent males were higher in anger levels compared to maritally non-violent males in their review of empirical studies. These divergent findings may be a function of the samples examined and the variety of measures employed to assess anger and aggression.

A further complicating factor that Novaco (1976, 1994) points out is that anger is not a necessary precondition for aggression. It has been suggested that anger can have positive functions: (1) energizing behavior, (2) providing discriminative cues for coping, (3) communicating negative sentiment, and (4) potentiating sense of control (Novaco, 1983). Given that anger can have adaptive functions, Novaco (1994) asserted

that anger can then only be moderately predictive of violence.

Aggression may occur in the absence of anger, as in the case of instrumental aggression motivated by personal gain. Regardless, anger is considered by academics, mental health professionals, and lay persons as a risk factor for aggressive behavior (Novaco, 1994).

With respect to driving anger and roadway aggression, there is a paucity of research that has examined this link. Some preliminary support for this relationship stems from two correlational studies that were conducted. This research received its impetus from the development of the self-report Driving Anger Scale (DAS) (Deffenbacher et al., 1994) which has been described as a measure of anger arousal in driving situations.

In a study involving 274 university students (117 males and 157 females), Lynch, Deffenbacher, Oetting, and Yingling (1995) found that the DAS was positively correlated with both the number of arguments with drivers of other vehicles, and with the number of physical fights with other drivers in the past year (r s of .12 and .26 respectively). As can be seen, the correlations in this study were not large. Unfortunately, no gender breakdowns were provided.

Antonowicz and Valliant (1998) examined a sample of 100 university students (37 males and 63 females) who had driven more than 100 kilometres in the past month to determine if the DAS was correlated

with various manifestations of roadway aggression in the past three months. The only significant finding to emerge was that for both males and females, the DAS was positively correlated with the frequency of making angry gestures at other drivers or pedestrians (r s of .45 and .53, respectively).

Further support for the link between driving anger and roadway aggression emanates from a series of studies completed by Deffenbacher and his colleagues (Deffenbacher, Huff, Lynch, Oetting, & Salvatore, 2000; Filetti & Deffenbacher, 1999; Lynch, Deffenbacher, Filetti, & Dahlen, 1999). On the basis of scoring in the upper quartile of the DAS (scores >53), identifying themselves as having a personal problem with driving anger, and expressing a desire for counseling for that problem, university students were identified as high-anger drivers. These drivers were compared to low-anger drivers who received this categorization by scoring in the lower quartile (scores <42) and by indicating that they did not have a problem with driving anger. Across these studies, high-anger drivers reported more aggression (e.g., cutting someone off in anger, giving someone the finger, etc.) on the road over intervals from three months to a year compared to low-anger drivers.

According to Geen's model, whether anger leads to aggression may depend on how individuals cope with anger. Those who are

impulsive and/or who cope poorly with anger would be expected to engage in more aggression.

Impulsivity and Driving Anger Coping

There exists little consensus in the literature regarding what comprises the construct of impulsivity (Parker, Bagby, & Webster, 1993). This lack of conceptual clarity in impulsivity has led to widespread confusion in the literature. Many of the scales and measures that have been developed to assess impulsivity do not intercorrelate very highly. Despite this situation, Parker et al. (1993) assert that a central element of most definitions of impulsivity is a tendency to make quick decisions and to act without thinking. Empirical research linking impulsivity to aggression has demonstrated that impulsivity is moderately related to expressions of aggression (see Barratt, 1994; Plutchik & van Praag, 1995).

Impulsivity was not referred to in the model but it has been linked to aggression and may play a role in roadway aggression. Driving anger coping refers to how the individual deals with driving anger. It is acknowledged that many people get at least moderately angry while driving but not everyone engages in roadway aggression as a result (Deffenbacher, 1999). To date, no studies have attempted to examine impulsivity or driving anger coping in relation to roadway aggression.

Roadway Aggression

The assessment of roadway aggression has typically consisted of posing individual questions about a variety of behaviors such as tailgating and making hostile gestures. Some studies have focused on certain behaviors while others have focused on other behaviors (see section on Descriptive Studies of Roadway Aggression). More recently, Wiesenthal, Hennessy, and Gibson (2000) developed the Driving Vengeance Questionnaire (DVQ). The DVQ is a paper and pencil self-report measure that assesses a driver's endorsement of the use of revenge when faced with common driving situations. Wiesenthal et al. (2000) report that this measure has adequate psychometric properties (see Method section in Main Study). Given that this measure has only recently been developed, there is a need for further research that assesses its psychometric properties.

Rationale and Purpose of Present Study

While roadway aggression has received more research attention in recent years, no study has employed a theoretical model to examine the role of hostile attributional biases in driving anger and roadway aggression. Despite the fact that factors linked to general aggressive behavior have been examined in numerous studies, there is a paucity of work on mediating factors in the aggression literature (Anderson et al., 1998). How a particular factor (independent variable) leads to aggressive

behavior (dependent variable) is sometimes discussed at a theoretical level, but it seldom receives adequate empirical attention. There is clearly a need to examine mediational mechanisms.

The present study sought to address these gaps by employing the model of affective aggression developed by Geen (1990). Some modifications and extensions of this model were incorporated for the purposes of this study. In contrast to Geen's model (1990), the present study focused on interpersonal provocations (e.g., hostile gestures, verbal insults) and excluded frustrations resulting from traffic obstructions such as potholes and traffic jams or stressors such as noise and heat.

A review of the literature suggested that hostile attributional biases in general situations (ambiguous and hostile), general anger, and impulsivity were all related to general aggression. It may be that these variables are also related to roadway aggression which is a more specific form of aggression. The present study examined these relationships in addition to examining the contributions of driving-specific variables in explaining roadway aggression.

Given the limited research conducted on roadway aggression, it was decided that both driving and general paths to roadway aggression would be investigated. The driving paths entailed examining variables such as hostile attributional biases in driving situations (ambiguous and hostile), anger while driving, and coping with driving anger. In contrast,

the general paths involved examining variables such as hostile attributional biases in general situations (ambiguous and hostile), general anger, and impulsivity. Figures 2 and 3 outline the hypothesized driving and general paths, and the specific measures that were employed to address the different components of the model. Three new scales were created to assess the components for which no scales were currently available. These included measures of (1) hostile attributional biases in driving situations; (2) driving anger coping which was derived from a pre-existing measure of driving anger expression (see the description of Driving Anger Expression Inventory in the Method section); and (3) roadway aggression frequency.

Other variables may also contribute to the occurrence of roadway aggression and may require that their influence be taken into account in conducting analyses. These include (1) driving exposure (i.e., kilometres driven), (2) frequently driving during rush hour traffic, and (3) urban versus rural driving.

Furthermore, socially desirable responding may be present which may influence subjects' responses on measures such as anger and aggression. Some individuals may attempt to present their responses in a more socially appropriate manner. Therefore, a measure of social desirability will also be included to address this issue.

Gender was also examined in the present study. Gender stereotypes and the social psychological literature on aggression (Baron & Richardson, 1994) suggest that males engage in more aggressive behavior than females. The studies reviewed previously on prevalence rates indicate that rates of roadway aggression for males are higher compared to those of females.

Figure 2. Measures used to assess hypothesized driving paths in the affective aggression model.

Note. ADSS-A=Attributions in Driving Situations Scale - Ambiguous; ADSS-H=Attributions in Driving Situations Scale - Hostile; DAS=Driving Anger Scale; DACS=Driving Anger Coping Scale; RAS=Roadway Aggression Scale; DVQ=Driving Vengeance Questionnaire.

Hypotheses

Eight hypotheses were postulated in the present study and they are listed below. Hypotheses 2 through 7 pertain to the overall sample (i.e., males and females) while Hypothesis 8 provides results by gender.

- (1) Males will engage in higher levels of roadway aggression (as measured by the RAS, DVQ, and the Negative Driving Anger Expression Scale (NDAEXPS)) compared to females.
- (2) When only driving paths are examined, driving anger coping will have a direct effect on measures of roadway aggression (i.e., RAS and DVQ).
- (3) When only driving paths are examined, driving anger will have an indirect effect on measures of roadway aggression (i.e., RAS and DVQ) via driving anger coping.
- (4) When only driving paths are examined, hostile attributional biases in driving situations (both ambiguous and hostile) will have an indirect effect on measures of roadway aggression (i.e., RAS and DVQ) via driving anger.
- (5) When only general paths are examined, impulsivity will have a direct effect on measures of roadway aggression (i.e., RAS and DVQ).
- (6) When only general paths are examined, general anger will have an indirect effect on measures of roadway aggression (i.e., RAS and DVQ) via impulsivity.

- (7) When only general paths are examined, hostile attributional biases in general situations (both ambiguous and hostile) will have an indirect effect on measures of roadway aggression (i.e., RAS and DVQ) via general anger.
- (8) Driving-specific variables (i.e., hostile attributional biases in driving situations, driving anger, and driving anger coping) will account for incremental variance in measures of roadway aggression (i.e., RAS and DVQ) for both males and females after the effects of general variables (i.e., hostile attributional biases in general situations, general anger, and impulsivity) have been taken into account.

Pilot Study

Method

Participants

Participants were 60 students (30 males and 30 females) attending Carleton University who volunteered to take part in a study on hostile attributional biases as partial fulfillment of a research requirement for an Introductory Psychology class. These students had indicated that they had driven a motor vehicle in the three month time period prior to the study. The mean age for the sample was 19.38 years of age ($SD=1.43$). The age range was 18 to 24 years of age.

Scale

(1) Attributions in General Situations Scale (Epps & Kendall, 1995) (see Appendix A). This measure is comprised of 21 scenarios depicting interpersonal interactions where participants rate on a 9-point Likert-type scale how sure they are that the other person's motives were hostile (1=not at all sure to 9=very sure). Of the 21 scenarios, seven involve hostile intent, seven are ambiguous, and seven are benign. Epps and Kendall (1995) found that the scenario types were distinct as hostile scenarios were rated as more hostile than the ambiguous ones and the ambiguous scenarios as more hostile than the benign ones by subjects. They also found that self-reported anger/aggression was significantly related to attributed hostility in both hostile and ambiguous situations. No

gender differences were found on hostile attributional biases. For the present study, only the hostile (AGSS-H) and ambiguous (AGSS-A) scenarios were presented and one hostile scenario involving a driving situation was omitted leaving a total of 13 scenarios.

Procedure

The initial step in the pilot study was to construct a scale that measures hostile attributional biases in driving situations. Fifteen driving situations that reflect either hostile or ambiguous intent on the part of other drivers were generated by the writer. Eight judges (4 males and 4 females) from the general community were asked to rate each of the 15 driving situations on a 9-point Likert-type scale (1=clearly not hostile to 9=clearly hostile) in order to determine whether the situation involved either hostile intent on the part of the other driver or if the other driver's intent was ambiguous. A mean score for each driving situation was computed and situations were retained if the mean score fell between 4 and 6 indicating an ambiguous situation, or the mean score fell between 7 and 9 indicating a hostile situation. This resulted in 14 situations being retained. The scale will be referred to as the Attributions in Driving Situations Scale (see Appendix B).

The next step was to examine the psychometric properties of the 14-item Attributions in Driving Situations Scale. Mass testing was used to identify Introductory Psychology students meeting the criterion of having

driven in the past three months. Once students had been identified through mass testing, they were recruited by telephone to participate in the study (see Appendix C).

Sixty students (30 males and 30 females) were administered the Attributions in Driving Situations Scale (ADSS) and the Attributions in General Situations Scale (AGSS). As part of the ADSS, student participants were asked to rate on a 9-point Likert-type scale how sure they were that other driver's actions in each of these situations were hostile (1=not at all sure to 9=very sure). As part of the validation process, participants were also asked to rate on a 9-point Likert-type scale how angry they would be in response to the driving situations on the ADSS (1=not at all angry to 9=very angry). The AGSS was administered in order to examine the validity of the ADSS.

Participants were tested individually or in small groups by the writer in a seminar room on the university campus and were required to give their informed consent (see Appendix D). The pilot study required approximately 15 minutes to complete the two self-report questionnaires. In order to prevent any test sequencing effects in the pilot study, half of the students completed the ADSS first followed by the AGSS whereas the other half started with AGSS. Following testing in the pilot study, students were debriefed regarding the purpose of the study (see Appendix E).

Results

The reliability and validity of the ADSS-A and ADSS-H were assessed in the pilot study. Internal consistencies were found to be adequate for both the Ambiguous and the Hostile subscales ($\alpha=.83$ and $.74$, respectively). The construct validities of the ADSS-A and the ADSS-H were examined by correlating the two subscales with the AGSS-A and the AGSS-H, respectively. The results revealed that the ADSS-A was significantly correlated with the AGSS-A, and the ADSS-H was significantly correlated with the AGSS-H (see Table 2). The criterion validities of the ADSS-A and the ADSS-H were examined by correlating the two subscales with levels of anger aroused (assessed by asking how angry they would be in each situation) in response to the two types of driving situations. The results revealed that the two subscales were significantly correlated with levels of anger aroused. The ADSS-A was also significantly correlated with the ADSS-H.

Discussion

The results of the pilot study demonstrated that both the ADSS-A and the ADSS-H had adequate reliability and validity (construct and criterion). The ADSS-A and the ADSS-H were also significantly related to one another. The magnitude of this correlation indicated that the subscales were related but distinct.

Table 2

Intercorrelations among the ADSS subscales, Anger Arousal, and AGSS subscales: Pilot Study

	ADSS-A	ADSS-H	AGSS-A
ADSS-H	.56		
AGSS-A	.51	.37	
AGSS-H	.51	.54	.73
ANGER	.53	.38	

Note. N=60. ADSS-A=Attributions in Driving Situations Scale – Ambiguous; ADSS-H=Attributions in Driving Situations Scale – Hostile; AGSS-A=Attributions in General Situations Scale – Ambiguous; AGSS-H=Attributions in General Situations Scale – Hostile; ANGER= Level of anger aroused in each driving situation.

All $r_s > .38$, $p < .001$.

Level of anger aroused in general situations was not assessed.

Interestingly, the correlation of the ADSS-A and the AGSS-A, and the correlation of the ADSS-A and the AGSS-H were of the same magnitude. It may be that individuals who have higher levels of hostile attributional biases in ambiguous situations (driving and general) also have higher levels of biases even in clearly hostile situations. This is consistent with Epps and Kendall (1995) who found that aggressive individuals had biases in both hostile and ambiguous general situations.

Although the psychometric properties of the ADSS-A and the ADSS-H suggest that the two subscales are promising, more research examining the psychometric properties with larger samples is required for the development of these subscales. The pilot study represents the first stage in the development of the ADSS-A and the ADSS-H.

Main Study

Method

Participants

Participants were 218 students (109 males and 109 females) attending Carleton University who volunteered to take part in a study on driving anger and roadway aggression as partial fulfillment of a research requirement for an Introductory Psychology class. These students had indicated that they had driven a motor vehicle in the three month time period prior to the study. The mean age for the sample was 20.10 years of age ($SD=3.72$). The participants ranged in age from 17 to 45.

Scales

(1) Driving Anger Scale (DAS) (Deffenbacher et al., 1994) (see Appendix F). The DAS is a 14-item scale on which participants are asked to imagine that each situation described was actually happening to them and then to rate the amount of anger that would be provoked on a 5-point Likert-type scale (1=not at all to 5=very much). The 14-item DAS forms a unidimensional measure of driving anger and correlates highly ($r=.95$) with the 33-item long-form (Deffenbacher et al., 1994). Acceptable Cronbach's alphas for the 14-item DAS have been reported ranging from .80 to .88 (Antonowicz & Gabor, 1999; Antonowicz & Valliant, 1998; Deffenbacher et al., 1994). In terms of validity, Lynch, Deffenbacher, and Huff (1998) found that the DAS discriminated high- from low-driving anger

groups. The high-driving anger group experienced greater anger reactivity to a wide range of driving-related situations, and logs of driving emotion and behavior revealed that they were more intensely and frequently angered than the low-anger group. No gender differences were uncovered in studies that examined the DAS (Antonowicz & Gabor, 1999; Antonowicz & Valliant, 1998; Deffenbacher et al., 1994).

(2) Trait Anger Scale (TAS) (Spielberger, 1988) (see Appendix G).

The TAS is a 10-item scale on which participants rate on a 4-point Likert-type scale how angry they are in general (1=almost never to 4=almost always). TAS coefficient alpha reliabilities range from .81 to .91 and two-week test-retest reliabilities range from .70 - .77 (Jacobs, Latham, & Brown, 1988; Spielberger, 1988). There is evidence of construct validity for the TAS reflected in positive correlations with a wide variety of anger and hostility measures such as the Buss-Durkee Hostility Inventory and with various state anger measures (Deffenbacher, 1992; Deffenbacher, Oetting, Thwaites et al., 1996; Spielberger, 1988) and its successful discrimination of high from low anger groups (Deffenbacher, Demm, & Brandon, 1986; Deffenbacher, Oetting, Thwaites et al., 1996). No gender differences were reported (Spielberger, 1988).

(3) Attributions in Driving Situations Scale. A detailed description of this scale was provided in the pilot study.

(4) Attributions in General Situations Scale. A detailed description of this scale was provided in the pilot study.

(5) Barratt Impulsiveness Scale-Version 11 (BIS-11) (Patton, Stanford, & Barratt, 1995) (see Appendix H). The BIS-11 is a 30-item scale on which participants rate statements reflecting impulsive tendencies on a 4-point Likert-type scale (1=rarely/never to 4=almost always/always). The scale yields a total score and has acceptable reliability ($\alpha=.82$). Validity for this scale has been demonstrated through laboratory studies on perceptual motor tasks (see Barratt, 1994). No gender differences were found by Patton et al. (1995).

(6) Paulhus Deception Scales (PDS) (Paulhus, 1999) (see Appendix I). The PDS is a 40-item self-report instrument intended to assess socially desirable responding. The PDS is a two-factor scale comprised of Impression Management (IM), the purposeful attempt to impress others by responding in a socially desirable way, and Self-Deceptive Enhancement (SDE), the tendency to unconsciously distort self-reports in an exaggeratedly positive manner. Each of the subscales is comprised of 20 items with each item rated on a 7-point Likert-type scale according to the extent to which the participant agrees with it (1=Not true, 4=Somewhat true, 7=Very true). In terms of reliability, Paulhus (1991) reports a coefficient alpha of .83 for the entire scale. For the Impression Management factor and for the Self-Deceptive factor, coefficient alphas

range from .68 to .80 and .75 to .86 respectively (Paulhus, 1991).

Paulhus (1991) found test-retest correlation for the Impression Management factor equal to .65 and for the Self-Deceptive factor to be equal to .69. This scale has also been shown to have validity through correlations with the Marlowe-Crowne Scale (Crowne & Marlowe, 1960). The Self-Deceptive factor is positively correlated with other traditional measures of defense and coping, and the Impression Management factor is positively correlated with traditional "lie scales" and role-playing measures (Paulhus, 1991). For the purposes of the present study, subscale scores for both the Impression Management and Self-Deceptive Enhancement subscales were employed.

(7) Driving Vengeance Questionnaire (DVQ) (Wiesenthal et al., 2000) (see Appendix J). The DVQ is a 15-item scale on which participants are asked to indicate the level of aggressiveness they would most likely respond with in common driving situations in which they might be irritated by another driver. Four response choices are provided for each item along with an option for an alternative response. The DVQ has adequate internal consistency ($\alpha=.83$) and construct validity (Wiesenthal et al., 2000). Males were found to be more aggressive than females and younger drivers were more aggressive than older drivers.

(8) Driving Anger Expression Inventory (DAEI) (Deffenbacher, 1997) (see Appendix K). The DAEI is a 61-item scale on which participants are

asked to rate how often they generally react or behave in the manner described when they are angry or furious while driving on a 4-point Likert-type scale (1=almost never to 4=almost always). The DAEI consists of 12 subscales. Six subscales pertain to negative, destructive forms of driving anger expression toward other drivers: (1) 7-item Revenge (e.g., I think about revenge or I try to scare the other driver) ($\alpha=.86$); (2) 10-item Aggressive Endangerment (e.g., I drive right up on the other driver's bumper or I speed up to frustrate the other driver) ($\alpha=.88$); (3) 4-item Hostile Gestures (e.g., I give the other driver the finger) ($\alpha=.85$); (4) 5-item Overt Verbal Aggression (e.g., I swear at the other driver aloud) ($\alpha=.92$); (5) 6-item Covert Verbal Aggression (e.g., I call the other driver names under my breath) ($\alpha=.90$); and (6) 4-item Nonverbal Disapproval (e.g., I give the other driver a dirty look) ($\alpha=.83$). Four subscales reflected positive, constructive ways of expressing anger: (7) 2-item Increased Attention (e.g., I pay even closer attention to being a safe driver) ($\alpha=.80$); (8) 10-item Cognitive Reframing, Acceptance, and Problem-solving (e.g., I tell myself it's not worth getting all mad about or I try to think of positive solutions to deal with the situation) ($\alpha=.91$); (9) 4-item Cognitive Distraction (e.g., I think about things that distract me from thinking about the other driver or I turn on the radio or music to calm down) ($\alpha=.75$); and (10) 3-item Active Disengagement (e.g., I back off to get away from trouble) ($\alpha=.82$). The last two subscales tapped (11) 3-item Anger

Suppression (e.g., I hide my angry feelings from others) ($\alpha=.83$), and (12) 3-item Displaced Aggression (e.g., I take my anger out on other people riding with me) ($\alpha=.60$). There is some evidence of convergent and discriminant validity for the subscales of this instrument (Deffenbacher, 1997). The six negative forms of anger expression toward other drivers correlated positively with each other (r s from .30 to .65) and with driving anger (r s of .28 to .52). The four constructive forms of driving anger were positively correlated with each other (r s of .16 to .44), but only Cognitive Reframing, Acceptance and Problem-solving correlated with driving anger ($r=-.32$). Anger Suppression and Displaced Aggression tended not to be highly correlated with other forms of expression. Negative forms of expression all correlated positively with 3 month frequencies of aggressive driving behavior (r s of .31 to .50) and of risky driving behavior (r s of .22 to .60) with similar but somewhat smaller correlations found between these forms of expression and the intensity of anger, aggressive behavior, and risky behavior in daily driving as indicated on an anger log. No data was presented on gender effects. For the purposes of the present study, the six subscales pertaining to negative expression of driving anger with the exception of Nonverbal Disapproval were combined to yield a composite measure (i.e., Negative Driving Anger Expression Scale (NDAEXPS)). Furthermore, two of the four subscales concerning positive expression of driving anger (i.e., Cognitive Reframing,

Acceptance, and Problem-solving; and Cognitive Distraction) were combined to yield a composite measure of driving anger coping. This scale was named the Driving Anger Coping Scale (DACS).

(9) Roadway Aggression Scale (RAS) (see Appendix L). This is an 11-item measure adapted and revised from Deffenbacher (1996) by the writer on which participants are asked to indicate the frequency (0-5+) of various manifestations of roadway aggression (e.g., physical fights, hostile gestures) in the past three months. A total score was generated for the scale based on eight of these 11 items. Three questions were excluded from the total score given that they were anger-related and would have created a confound with the anger predictors. In addition, there are questions pertaining to the number of kilometres driven in the past three months, and whether most of this driving occurred in urban versus rural settings and whether they commonly drove during rush-hour traffic.

Procedure

In the main study, mass testing was also used to identify Introductory Psychology students meeting the criterion of having driven in the past three months. Once students had been identified through mass testing, they were recruited by telephone to participate in the study (see Appendix M).

Students from the pilot study did not participate in the main study. Participants were tested individually or in small groups by the writer in a seminar room on the university campus and were required to give their informed consent (see Appendix N). Students were asked to complete a number of self-report questionnaires that took approximately 50 minutes. In order to prevent any test sequencing effects there were four randomized orders of the questionnaires. Following testing, students were debriefed regarding the purpose of the study (see Appendix O).

Design

The present study employed a recursive path analysis. Comparisons were made between male and female university students in accordance with the hypotheses.

Results

Data screening procedures were conducted separately for males and females since gender differences on roadway aggression were hypothesized. Missing values were dealt with first as recommended by Tabachnick and Fidell (1989). As a standard, if more than 10% but less than 15% of the cases for a particular scale were missing then the items that were missing were then replaced by the average for the group (i.e., males or females) for that item. However, if more than 15% of items in a scale for a particular case were missing then none of the items were replaced by the mean. Frequency analyses revealed that only kilometres driven in the past three months for females had more than 10% of data missing. A decision was then made to replace the missing values for all scales for both males and females as long as there was not more than 15% of items missing in a specific scale for a particular case.

Skewness and kurtosis analyses revealed that kilometres driven in the previous three months had skewness and kurtosis issues for both males and females. A log transformation was then performed on this variable for both groups. Subsequent skewness and kurtosis analyses revealed that they were within acceptable limits.

The next step was to cross-validate the ADSS in the main study. As shown in Table 3, adequate internal consistencies were found for both the ADSS-A and the ADSS-H subscales. Table 3 further lists the internal

Table 3

Internal Consistencies of Scales in Main Study: Overall Sample

Scale	Cronbach's Alpha
Driving Anger Scale	.83
Attributions in Driving Situations Scale	
Ambiguous	.74
Hostile	.77
Trait Anger Scale	.83
Attributions in General Situations Scale	
Ambiguous	.61
Hostile	.68
Barratt Impulsiveness Scale	.84
Driving Anger Coping Scale	.89
Negative Driving Anger Expression Scale	.92
Driving Vengeance Questionnaire	.79
Roadway Aggression Scale	.73
Paulhus Deception Scales	
Impression Management	.83
Self-Deceptive Enhancement	.69

consistencies for all the scales employed in the main study; all scales were found to be within acceptable limits. As can be seen, the AGSS-A scale had a somewhat low level of internal consistency.

In terms of the cross-validation of the ADSS-A and ADSS-H, both these subscales were significantly correlated with the AGSS-A and the AGSS-H, respectively, and with levels of anger aroused in response to driving situations (see Table 4). These correlations provide support for the construct and criterion validities of these two subscales, respectively. In addition, the ADSS-A was significantly correlated with the ADSS-H ($r=.39$) which indicates that the subscales are related but distinct. These results replicated the findings of the pilot study.

Table 4

Intercorrelations among the ADSS subscales, Anger Arousal, and AGSSSubscales-Cross-Validation in Main Study

	ADSS-A	ADSS-H	AGSS-A
ADSS-H	.39		
AGSS-A	.58	.34	
AGSS-H	.55	.40	.65
ANGER	.56	.57	

Note. Ns range from 215 to 218. ADSS-A=Attributions in Driving Situations Scale – Ambiguous; ADSS-H=Attributions in Driving Situations Scale – Hostile; AGSS-A=Attributions in General Situations Scale – Ambiguous; AGSS-H=Attributions in General Situations Scale – Hostile
ANGER= Level of anger aroused in driving situations.

All $p < .0001$.

Level of anger aroused in general situations was not assessed.

Prior to examining the hypotheses delineated earlier, two non-hypothesized comparisons were examined. First of all, participants who regularly drive during rush hour were compared to their counterparts who did not drive regularly at these times on all driving-related measures. The family-wise error rate for the one-way ANOVAs was held at .05 by testing each comparison at the $.05/7 = .0071$ level. Separate analyses were conducted for males and females. The results revealed that there were differences on the following measures for males: NDAEXPS $F(1, 106) = 11.95, p < .001$; and the RAS $F(1, 106) = 14.79, p < .001$. This indicates that males who regularly drive during rush hour traffic engaged in higher levels of roadway aggression as measured by the NDAEXPS and the RAS compared to their male counterparts who did not regularly drive during these times. No differences, however, were found for females.

The second non-hypothesized comparison concerned whether there are differences between participants who primarily drive in urban versus rural settings on any of the driving-related measures. The family-wise error rate for the one-way ANOVAs was held at .05 once again by testing each comparison at the $.05/7 = .0071$ level. The results indicated that there were no differences for males or females.

In order to test the first hypothesis (Hypothesis 1) that there would be gender differences on all three measures of roadway aggression (i.e., RAS, DVQ, and NDAEXPS) a series of one-way ANOVAs was conducted.

The family-wise error rate for the one-way ANOVAs was held at .05 by testing each comparison at the $.05/16=.0031$ level. Although no specific hypotheses were made regarding gender differences on all other variables, they were also examined. The results revealed that there was only a gender difference on one measure of roadway aggression: the DVQ $F(1, 216)=13.51, p<.001$. As indicated by the results, males had significantly higher levels of roadway aggression as measured by the DVQ.

Means and standard deviations for all measures are reported separately for males and females in Table 5. Table 6 presents the percentage of males and females that engaged in each of the 11 types of roadway aggression that comprise the RAS. In order to test whether there were significant gender differences on the 11 types of roadway aggression, 11 chi-squares were computed. The family-wise error rate for the chi-squares was held at .05 by testing each comparison at the $.05/11=.0045$ level. The results revealed that no significant differences emerged. A review of the actual percentages indicated that a higher percentage of males engaged in 10 of the 11 different types of roadway aggression; females only had higher rates of making hostile or rude gestures. Of note, no female and only one male indicated that they had been involved in a physical fight with another driver.

Table 5

Means and Standard Deviations of all Scales in Main Study by Gender

	Male		Female	
	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>
ADSS-A	26.60	8.92	26.69	9.10
ADSS-H	46.99	6.48	46.66	6.51
DAS	43.44	9.35	45.51	8.23
DACS	32.03	8.65	33.93	7.48
AGSS-A	26.64	7.20	26.15	7.01
AGSS-H	28.80	8.48	26.99	6.60
TAS	21.24	5.70	21.37	5.09
BIS-11	64.49	11.15	64.27	10.49
DVQ	44.94	7.96	41.40	6.15
RAS	3.71	2.12	2.60	1.84
NDAEXPS	60.81	15.56	56.24	12.11
KM 3 MONS.	2974.86	5616.03	1867.69	5259.14
PDS-SDE	87.55	13.26	83.12	11.62
PDS-IM	70.57	19.22	73.54	17.85

Note. ns range from 106 to 109. ADSS-A=Attributions in Driving

Situations Scale – Ambiguous; ADSS-H=Attributions in Driving Situations

Continued

Scale – Hostile; DAS= Driving Anger Scale; DACS=Driving Anger Coping Scale; AGSS-A=Attributions in General Situations Scale – Ambiguous; AGSS-H=Attributions in General Situations Scale – Hostile; TAS=Trait Anger Scale; BIS-11=Barratt's Impulsiveness Scale; DVQ=Driving Vengeance Questionnaire; RAS=Roadway Aggression Scale; NDAEXPS=Negative Driving Anger Expression Scale; KM= Kilometres driven in past 3 months; PDS-IM=Paulhus Deception Scales-Impression Management; PDS-SDE=Paulhus Deception Scales-Self-Deceptive Enhancement.

Table 6

Percentage of Males and Females Engaging in the 11 Types of Roadway Aggression

Roadway Aggression Type	Males (%) ($n=109$)	Females (%) ($n=109$)	χ^2
Verbal argument	26	13	5.78
Physical fight	1	0	-
Hostile or rude gesture	66	68	0.08
Flashed headlights	49	41	1.19
Honked horn	74	73	0.02
Yelled	42	34	1.58
Tailgated	46	36	2.30
Deliberately cut off driver	24	17	1.37
Chased driver	27	12	7.55
Blocked or obstructed	39	22	7.04
Swore out loud	74	70	0.57

Note: None of the chi-squares were found to be significant.

Table 7 and 8 present the intercorrelations among items on the RAS for males and females, respectively. The family-wise error rate for the intercorrelations of the 11 items of the RAS was held at .05 by testing each correlation at the $.05/55=.0009$ level for males and at the $.05/45=.0011$ for females. There were fewer correlations calculated for females since no female reported being involved in a physical fight with another driver. Only one male was involved in a physical fight but correlations were still computed. The results revealed that being involved in a physical fight was not correlated with any of the other behaviors. A number of behaviors were correlated with each other and in the expected directions for males and females, respectively.

The next series of analyses examined the extent that measures in the present study were contaminated by social desirability. The influence of social desirability in responding was examined by correlating each measure with the PDS-IM and PDS-SDE scales for males and for females, respectively. The family-wise error rate for the correlations was held at .05 by testing each comparison at the $.05/11=.0045$ level. Social desirability contamination was found for a number of measures thus

Table 7

Intercorrelations among RAS items for Males

	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11
R1	.16	.33	.18	.25	.52	.13	.21	.26	.31	.25
R2	--	.07	.10	.06	.11	-.09	.17	.16	.12	.06
R3		--	.23	.29	.46	.31	.27	.26	.33	.51
R4			--	.45	.25	.50	.32	.25	.36	.15
R5				--	.21	.20	.28	.26	.25	.28
R6					--	.29	.26	.33	.32	.42
R7						--	.39	.32	.29	.29
R8							--	.44	.31	.18
R9								--	.25	.21
R10									--	.25

Note. $n=109$. R1 through R11 represent the 11 items of the Roadway Aggression Scale. R1= Verbal argument; R2=Physical Fight; R3=Hostile or rude gesture; R4=Flashed headlights in anger; R5=Honked horn in annoyance; R6=Yelled; R7=Tailgated; R8=Cut of driver; R9=Chased another driver who annoyed you; R10=Blocked or obstructed another driver; R11=Swore.

$r > .30$, $p < .0009$.

Table 8

Intercorrelations among RAS items for Females

	R3	R4	R5	R6	R7	R8	R9	R10	R11
R1	.26	.29	.11	.19	.17	.19	.03	.06	.01
R3	--	.42	.43	.37	.43	.26	.13	.18	.32
R4		--	.29	.15	.31	.25	.27	.14	.15
R5			--	.26	.23	.17	.16	.22	.15
R6				--	.35	.23	.16	.18	.30
R7					--	.52	.38	.44	.16
R8						--	.35	.57	.09
R9							--	.42	.12
R10								--	.11

Note. $n=109$. R1 through R11 represent the 11 items of the Roadway Aggression Scale. R1= Verbal argument; R2=Physical Fight; R3=Hostile or rude gesture; R4=Flashed headlights in anger; R5=Honked horn in annoyance; R6=Yelled; R7=Tailgated; R8=Cut off driver; R9=Chased another driver who annoyed you; R10=Blocked or obstructed another driver; R11=Swore.

R2 – Not included since all females responded that they had not been involved in a physical fight with another driver.

$r>.29$; $p<.0011$.

necessitating that subsequent analyses control for social desirability on those measures that were influenced. Furthermore, driving exposure (i.e., number of kilometres driven in the past three months) was also examined to assess the extent that it may influence driving measures. The family-wise error rate for the correlations was held at .05 by testing each comparison at the $.05/7=.0071$ level. The measures influenced by kilometres driven required that subsequent analyses control for kilometres driven. Residuals were computed via regression analyses for all variables (i.e., independent and dependent variables) that were influenced by the control variables to remove their influence.

Tables 9 and 10 present the partial correlations among predictor variables after partialling out the effects of social desirability and kilometres driven in the past three months. The family-wise error rate for the correlations was held at .05 by testing each comparison at the $.05/28=.0018$ level. Results are presented separately for males and females. For both males and females, the majority of the correlations were significant and in the expected directions. The notable exceptions for males were correlations involving the BIS-11 and the DACS. Neither of these two predictors was significantly correlated with the other predictors. With respect to females, the majority of correlations were significant and in the expected directions. Similar to males, notable

Table 9

Intercorrelations among Predictor Variables after Partialling out ControlVariables for Males

	ADSS-H	DAS	AGSS-A	AGSS-H	TAS	DACS	BIS-11
ADSS-A	.37*	.35*	.59*	.52*	.22	-.11	-.10
ADSS-H	--	.37*	.30	.35*	.17	-.28	-.15
DAS		--	.38*	.35*	.36*	-.27	-.21
AGSS-A			--	.61*	.46*	-.07	-.07
AGSS-H				--	.42*	-.05	-.16
TAS					--	-.15	-.13
DACS						--	-.02

Note. *ns* range from 106 to 109. ADSS-A=Attributions in Driving

Situations Scale – Ambiguous; ADSS-H=Attributions in Driving Situations

Scale – Hostile; DAS=Driving Anger Scale; AGSS-A=Attributions in

General Situations Scale – Ambiguous; AGSS-H=Attributions in General

Situations Scale – Hostile; TAS=Trait Anger Scale; DACS=Driving Anger

Coping Scale; BIS-11=Barratt's Impulsiveness Scale.

* $p < .0018$

Table 10

Intercorrelations among Predictor Variables after Partialling out ControlVariables for Females

	ADSS-H	DAS	AGSS-A	AGSS-H	TAS	DACS	BIS-11
ADSS-A	.35*	.38*	.57*	.55*	.21	-.15	.19
ADSS-H	--	.36*	.32*	.37*	.20	-.18	.06
DAS		--	.36*	.26	.38*	-.26	.14
AGSS-A			--	.67*	.21	-.29	.04
AGSS-H				--	.20	-.10	-.02
TAS					--	-.28	-.05
DACS						--	-.17

Note. ns range from 108 to 109. ADSS-A=Attributions in Driving

Situations Scale–Ambiguous; ADSS-H=Attributions in Driving Situations

Scale–Hostile; DAS=Driving Anger Scale; AGSS-A=Attributions in

General Situations Scale–Ambiguous; AGSS-H=Attributions in General

Situations Scale–Hostile; TAS=Trait Anger Scale; DACS=Driving Anger

Coping Scale; BIS-11=Barratt's Impulsiveness Scale.

* $p < .0018$

exceptions were that the BIS-11 and the DACS were not significantly correlated with any of the other predictor variables. In addition, the TAS was only significantly correlated with the DAS.

Correlations between the two roadway aggression measures (i.e., RAS and DVQ) were also computed. The results revealed that for both males and females the two measures were significantly correlated ($r=.52$, $p<.001$; $r=.62$, $p<.001$, respectively).

Correlations were then computed between predictor variables and roadway aggression measures (i.e., RAS and DVQ). The correlations between predictor variables and roadway aggression, partialling out the effects of social desirability and driving exposure, are presented for males and females in Tables 11 through 14. The family-wise error rate for the correlations involving the PDS-IM and the PDS-SDE were held at .05 by testing each comparison at the $.05/11=.0045$ level. In terms of the correlations involving kilometres driven in the previous three months, they were tested at $.05/7=.0071$ level. Lastly, the family-wise error rate for the correlations involving the RAS and the DVQ were held at $.05/8=.0063$ level.

As indicated in Table 11, roadway aggression (as measured by the RAS) for males was only significantly correlated with two of the four driving variables: the DAS and the DACS. In addition, Table 11 also shows that roadway aggression (as measured by the RAS) was

Table 11

Correlations between all Measures, RAS, and Control Variables for Males

	RAS	PDS-IM	PDS-SDE	Km Driven
	<i>r</i>	<i>r</i>	<i>r</i>	<i>r</i>
Control Variables				
PDS-IM	-.45*			
PDS-SDE	-.07			
Km Driven	.41*			
Driving Variables				
ADSS-A	.05	-.14	-.20*	.09
ADSS-H	.23	-.31*	-.31*	.27*
DAS	.38*	-.35*	-.31*	.13
DACS	-.32*	.32*	.18	-.38*
General				
AGSS-A	.30*	-.19	-.21	
AGSS-H	.32*	-.15	-.31*	
TAS	.52*	-.53*	-.38*	
BIS-11	-.12	-.57*	-.54*	

Note. *ns* range from 106 to 109. RAS=Roadway Aggression Scale; PDS-IM=Paulhus Deception Scales-Impression Management; PDS-

Continued

SDE=Paulhus Deception Scales-Self-Deceptive Enhancement;
 ADSS-A=Attributions in Driving Situations Scale–Ambiguous; ADSS-H=Attributions in Driving Situations Scale–Hostile; DAS= Driving Anger Scale; DACS=Driving Anger Coping Scale; AGSS-A=Attributions in General Situations Scale–Ambiguous; AGSS-H=Attributions in General Situations Scale–Hostile; TAS=Trait Anger Scale; BIS-11=Barratt's Impulsiveness Scale.

All correlations involving the PDS-IM and the PDE-SDE were tested at $*p < .0045$. All correlations involving kilometres driven in the previous three months were tested at $*p < .0071$. The correlations between the RAS and the driving and general variables were tested at $*p < .0063$.

Table 12

Correlations between all Measures, RAS, and Control Variables for Females

	RAS	PDS-IM	PDS-SDE	Km Driven
	<i>r</i>	<i>r</i>	<i>r</i>	<i>r</i>
Control Variables				
PDS-IM	-.26			
PDS-SDE	.04			
Km Driven	.19			
Driving Variables				
ADSS-A	.30*	-.18	-.12	-.10
ADSS-H	.23	-.15	-.00	-.03
DAS	.36*	-.13	-.03	.13
DACS	-.47*	.38*	.30*	-.09
General				
AGSS-A	.35*	-.23	.03	
AGSS-H	.21	-.22	-.10	
TAS	.45*	-.33*	-.19	
BIS-11	.18	-.41*	-.44*	

Note. ns range from 108 to 109. RAS=Roadway Aggression Scale; PDS-IM=Paulhus Deception Scales-Impression Management; PDS-

Continued

SDE=Paulhus Deception Scales-Self-Deceptive Enhancement; ADSS-A=Attributions in Driving Situations Scale–Ambiguous; ADSS-H=Attributions in Driving Situations Scale–Hostile; DAS= Driving Anger Scale; DACS=Driving Anger Coping Scale; AGSS-A=Attributions in General Situations Scale–Ambiguous; AGSS-H=Attributions in General Situations Scale–Hostile; TAS=Trait Anger Scale; BIS-11=Barratt's Impulsiveness Scale.

All correlations involving the PDS-IM and the PDE-SDE were tested at $*p < .0045$. All correlations involving kilometres driven in the previous three months were tested at $*p < .0071$. The correlations between the RAS and the driving and general variables were tested at $*p < .0063$.

Table 13

Correlations between all Measures, DVQ and Control Variables for Males

	DVQ	PDS-IM	PDS-SDE	Km Driven
	r	r	r	r
Control Variables				
PDS-IM	-.42*			
PDS-SDE	-.22			
Km Driven	.37*			
Driving Variables				
ADSS-A	.33*	-.14	-.20	.09
ADSS-H	.27*	-.31*	-.31*	.27*
DAS	.38*	-.35*	-.31*	.13
DACS	-.44*	.32*	.18	-.38*
General				
AGSS-A	.33*	-.19	-.21	
AGSS-H	.30*	-.15	-.31*	
TAS	.31*	-.53*	-.38*	
BIS-11	.11	-.57*	-.54*	

Note. ns range from 106 to 109. DVQ=Driving Vengeance

Questionnaire; PDS-IM=Paulhus Deception Scales-Impression

Continued

Management; PDS-SDE=Paulhus Deception Scales-Self-Deceptive Enhancement; ADSS-A=Attributions in Driving Situations Scale–Ambiguous; ADSS-H=Attributions in Driving Situations Scale–Hostile; DAS= Driving Anger Scale; DACS=Driving Anger Coping Scale; AGSS-A=Attributions in General Situations Scale–Ambiguous; AGSS-H=Attributions in General Situations Scale – Hostile; TAS=Trait Anger Scale; BIS-11=Barratt's Impulsiveness Scale.

All correlations involving the PDS-IM and the PDE-SDE were tested at $*p < .0045$. All correlations involving kilometres driven in the previous three months were tested at $*p < .0071$. The correlations between the DVQ and the driving and general variables were tested at $*p < .0063$.

Table 14

Correlations between all Measures, DVQ, and Control Variables for
Females

	DVQ	PDS-IM	PDS-SDE	Km Driven
	r	r	r	r
Control Variables				
PDS-IM	-.35*			
PDS-SDE	-.03			
Km Driven	.07			
Driving Variables				
ADSS-A	.31*	-.18	-.12	-.10
ADSS-H	.21	-.15	-.00	-.03
DAS	.36*	-.13	-.03	.13
DACS	-.48*	.38*	.30*	-.09
General				
AGSS-A	.41*	-.23	.03	
AGSS-H	.32*	-.22	-.10	
TAS	.39*	-.33*	-.19	
BIS-11	.10	-.41*	-.44*	

Note. ns range from 108 to 109. DVQ=Driving Vengeance

Questionnaire; PDS-IM=Paulhus Deception Scales-Impression

Continued

Management; PDS-SDE=Paulhus Deception Scales-Self-Deceptive
Enhancement; ADSS-A=Attributions in Driving Situations Scale–
Ambiguous; ADSS-H=Attributions in Driving Situations
Scale–Hostile; DAS= Driving Anger Scale; DACS=Driving Anger Coping
Scale; AGSS-A=Attributions in General Situations Scale–Ambiguous;
AGSS-H=Attributions in General Situations Scale–Hostile; TAS=Trait
Anger Scale; BIS-11=Barratt's Impulsiveness Scale.

All correlations involving the PDS-IM and the PDE-SDE were tested at
 $*p < .0045$. All correlations involving kilometres driven in the previous
three months were tested at $*p < .0071$. The correlations between the
DVQ and the driving and general variables were tested at $*p < .0063$.

significantly correlated with all general variables with the exception of the BIS-11. In Table 12, roadway aggression (as measured by the RAS) for females was significantly correlated with all driving variables with the exception of the ADSS-H. Furthermore, Table 12 also shows that roadway aggression was only significantly related with the following general variables: the AGSS-A and the TAS. Similar to males, there was no significant relationship between roadway aggression and the BIS-11.

Roadway aggression (as measured by the DVQ) for males was significantly correlated with all of the driving variables and with three of the four of the general variables; the only exception was with the BIS-11 (see Table 13). Furthermore for females, as demonstrated in Table 14, roadway aggression (i.e., DVQ) was significantly correlated with all the driving variables except for the ADSS-H. With respect to general variables, roadway aggression was significantly correlated with all variables except for the BIS-11.

The residuals obtained previously were in turn were used in the multiple regressions that were conducted as part of the path analyses. In order to test Hypotheses 2, 3, 4, 5, 6, and 7 delineated earlier, a series of path analyses was computed. The family-wise error rate for the number of multiple regressions conducted was held at .05 by testing each comparison at the $.05/3=.0167$ level.

In terms of the path analyses, multiple regressions were computed for the overall sample (i.e., males and females). For the first series of multiple regressions, only driving-related variables were included in predicting scores on the RAS and then on the DVQ. Three multiple regressions were computed. First of all, direct effects were examined by regressing the RAS on DACS, DAS, ADSS-A, ADSS-H, gender, setting, and rush-hour. Indirect effects were then examined by regressing the DACS on DAS, ADSS-A, and ADSS-H. Next, the DAS was regressed on the ADSS-A and the ADSS-H.

In the next set of path analyses, indirect effects were examined by regressing the RAS on the general related variables: BIS-11, TAS, AGSS-A, AGSS-H, in addition to gender, setting, and rush-hour. The second regression involved examining the indirect effects of predictors by regressing the BIS-11 on the TAS, AGSS-A, and the AGSS-H. Following this, the TAS was regressed on AGSS-A and the AGSS-H. The NDAEXPS was not used as an outcome measure in the driving and general path analyses since respondents were asked how they would express their anger while driving. This would create a confound given that measures of driving and general anger were being used to predict roadway aggression.

As per Hypothesis 2, it was hypothesized that driving anger coping (i.e., DACS) would have a direct effect on both the RAS and DVQ. This

was supported by the results of this study for both the RAS (standardized coefficient, $\beta = -.27$, $p < .0001$) and the DVQ ($\beta = -.37$, $p < .0001$) (see Figures 4 and 5). Although it was not hypothesized, driving anger (i.e., DAS) had significant direct effects on the RAS ($\beta = .27$, $p < .0001$) and the DVQ ($\beta = .21$, $p < .01$) while hostile attributional biases in ambiguous driving situations had a significant direct effect on the DVQ ($\beta = .20$, $p < .01$).

With respect to Hypothesis 3, it was hypothesized that driving anger (i.e., DAS) would have an indirect effect on measures of roadway aggression via driving anger coping (i.e., DACS). This hypothesis was supported by the results as the DAS emerged as a significant predictor ($\beta = -.25$, $p < .001$) when the DACS was regressed on the DAS, ADSS-A, and ADSS-H.

Figure 4. Results of the path analysis delineating the driving paths found to be statistically significant in predicting roadway aggression as measured by the RAS.

Note. ADSS-A=Attributions in Driving Situations Scale - Ambiguous; Attributions in Driving Situations Scale - Hostile; DAS=Driving Anger Scale; DACS=Driving Anger Coping Scale; RAS=Roadway Aggression Scale.

$p < .0167$

Figure 5. Results of the path analysis delineating the driving paths found to be statistically significant in predicting roadway aggression as measured by the DVQ.

Note. ADSS-A=Attributions in Driving Situations Scale - Ambiguous; Attributions in Driving Situations Scale - Hostile; DAS=Driving Anger Scale; DACS=Driving Anger Coping Scale; DVQ=Driving Vengeance Questionnaire.

p<.0167

In the present study, it was also hypothesized (Hypothesis 4) that hostile attributional biases in driving situations (i.e., ADSS-A and ADSS-H) would have an indirect effect on both measures of roadway aggression via the DAS. The results indicated that the ADSS-A had an indirect effect on the RAS and the DVQ via the DAS ($\beta=.28$, $p<.0001$). In contrast, the ADSS-H did not have an indirect effect on measures of roadway aggression.

The next three Hypotheses (5 through 7) were related to hypothesized general paths leading to roadway aggression. Hypothesis 5 asserted that impulsivity (i.e., BIS-11) would have a direct effect on both measures of roadway aggression. The results revealed that the BIS-11 did not have a direct effect on the RAS and the DVQ. Although they were not hypothesized, general anger (i.e., TAS) had significant direct effects on the RAS ($\beta=.36$, $p<.0001$) and the DVQ ($\beta=.26$, $p<.001$), and gender had a significant direct effect on the RAS ($\beta=.36$, $p<.0167$) (see Figures 6 and 7). Given the abovementioned finding that impulsivity did not have an effect on roadway aggression, Hypothesis 6 becomes moot. Hypothesis 6 indicated that general anger (i.e., TAS) would have an indirect effect on measures of roadway aggression via impulsivity (i.e., BIS-11).

With respect to Hypothesis 7, it was hypothesized that hostile attributional biases in general situations (i.e., AGSS-A and AGSS-H)

would have an indirect effect on measures of roadway aggression via the TAS. The results indicated that the AGSS-A had an indirect effect ($\beta=.32$, $p<.0001$) on roadway aggression via the TAS whereas this was not the case for the AGSS-H.

All non-significant driving and general paths to roadway aggression are outlined in figures presented in the Appendices. Appendices P and Q present the non-significant driving-related paths to roadway aggression while Appendices R and S present the non-significant general paths to roadway aggression.

The last hypothesis (Hypothesis 8) pertained to the notion that driving-specific variables (i.e., hostile attributional biases in driving situations, driving anger, and driving anger coping) would account for incremental variance in measures of roadway aggression (i.e., RAS and DVQ) after the effects of general variables (i.e., hostile attributional

Figure 6. Results of the path analysis delineating the general paths found to be statistically significant in predicting roadway aggression as measured by the RAS.

Note. AGSS-A=Attributions in General Situations Scale - Ambiguous; AGSS-H=Attributions in General Situations Scale - Hostile; TAS=Trait Anger Scale; BIS-11=Barratt's Impulsiveness Scale; RAS=Roadway Aggression Scale.

$p < .0167$

Figure 7. Results of the path analysis delineating the general paths found to be statistically significant in predicting roadway aggression as measured by the DVQ.

Note. AGSS-A=Attributions in General Situations Scale - Ambiguous; AGSS-H=Attributions in General Situations Scale - Hostile; TAS=Trait Anger Scale; BIS-11=Barratt's Impulsiveness Scale; DVQ=Driving Vengeance Questionnaire.

$p < .0167$

biases in general situations, general anger, and impulsivity) had been taken into account for males and females, respectively. Four hierarchical multiple regressions were conducted to examine this hypothesis. Another four hierarchical multiple regressions were conducted to examine the incremental value of general variables in predicting roadway aggression after the variance attributable to driving-specific variables had been taken into account. No specific hypothesis was formulated.

For males, the results revealed that the incremental variance accounted for by driving variables in each measure of roadway aggression after the set of general variables was entered first was significant (see Tables 15 and 16): RAS F change (4,97)=5.022, $p<.001$; DVQ F change(4,97)=6.766, $p<.0001$. This was also the case for females (see Tables 17 and 18): RAS F change (4,99)=3.299, $p<.014$; DVQ F change(4,99)=6.262, $p<.0001$.

For males, the incremental variance accounted for by general variables after driving variables had been entered into the regression for predicting the RAS was significant but this was not the case for the DVQ (see Tables 19 and 20): RAS F change (4,97)=6.392, $p<.0001$. Similar results were obtained for females (see Tables 21 and 22): RAS F change (4,99)=3.339, $p<.05$.

Table 15

Summary of Hierarchical Regression Analysis for Driving and General
Variables Predicting RAS in Males: General Variables Entered First

Variable	<u>B</u>	<u>SE B</u>	β
Step 1			
AGSS-A	.01	.11	.01
AGSS-H	.10	.09	.12
TAS	.68	.15	.45*
BIS-11	-.03	.08	-.04
Model $F(4,101)=9.820$, $p<.0001$			
Step 2			
AGSS-A	.06	.11	.07
AGSS-H	.12	.09	.14
TAS	.53	.14	.35*
BIS-11	-.02	.07	-.03
ADSS-A	-.18	.08	-.22*
ADSS-H	.08	.11	.07
DAS	.16	.08	.19*
DACS	-.20	.08	-.22*
Model $F(8,97)=8.203$, $p<.0001$			

Continued

Note. AGSS-A=Attributions in General Situations Scale–Ambiguous; AGSS-H=Attributions in General Situations Scale–Hostile; TAS=Trait Anger Scale; BIS-11=Barratt's Impulsiveness Scale; ADSS-A=Attributions in Driving Situations Scale– Ambiguous; ADSS-H=Attributions in Driving Situations Scale–Hostile; DAS=Driving Anger Scale; DACS=Driving Anger Coping Scale; RAS=Roadway Aggression Scale.

$R^2 = .28$ for Step 1; $\Delta R^2 = .12$ for Step 2 ($ps < .001$).

* $p < .05$

Table 16

Summary of Hierarchical Regression Analysis for Driving and General
Variables Predicting DVQ in Males: General Variables Entered First

Variable	<u>B</u>	<u>SE B</u>	β
Step 1			
AGSS-A	.14	.11	.15
AGSS-H	.12	.10	.14
TAS	.34	.15	.23*
BIS-11	.15	.08	.18
Model $F(4,101)=5.922$, $p<.0001$			
Step 2			
AGSS-A	.06	.11	.07
AGSS-H	.08	.09	.09
TAS	.20	.14	.13
BIS-11	.16	.07	.18*
ADSS-A	.09	.08	.11
ADSS-H	.03	.11	.02
DAS	.14	.08	.17
DACS	-.30	.08	-.34*
Model $F(8,97)=7.020$, $p<.0001$			

Continued

Note. AGSS-A=Attributions in General Situations Scale–Ambiguous;
 AGSS-H=Attributions in General Situations Scale–Hostile; TAS=Trait
 Anger Scale; BIS-11=Barratt's Impulsiveness Scale; ADSS-A=Attributions
 in Driving Situations Scale– Ambiguous; ADSS-H=Attributions in Driving
 Situations Scale–Hostile; DAS=Driving Anger Scale; DACS=Driving
 Anger Coping Scale; DVQ=Driving Vengeance Questionnaire.

$\underline{R}^2 = .19$ for Step 1; $\Delta \underline{R}^2 = .18$ for Step 2 ($ps < .001$).

* $p < .05$

Table 17

Summary of Hierarchical Regression Analysis for Driving and General
Variables Predicting RAS in Females: General Variables Entered First

Variable	<u>B</u>	<u>SE B</u>	β
Step 1			
AGSS-A	.25	.09	.30*
AGSS-H	-.05	.10	-.06
TAS	.50	.10	.41*
BIS-11	.12	.05	.18*
Model $F(4,103)=11.339$, $p<.0001$			
Step 2			
AGSS-A	.12	.10	.15
AGSS-H	-.04	.10	-.04
TAS	.37	.11	.30*
BIS-11	.07	.05	.11
ADSS-A	.06	.07	.09
ADSS-H	.03	.08	.03
DAS	.05	.07	.07
DACS	-.25	.08	-.29*
Model $F(4,101)=7.825$, $p<.0001$			

Continued

Note. AGSS-A=Attributions in General Situations Scale–Ambiguous;
 AGSS-H=Attributions in General Situations Scale–Hostile; TAS=Trait
 Anger Scale; BIS-11=Barratt's Impulsiveness Scale; ADSS-A=Attributions
 in Driving Situations Scale– Ambiguous; ADSS-H=Attributions in Driving
 Situations Scale–Hostile; DAS=Driving Anger Scale; DACS=Driving
 Anger Coping Scale; RAS=Roadway Aggression Scale.

$R^2 = .31$ for Step 1; $\Delta R^2 = .08$ for Step 2 ($ps < .05$).

* $p < .05$

Table 18

Summary of Hierarchical Regression Analysis for Driving and General
Variables Predicting DVQ in Females: General Variables Entered First

Variable	<u>B</u>	<u>SE B</u>	β
Step 1			
AGSS-A	.25	.09	.31*
AGSS-H	.04	.10	.05
TAS	.39	.10	.32*
BIS-11	.07	.05	.10
Model $F(4,103)=9.912$, $p<.0001$			
Step 2			
AGSS-A	.10	.09	.12
AGSS-H	.10	.10	.12
TAS	.19	.10	.16
BIS-11	.08	.05	.01
ADSS-A	.04	.07	.01
ADSS-H	-.05	.08	-.06
DAS	.18	.06	.26*
DACS	-.28	.07	-.33*
Model $F(8,99)=9.100$, $p<.0001$			

Continued

Note. AGSS-A=Attributions in General Situations Scale–Ambiguous; AGSS-H=Attributions in General Situations Scale–Hostile; TAS=Trait Anger Scale; BIS-11=Barratt's Impulsiveness Scale; ADSS-A=Attributions in Driving Situations Scale– Ambiguous; ADSS-H=Attributions in Driving Situations Scale–Hostile; DAS=Driving Anger Scale; DACS=Driving Anger Coping Scale; DVQ=Driving Vengeance Questionnaire.

$R^2 = .28$ for Step 1; $\Delta R^2 = .15$ for Step 2 ($ps < .001$).

* $p < .05$

Table 19

Summary of Hierarchical Regression Analysis for Driving and General
Variables Predicting RAS in Males: Driving Variables Entered First

Variable	B	SE B	β
Step 1			
ADSS-A	-.06	.08	-.07
ADSS-H	.11	.12	.10
DAS	.30	.08	.36*
DACS	-.21	.08	-.23*
Model $F(4,101)=8.252$, $p<.0001$			
Step 2			
ADSS-A	-.18	.08	-.22*
ADSS-H	.08	.11	.07
DAS	.16	.08	.19*
DACS	-.20	.08	-.22*
AGSS-A	.06	.11	.07
AGSS-H	.12	.09	.14
TAS	.53	.14	.35*
BIS-11	-.02	.07	-.03
Model $F(8,103)=8.203$, $p<.0001$			

Continued

Note. AGSS-A=Attributions in General Situations Scale—Ambiguous;
 AGSS-H=Attributions in General Situations Scale—Hostile; TAS=Trait
 Anger Scale; BIS-11=Barratt's Impulsiveness Scale; ADSS-A=Attributions
 in Driving Situations Scale— Ambiguous; ADSS-H=Attributions in Driving
 Situations Scale—Hostile; DAS=Driving Anger Scale; DACS=Driving
 Anger Coping Scale; RAS=Roadway Aggression Scale.

$\underline{R}^2 = .25$ for Step 1; $\Delta \underline{R}^2 = .16$ for Step 2 ($p < .001$).

* $p < .05$

Table 20

Summary of Hierarchical Regression Analysis for Driving and General
Variables Predicting DVQ in Males: Driving Variables Entered First

Variable	<u>B</u>	<u>SE B</u>	β
Step 1			
ADSS-A	.16	.07	.20*
ADSS-H	.02	.11	.02
DAS	.17	.08	.21*
DACS	-.32	.08	-.36*
Model $F(4,104)=11.001$, $p<.0001$			
Step 2			
ADSS-A	.09	.08	.11
ADSS-H	.03	.11	.02
DAS	.14	.08	.17
DACS	-.30	.08	-.34*
AGSS-A	.06	.11	.07
AGSS-H	.08	.09	.09
TAS	.20	.14	.13
BIS-11	.16	.07	.18*
Model $F(8,97)=7.020$, $p<.0001$			

Continued

Note. AGSS-A=Attributions in General Situations Scale–Ambiguous;
 AGSS-H=Attributions in General Situations Scale–Hostile; TAS=Trait
 Anger Scale; BIS-11=Barratt's Impulsiveness Scale; ADSS-A=Attributions
 in Driving Situations Scale– Ambiguous; ADSS-H=Attributions in Driving
 Situations Scale–Hostile; DAS=Driving Anger Scale; DACS=Driving
 Anger Coping Scale; DVQ=Driving Vengeance Questionnaire.

$R^2 = .30$ for Step 1; $\Delta R^2 = .06$ for Step 2 ($ps < .10$).

* $p < .05$

Table 21

Summary of Hierarchical Regression Analysis for Driving and General
Variables Predicting RAS in Females: Driving Variables Entered First

Variable	<u>B</u>	<u>SE B</u>	β
Step 1			
ADSS-A	.11	.06	.17
ADSS-H	.03	.08	.04
DAS	.13	.07	.18
DACS	-.34	.07	-.39*
Model $F(4,103)=11.286$, $p<.0001$			
Step 2			
ADSS-A	.06	.07	.09
ADSS-H	.03	.08	.03
DAS	.05	.07	.07
DACS	-.25	.08	-.29*
AGSS-A	.12	.10	.15
AGSS-H	-.04	.10	-.04
TAS	.37	.11	.30*
BIS-11	.07	.05	.11
Model $F(8,99)=7.825$, $p<.0001$			

Continued

Note. AGSS-A=Attributions in General Situations Scale–Ambiguous;
 AGSS-H=Attributions in General Situations Scale–Hostile; TAS=Trait
 Anger Scale; BIS-11=Barratt's Impulsiveness Scale; ADSS-A=Attributions
 in Driving Situations Scale– Ambiguous; ADSS-H=Attributions in Driving
 Situations Scale–Hostile; DAS=Driving Anger Scale; DACS=Driving
 Anger Coping Scale; RAS=Roadway Aggression Scale.

$\underline{R}^2 = .31$ for Step 1; $\Delta \underline{R}^2 = .08$ for Step 2 ($ps < .05$).

* $p < .05$

Table 22

Summary of Hierarchical Regression Analysis for Driving and General
Variables Predicting DVQ in Females: Driving Variables Entered First

Variable	<u>B</u>	<u>SE B</u>	β
Step 1			
ADSS-A	.08	.06	.13
ADSS-H	-.02	.08	-.02
DAS	.23	.06	.33*
DACS	-.33	.07	-.38*
Model $F(4,103)=15.270$, $p<.0001$			
Step 2			
ADSS-A	.04	.07	.01
ADSS-H	-.05	.08	-.06
DAS	.18	.06	.26*
DACS	-.28	.07	-.33*
AGSS-A	.10	.09	.12
AGSS-H	.10	.10	.12
TAS	.19	.10	.16
BIS-11	.08	.05	.01
Model $F(8,99)=9.100$, $p<.0001$			

Continued

Note. AGSS-A=Attributions in General Situations Scale–Ambiguous;
AGSS-H=Attributions in General Situations Scale–Hostile; TAS=Trait
Anger Scale; BIS-11=Barratt's Impulsiveness Scale; ADSS-A=Attributions
in Driving Situations Scale– Ambiguous; ADSS-H=Attributions in Driving
Situations Scale–Hostile; DAS=Driving Anger Scale; DACS=Driving
Anger Coping Scale; DVQ=Driving Vengeance Questionnaire.

$R^2 = .37$ for Step 1; $\Delta R^2 = .05$ for Step 2 ($p < .10$).

* $p < .05$

Discussion

Recent years have witnessed an increased amount of research attention being devoted to roadway aggression. While a few studies have examined the relationship between driving anger and roadway aggression, none of these studies have attempted to examine the process of how anger is aroused and how it leads to or does not lead to roadway aggression. The present study was undertaken to assess the applicability of a modified version of Geen's (1990) model of affective aggression in the study of roadway aggression. The study examined the relationship between hostile attributional biases, anger and roadway aggression in university students. Given the limited research conducted on roadway aggression, it was decided that both driving and general paths to roadway aggression would be investigated via path analysis in order to increase our knowledge base. The driving path entailed examining driving-related variables such as hostile attributional biases in driving situations (ambiguous and hostile), anger while driving, and coping with driving anger. In contrast, the general paths involved examining general variables such as hostile attributional biases in general situations (ambiguous and hostile), general anger, and impulsivity. The roadway aggression prevalence findings from the present study will be compared and contrasted with prior literature, and then the results of the analyses examining each of the hypothesis will be compared to the literature. The

discussion concludes by delineating the limitations of the current study and proposing directions for future research.

Prevalence of Roadway Aggression

Studies on the prevalence of roadway aggression have been conducted which indicate that this type of behavior is not uncommon among drivers. The mild forms of roadway aggression such as hostile gestures and swearing are more common than the so-called "road rage" behaviors. These findings were confirmed in the present study. No female and only one male indicated that they had been involved in a physical fight with another driver in the three month period examined whereas behaviors such as making hostile gestures and swearing out loud were quite common. Some suggest that it is important to investigate the more mild forms of roadway aggression as they may escalate into the more serious forms (Novaco, 1991). In the present study, annoyance-motivated horn honking, considered a mild form of roadway aggression, was only correlated with flashing headlights at another driver in anger in males. This is in contrast to Novaco's findings which found that annoyance-motivated horn honking was correlated with a number of other "low grade" behaviors such as making hostile gestures and verbal abuse in a sample of males and females who were attending traffic law violators school. This discrepancy may stem from the sample examined. Novaco's sample was drawn from a group of individuals that had violated the law.

The rates for the various manifestations of roadway aggression found in the present study for males and females were also examined in comparison to those rates reported in the literature. The rates of physically fighting with another driver were lower in the present study for males compared to some of the studies reviewed. It may be that the shorter time frame employed to assess the behaviors in the present study may have resulted in a lower rate. A longer period may have resulted in higher rates. The rates for females were quite comparable across the literature.

With respect to following or chasing another driver, the percentages for males and females in the present study were identical to those found by Parry (1968) and similar to the rates in other studies. Tailgating was also examined in the present research. The rates for males and females were consistent with those found by Antonowicz and Valliant (1998) while the other studies found much lower rates.

In terms of deliberately cutting other drivers off, the rate in the present study for males was comparable to that found by Antonowicz and Valliant (1998). The rate for females in the present study was somewhat lower in comparison to the abovementioned study while Anderson et al. (1999) found a much lower rate than either of these two studies.

Regarding deliberately obstructing or blocking other drivers, the present study found much higher rates for both males and females than did any of the other studies.

Another behavior that was examined was swearing at other drivers.

The rates for males in the present study were quite comparable to those found by Antonowicz and Valliant (1998) for males. In contrast, the rates for females were somewhat higher in the present study in comparison. The rates in the other studies for males and females were much lower. In terms of obscene/rude gestures, the rates in the current study for males were slightly higher than those found by Antonowicz and Valliant (1998) and much higher for females. Once again, the rates in these two studies were much higher than those found in the other studies.

In terms of flashing headlights in annoyance, the rate for males was comparable to that found by Turner et al. (1975) and slightly higher than in Antonowicz and Valliant (1998). In contrast, the rate for females in the present study was much higher in comparison to that of the other studies.

With respect to horn honking in annoyance, once again the present study and Antonowicz and Valliant (1998) found much higher rates for both males and females compared to the other studies. The present study had similar rates for males but a much higher rate for females compared to Antonowicz and Valliant (1998).

Overall, the prevalence rates in the present study were comparable to the rates found in the literature in some instances. They were most comparable to those found by Antonowicz and Valliant (1998). The results for males were mostly similar but rates for female were higher in the present study for some behaviors compared to the rates for females in Antonowicz and Valliant (1998). Differences for females were noted on swearing out loud, hostile/rude gestures, flashing headlights in anger, and honking horn in annoyance. It may be that the larger number of subjects in the present study were more representative as compared to the Antonowicz and Valliant (1998) study. Both the Antonowicz and Valliant study and the current study had higher rates of the various roadway aggression behaviors compared to the other studies. This is probably due to the restricted age range that these two studies examined. Most of the respondents were young adults and as a result there was minimal variation in the age range.

Consistent with Hypothesis 1 and the prevalence studies reviewed, males had higher levels of roadway aggression compared to females as assessed by the DVQ in the present study. These findings also confirmed the results of the Wiesenthal et al. (2000) study which found similar gender differences on the DVQ. Males also had higher levels of roadway aggression as assessed by the RAS but due to the stringent alpha this difference did not remain significant. Comparisons were also

made on the individual items of the RAS but no significant gender differences emerged. The lack of significant findings was also partially due to the stringent alpha level that was employed. Although no significant differences were revealed, males reported higher rates across all the various types of roadway aggression with the exception of hostile or rude gestures where females reported slightly higher rates. This is consistent with the literature where males had higher rates of roadway aggression compared to females in all studies reviewed. While rates were higher for males in comparison to females in the present study, the rates for females were still quite high.

Driving-Related Paths to Roadway Aggression

Hypotheses 2 through 4 examined the driving paths that were hypothesized based on an adaptation of Geen's (1990) model of affective aggression. In Geen's model, the process begins with some type of provocation which may include frustration, interpersonal provocation (e.g., physical attack), and environmental stressors (e.g., heat). For the purposes of the present study, the focus was on interpersonal provocation. Following the provocation, the individual formulates a judgement about whether there was any hostile intent on the part of the other person. Geen's model proposes that hostile attributional biases lead to anger and those that cope poorly with anger may engage in

aggression. To date, there do not appear to be any evaluations of Geen's model.

The present study provided support for Hypothesis 2 that driving anger coping (i.e., DACS) would have a direct effect on measures of roadway aggression (i.e., RAS and DVQ). This is consistent with the notion that anger does not necessarily lead to aggression; it depends on how the individual copes with anger (Tulloch, 1991).

There were also some other notable findings that were not hypothesized: driving anger (i.e., DAS) had a direct effect on both measures of roadway aggression while hostile attributional biases in ambiguous driving situations (i.e., ADSS-A) had a direct effect on the DVQ. It may be that there exist some other factors, in addition to driving anger coping, that may mediate the relationship between driving anger and roadway aggression. One possible example is coping self-efficacy. Geen (1990) included coping self-efficacy in his model of affective aggression but it was not examined in the present study. Coping self-efficacy stems from a stress paradigm (Lazarus & Folkman, 1984) and pertains to an individual's evaluation of his/her capacity to cope with an aversive situation.

While the ADSS-A had a direct effect on roadway aggression as assessed by the DVQ, this was not the case when roadway aggression was assessed by the RAS. It may be that the DVQ has a dimension of

hostile intentions and this accounts for its relationship to the ADSS-A. These mixed findings raise questions as to whether the ADSS-A does indeed have a direct effect on roadway aggression.

Hypotheses 3 and 4 assessed the indirect effects of variables on roadway aggression. The hypothesis that driving anger (i.e., DAS) would have an indirect effect on roadway aggression via driving anger coping was confirmed by the results. This finding also supports the notion that anger does not necessarily lead to aggression. The latter hypothesis that hostile attributional biases (ambiguous and hostile) would have an indirect effect on measures of roadway aggression via driving anger was partially confirmed. Biases in ambiguous driving situations had an indirect effect while biases in hostile driving situations did not; it may be that most respondents attribute hostile intent in these clearly hostile situations and there is limited variability. In other words, in extreme cases even less aggressive individuals will attribute hostile intent. While the results replicate the findings in the literature for hostile attributional biases in ambiguous situations, this was not the case for biases in hostile situations. Epps and Kendall (1995) and Dill et al. (1997) each found support for biases in hostile situations. Overall, these findings provide some preliminary support for examining driving-specific pathways to roadway aggression using a modified version of Geen's model.

General Paths to Roadway Aggression

The results emanating from the analyses of general paths hypothesized to be leading to roadway aggression were examined in the context of Hypotheses 5, 6, and 7. Contrary to Hypothesis 5, impulsivity (i.e., BIS-11) did not have a direct effect on measures of roadway aggression. It may be that there exists some other factor that mediates its relationship to roadway aggression (e.g., general anger coping). It is also possible that another measure of impulsivity may have led to different findings. There is a lack of consensus in the literature regarding what comprises the construct of impulsivity (Parker et al., 1993). As indicated previously, many of the measures of impulsivity do not intercorrelate very highly.

Although it was not hypothesized, general anger (i.e., TAS) had a significant direct effect on both measures of roadway aggression. It may be that there exist some other factors that may mediate the relationship between general anger and roadway aggression. One possible example is general anger coping. Given that impulsivity did not have a direct effect on roadway aggression, it was not possible for general anger to indirectly have an effect on roadway aggression via impulsivity (Hypothesis 6).

As per Hypothesis 7, biases in ambiguous general situations (i.e., AGSS-A) had an indirect effect on both measures of roadway aggression

via the TAS. In contrast, biases in hostile general situations (i.e., AGSS-H) did not. These findings replicate the results from examining the driving paths in the present study. Similar to driving situations, it may be that most respondents attribute hostile intent in these clearly hostile situations and there is limited variability. In other words, in extreme cases even less aggressive individuals will attribute hostile intent. Overall, these results partially confirmed the modified version of Geen's model in examining general pathways to roadway aggression.

As per Hypothesis 8, driving variables contributed a significant amount of variance in roadway aggression (both measures) after the effects of the general variables were accounted for in the outcome measures. This was the case for both males and females. In contrast, general variables did not significantly increment the prediction of roadway aggression for males and females except on one measure of roadway aggression (i.e., RAS) for both males and females. This suggests that driving variables may play a more important role in explaining roadway aggression and supports the utility of focusing on driving-related measures. The implications of this finding are that we need to target hostile attributional biases in driving situations, driving anger, and driving anger coping to prevent roadway aggression. These measures are context-specific and are more predictive of the behaviors within these specific contexts.

Contributions to Research Literature and Implications

Consistent with the literature, hostile attributional biases in ambiguous situations were related to aggression. The results of this study confirmed the importance researchers have given hostile attributional biases in the development of their theories of aggression (Anderson et al., 1995; Dodge & Schwartz, 1997; Geen, 1990). The importance of the construct of hostile attributional biases adds substantially to the literature because this was an as yet unexplored construct with regard to empirical studies of roadway aggression. In fact, these biases have only received scant attention in the general aggression literature. Studies examining hostile attributions in the general aggression literature have each assessed these biases using a different measure making it difficult to make comparisons. Increased attention to this construct is evidenced by the recent development of the Hostile Interpretations Questionnaire (HIQ) by Simourd and Mamuza (2000) which includes a subscale on attribution of hostility. This self-report inventory consists of seven vignettes representing a range of social situations. The reliability and validity of this inventory was examined in a Canadian sample of 146 violent offenders. Despite the fact that the overall internal consistency of the HIQ was acceptable, the internal consistency of the attribution of hostility subscale fell in the borderline

range ($\alpha=.67$). Support for the construct validity of the subscale was provided via correlations with anger measures.

Another contribution of the present study is its examination of mediating factors and the role they play in the occurrence of aggression. This area of inquiry is sorely lacking (Anderson et al., 1998). This study examined mediational mechanisms involved in roadway aggression and found that both driving anger and general anger mediated the relationship between hostile attributional biases in ambiguous situations and roadway aggression. Furthermore, driving anger coping mediated the relationship between driving anger and roadway aggression. Anderson and her colleagues have recently formulated a General Affective Aggression Model (GAAM) that delineates how various situational (e.g., temperature) and personological (e.g., hostility) factors may have an effect on aggression via cognitive, affective, and/or arousal-based routes (Anderson et al., 1995). This multistage model lends itself to an examination of possible mediating variables and may contribute to the examination of roadway aggression. Anderson et al. (1995) developed their model partly based on Geen's model (1990). The GAAM differs in that it outlines situational variables, attitudes and traits in a multistage model.

The results of this study have implications for the development of driving intervention programs. Anger was found to be significant

contributor to roadway aggression. This suggests that anger management/reduction programming may be a worthwhile endeavor with individuals who engage in roadway aggression. Deffenbacher and his colleagues have recently initiated a series of controlled trials of driving anger reduction with university students. Two outcome studies emanating from these trials found that cognitive-behavioral interventions reduced driving anger in high-anger male and female drivers in a university sample compared to their low-anger counterparts (Deffenbacher, Filetti, Lynch, Dahlen, & Oetting, 2000; Deffenbacher, Huff, Lynch, Oetting, & Salvatore, 2000). Further, there may exist the possibility of screening and diverting individuals at high risk of engaging in roadway aggression to anger management programs.

Study Limitations and Future Research

The findings emanating from the present study need to be considered in light of limitations such as the generalizability of the findings. While the results may be representative of university students they may not extend to older populations of drivers. There is a need to examine community samples with larger age ranges to determine if the findings generalize to older populations. Secondly, the use of a retrospective design that relied on subjects' recollection of past incidents and behavior may affect the veracity of responses. Individuals may not be able to recall previous incidents and behaviors accurately. Future studies should employ a

prospective design to examine roadway aggression. Asking drivers to complete daily driving logs describing their behaviors may be one option.

Thirdly, the sole reliance on self-report measures of roadway aggression in the present study without corroboration from other sources render the responses vulnerable to issues of social desirability. As evidenced in this study, a number of measures were influenced by social desirability biases. This may be partially addressed by supplementing self-report measures of the respondents' behaviors with reports obtained from significant others (i.e., collateral contacts).

There are many promising directions for future research in this area. The model adapted from Geen (1990) appears to hold some promise in our understanding of roadway aggression and will need to be further examined in other student samples and in community samples in order to determine whether these findings can be replicated. Other potential mediating variables such as driving anger coping self-efficacy need to be examined to determine the contribution they may provide in explaining roadway aggression.

It would also be interesting to examine other forms of provocation included in Geen's model such as frustration (e.g., traffic congestion, road construction, and detours) and environmental stressors such as heat in addition to interpersonal provocation. Some research has found that driving in congested traffic conditions increases driver stress and

aggressive driving (Hennessy & Wiesenthal, 1997; Novaco, 1991). The present study focused solely on interpersonal provocations rather than on multiple forms of provocation. In addition, increased traffic volume may conceivably increase the anonymity of the driver. Novaco (1991) suggested that anonymity has a disinhibiting influence on drivers and may increase the likelihood of negative driving behavior. Anonymity is another factor that appears to warrant further research attention.

Another possible variable that may be interesting to investigate is the concept of angry thoughts while driving. Deffenbacher and his colleagues are in the process of developing a measure of angry thoughts while driving. Assessment of angry thoughts may assist in theoretical model development and aid in identifying treatment targets for drivers involved in anger management programs. Angry thoughts are outlined in Anderson et al.'s GAAM (1995).

Future studies will also need to contribute to the psychometric development of driving measures. Many of the driving measures used in the present study are still in their infancy and require more extensive empirical scrutiny and refinement. In particular, measures of hostile attributional biases in ambiguous and hostile driving situations need further psychometric examination. In the present study, both these measures had less than desirable internal consistencies.

As indicated previously, aggression in general has multiple determinants (Huesmann, 1988). The present study represented a preliminary empirical attempt to understand roadway aggression by examining a few of these determinants via a theoretical model of affective aggression. This study further contributes to the growing body of literature on the phenomenon of roadway aggression. As our understanding of driving anger and roadway aggression increases, we will hopefully be better able to reduce driving anger and the harm associated with roadway aggression by developing appropriate and effective anger management interventions for drivers.

References

- Adler, J. (1997, June 2). Road rage: We're driven to destruction. Newsweek, 70.
- Anderson, C. A., Deuser, W. E., & DeNeve, K. M. (1995). Hot temperatures, hostile affect, hostile cognition, and arousal: Tests of a general model of affective aggression. Personality and Social Psychology Bulletin, 21, 434-448.
- Anderson, B. J., Dunaway, R. G., Snow, R. W., Landrum, J. W., Wells-Parker, E., & McMillen, D. L. (1999, November). Self-reported road rage in a representative national sample: Incidence and demographic predictors. Paper presented at the American Society of Criminology Annual Meeting: Toronto.
- Antonowicz, D. H., & Gabor, T. (1999). Development and validation of the Driving Thoughts Questionnaire. Manuscript in preparation, Ottawa: Carleton University.
- Antonowicz, D. H., & Valliant, P. M. (1998). The relationship of trait driving anger, vengeance, and irrational beliefs to driving anger expression and consequences in university students. Manuscript in preparation, Ottawa: Carleton University.
- Averill, J. R. (1983). Studies on anger and aggression: Implications for theories of emotion. American Psychologist, 38, 1145-1160.

Baron, R. A. (1976). The reduction of human aggression: A field study of the influence of incompatible reactions. Journal of Applied Social Psychology, 6, 260-274.

Baron, R. A., & Richardson, D. R. (1994). Human aggression (2nd ed.). New York: Plenum.

Barratt, E. S. (1994). Impulsiveness and aggression. J. Monahan & H. J. Steadman (Eds.), Violence and mental disorder: Developments in risk assessment (pp. 61-79). Chicago: University of Chicago Press.

Berkowitz, L. (1989). The frustration-aggression hypothesis: Examination and reformulation. Psychological Bulletin, 106, 59-73.

Berkowitz, L. (1993). Aggression: Its causes, consequences, and control. New York: McGraw-Hill.

Blackburn, R., & Lee-Evans, J. M. (1985). Reactions of primary and secondary psychopaths to anger-evoking situations. British Journal of Clinical Psychology, 24, 93-100.

Chase, L. J., & Mills, N. H. (1973). Status of frustrator as a facilitator of aggression: A brief note. Journal of Psychology, 84, 225-226.

Copello, A. G., & Tata, P. R. (1990). Violent behavior and interpretative bias: An experimental study of the resolution of ambiguity in violent offenders. British Journal of Clinical Psychology, 29, 417-428.

Crick, N. R., & Dodge, K. A. (1994). A review and reformulation of social information-processing mechanisms in children's social adjustment. Psychological Bulletin, 115, 74-101.

Crowne, D. P., & Marlowe, D. (1960). A new scale of social desirability independent of psychopathology. Journal of Consulting Psychology, 24, 349-354.

Davison, G. C., Robins, C., & Johnson, M. K. (1983). Articulated thoughts during simulated situations: A paradigm for studying cognition in emotion and behavior. Cognitive Therapy and Research, 7, 17-40.

Deaux, K. K. (1971). Honking at the intersection: A replication and extension. Journal of Social Psychology, 84, 159-160.

Deffenbacher, J. L. (1992). Trait anger: Theory, findings, and implications. In C. D. Spielberger & J. N. Butcher (Eds.), Advances in personality assessment (Vol. 9, pp. 177-201). Hillsdale, NJ: Erlbaum.

Deffenbacher, J. L. (1996). Driving Study Questionnaire.
Fort Collins: Colorado State University.

Deffenbacher, J. L. (1997). Driving Anger Expression Inventory.
Fort Collins: Colorado State University.

Deffenbacher, J. L. (1999). Driving anger: Some characteristics and interventions. Proceedings of the 35th annual meeting: Prospective Medicine – The tools, the data, the interventions, and the outcomes (pp. 273-284). Pittsburgh, Pennsylvania: The Society of Prospective Medicine.

Deffenbacher, J. L., Demm, P. M., & Brandon, A. D. (1986). High general anger: Correlates and treatment. Behavior Research and Therapy, 24, 480-489.

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., Oetting, E. R., & Lynch, R. S. (1994). Development of a driving anger scale. Psychological Reports, 74, 83-91.

Deffenbacher, J. L., Oetting, E. R., Lynch, R. S., & Morris, C. D. (1996). The expression of anger and its consequences. Behavior Research and Therapy, 34, 575-590.

Deffenbacher, J. L., Oetting, E. R., Thwaites, G. A., Lynch, R. S., Baker, D. A., Stark, R. S., Thacker, S., & Eiswerth-Cox, L. (1996). State-trait anger theory and the utility of the Trait Anger Scale. Journal of Counseling Psychology, 43, 131-148.

Dill, K. E., Anderson, C. A., Anderson, K. B., & Deuser, W. E. (1997). Effects of aggressive personality on social expectations and social perceptions. Journal of Research in Personality, 31, 272-292.

Dodge, K. A. (1991). The structure and function of reactive and proactive aggression. In D. J. Pepler & K. H. Rubin (Eds.), The development and treatment of childhood aggression (pp. 201-218). Hillsdale, NJ: Erlbaum.

Dodge, K. A., & Newman, J. P. (1981). Biased decision making processes in aggressive boys. Journal of Abnormal Psychology, 90, 375-379.

Dodge, K. A., & Schwartz, D. (1997). Social information processing mechanisms in aggressive behavior. In D. M. Stoff, J. Breiling, & J. D. Maser (Eds.), Handbook of antisocial behavior (pp. 171-180). New York: John Wiley and Sons, Inc.

Dollard, J., Doob, L., Miller, N., Mowrer, O., & Sears, R. (1939). Frustration and aggression. New Haven, CT: Yale University Press.

Doob, A. N., & Gross, A. E. (1968). Status of frustrator as an inhibitor of horn-honking responses. Journal of Social Psychology, 76, 213-218.

Eckhardt, C. I., Barbour, K. A., & Davison, G. C. (1998). Articulated thoughts of maritally violent and non-violent men during anger arousal. Journal of Consulting and Clinical Psychology, 66, 259-269.

- Ellison, P. A., Govern, J. M., Petri, H. L., & Figler, M. H. (1995). Anonymity and aggressive driving behavior. Journal of Social Behavior and Personality, 10, 265-272.
- Endler, N. S., & Hunt, J. McV. (1968). S-R inventories of hostility and comparisons of the proportions of variance from persons, responses, and situations for hostility and anxiousness. Journal of Personality and Social Psychology, 9, 309-315.
- EPIC-MRA (1997). National poll on driver behavior. Lansing, MI.
- Epps, J., & Kendall, P. C. (1995). Hostile attributional bias in adults. Cognitive Therapy and Research, 19, 159-178.
- Ferguson, A. (1998, January 12). Road rage. Time, 44-48.
- Ferguson, T. J., & Rule, B. G. (1983). An attributional perspective on anger and aggression. In R. G. Geen & E. I. Donnerstein (Eds.), Aggression: Theoretical and empirical reviews: Volume 1: Theoretical and methodological issues (pp. 41-74). New York: Academic Press.
- Filleti, L. B., & Deffenbacher, J. L. (1999). Characteristics of high and low anger drivers. Manuscript in preparation.
- Flores, S. A. (1999). Attributional biases in sexually coercive males. Journal of Applied Social Psychology, 29, 2425-2442.
- Geen, R. G. (1990). Human aggression. Milton Keynes, UK: Open University Press.

Goldstein, A. P. (1999). Low-level aggression: First steps on the ladder to violence. Champaign, IL: Research Press.

Halderman, B. L., & Jackson, T. T. (1979). Naturalistic study of aggression: Aggressive stimuli and horn-honking: A replication. Psychological Reports, 45, 880-882.

Hare, R. D. (1991). Manual for the Revised Psychopathy Checklist. Toronto: Multi-Health Systems.

Hauber, A. R. (1980). The social psychology of driving behavior and the traffic environment : Research on aggressive behavior in traffic. International Review of Applied Psychology, 29, 461-474.

Hennessey, D. A., & Wiesensthal, D. L. (1997). The relationship between traffic congestion, driver stress, and direct versus indirect coping behaviours. Ergonomics, 40, 348-361.

Huesmann, L. R. (1988). An information processing model for the development of aggression. Aggressive Behavior, 14, 13-24.

Jacobs, G. A., Latham, L. E., & Brown, M. S. (1988). Test-retest reliability of the State-Trait Personality Inventory and the Anger Expression Scale. Anxiety Research, 1, 363-365.

Joint, M. (1995). Road rage. Wahington: AAA Foundation for Traffic Safety.

Lazarus, R. S., & Folkman, S. (1984). Stress appraisal and coping. New York: Springer.

Lynch, R. S., Deffenbacher, J. L., Oetting, E. R., & Yingling, D. A. (1995, August). Driving anger as a health risk factor. Paper presented at American Psychological Association Annual Convention: New York.

Lynch, R. S., Deffenbacher, J. L., Filetti, L. B., & Dahlen, E. R. (1999, August). Anger, aggression, and risk associated with driving anger. Paper presented at the Annual Convention of the American Psychological Association, Boston.

Marsh, P., & Collett, P. (1986). Driving passion. London: Jonathan Cape.

McDonald, P. J., & Wooten, S. A. (1987). The influence of incompatible responses on the reduction of aggression: An alternative explanation. Journal of Social Psychology, 128, 401-406.

Nasby, W., Hayden, B., & DePaulo, B. M. (1979). Attributional biases among aggressive boys to interpret unambiguous social stimuli as displays of hostility. Journal of Abnormal Psychology, 89, 459-468.

Novaco, R. W. (1986). Anger as a clinical and social problem. In R. Blanchard & C. Blanchard (Eds.), Advances in the study of aggression, (Vol 2, pp. 1-67). New York: Academic Press.

Novaco, R. W. (1991). Aggression on the roads. In R. Baenninger (Ed.), Targets of violence and aggression (pp. 253-326). North-Holland: Elsevier Science Publisher.

Novaco, R. W. (1992). Automobile driving and aggressive behavior. In M. Wachs & M. Crawford (Eds.), The car and the city: The automobile, the built environment, and daily urban life (pp. 234-247). Ann Arbor: University of Michigan Press.

Novaco, R. W. (1994). Anger as a risk factor for violence among the mentally disordered. In J. Monahan & H. J. Steadman (Eds.), Violence and mental disorder: Developments in risk assessment (pp. 21-59). Chicago: University of Chicago Press.

Novaco, R. W., Stokols, D., & Milanese, L. (1990). Objective and subjective dimensions of travel impedance as determinants of commuting stress. American Journal of Community Psychology, 18, 231-257.

Novaco, R. W., & Welsh, W. N. (1989). Anger disturbances: Cognitive mediation and clinical prescriptions. In K. Howell & C. R. Hollin (Eds.), Clinical approaches to violence (pp. 39-60). New York: John Wiley and Sons.

Parker, J. D. A., Bagby, R. M., & Webster, C. D. (1993). Domains of the impulsivity construct: A factor analytic investigation. Personality and Individual Differences, 15, 267-274.

Parry, M. H. (1968). Aggression on the road: A pilot study of behavior in the driving situation. London: Tavistock Publications.

Patton, J. H., Stanford, M. S., & Barratt, E. S. (1995). Factor structure of the Barratt Impulsiveness Scale. Journal of Clinical Psychology, 51, 768-774.

Paulhus, D. L. (1984). Two-component models of socially desirable responding. Journal of Personality and Social Psychology, 46, 598-609.

Paulhus, D. L. (1991). Measurement and control of response bias. In J. P. Robinson, P. P. Shaver, & L. S. Wrightsman (Eds.), Measures of personality and social psychological attitudes (pp. 17-59). San Diego: Academic Press.

Paulhus, D. L. (1999). Paulhus Deception Scales. Toronto: Multi-Health Systems.

Plutchik, R., & van Praag, H. M. (1995). The nature of impulsivity: Definitions, ontology, genetics, and relations to aggression. In E. Hollander & D. J. Stein (Eds.), Impulsivity and aggression (pp. 7-24). Toronto: John Wiley and Sons.

Serin, R. C. (1991). Psychopathy and violence in criminals. Journal of Interpersonal Violence, 6, 423-431.

Serin, R. C., & Kuriychuk, M. (1994). Social and cognitive processing deficits in violent offenders: Implications for treatment. International Journal of Law and Psychiatry, 17, 431-441.

Sieglman, A. W., & Smith, T. W. (1994). Anger, hostility, and the heart. Hillsdale, NJ: Lawrence Erlbaum Associates.

Simourd, D. J., & Mamuza, J. M. (2000). The Hostile Interpretations Questionnaire: Psychometric properties and construct validity. Criminal Justice and Behavior, 27, 645-663.

Spielberger, C. D. (1988). State-Trait Anger Expression Inventory. Orlando, FL: Psychological Assessment Resources.

Spielberger, C. D., Jacobs, G., Russell, S., & Crane, R. (1983). Assessment of anger: The State-Trait Anger Scale. In J. N. Butcher & C. D. Spielberger (Eds.), Advances in personality assessment (Vol. 2, pp.159-187). Hillsdale, NJ: Lawrence Erlbaum Associates.

Spielberger, C. D., Johnson, E. H., Russell, S. F., Crane, R. J., Jacobs, G. A., & Worden, T. J. (1985). The experience and expression of anger: Construction and validation of an anger expression scale. In M. A. Chesney & R. H. Rosenman (Eds.), Anger and hostility in cardiovascular and behavioral disorders (pp. 5-30). New York: Hemisphere.

Tabachnick, B. G., & Fidell, L. S. (1989). Using multivariate statistics (2nd ed). New York: Harper & Row.

Tulloch, R. (1991). Anger and violence. In W. Dryden & R. Rentoul (Eds.), Adult clinical problems: A cognitive-behavioral approach (pp. 86-113). New York: Routledge.

Turner, C. W., Layton, J. F., & Simons, L. S. (1975). Naturalistic studies of aggressive behavior: Aggressive stimuli, victim visibility, and horn honking. Journal of Personality and Social Psychology, 31, 1098-1107.

Wiesenthal, D. L., Hennessy, D. A., & Gibson, P. M. (2000). The Driving Vengeance Questionnaire (DVQ): The development of a scale to measure deviant drivers' attitudes. Violence and Victims, 15, 115-136.

Appendices

Appendix A: Attributions in General Situations Scale

Please read each scenario carefully and then answer the question below the scenario. Rate how sure you are that the offending actions of the other person in each scenario were intended to be hostile (i.e., intended to bring some harm or discomfort to you). Circle a number on the rating scale to indicate your response (1=I am not at all sure the action was hostile to 9= I am very sure the action was hostile).

1. You pull into a convenience store, with the intention of purchasing a single item. You do not care for waiting in lines-- this was the reason for choosing the convenience store over the more reasonably priced market down the street. However, a long line is forming due to a slow cashier. A wait of 20 minutes ensues. As customers complain to the cashier, service seems to become slower. The cashier stops several times to talk on the phone. The cashier must split time between several tasks. The cashier seems new and not very familiar with the procedures.

How sure are you that the cashier's motives were hostile?

1	2	3	4	5	6	7	8	9
Not at			Moderately					Very
all sure			sure					sure

2. You are in a restaurant with a romantic interest. It is a special occasion, and the meal is the prelude to a "night on the town". The intention is to create an intimate atmosphere. You are seated at the last available table. The waiter, who recognizes you, spills the full contents of your plate onto your lap. There are no burns, but clothing is ruined, plans for later must be cancelled, and the mood of the evening is broken. On a previous trip to this restaurant, you complained about this waiter's service, and left no tip. There is a water spill on the floor, in which the waiter may have slipped. You find it curious that the spilled food went entirely on you, and no one else. The waiter had been courteous to you all evening.

How sure are you that the waiter's motives were hostile?

1	2	3	4	5	6	7	8	9
Not at			Moderately					Very
all sure			sure					sure

3. You are presenting a report to a class for discussion and critique, and are a bit nervous about making the presentation before your peers. The class listens to the report, and a fellow student makes a strongly critical statement about your presentation. The student ends by saying that, as presented, your perceptions were "unsound and poorly thought out". You have recently had an argument with this student that has gone unsettled. You are relatively good friends with the student. The professor has made it clear that spirited debate is desired. The other student is quite competitive, and frequently brags about having "put others in their place".

How sure are you that the student's motives were hostile?

	1	2	3	4	5	6	7	8	9
Not at									
all sure				Moderately					Very
				sure					sure

4. You are at a party with friends, and strike up a conversation with an attractive friend. The friend is there with a long-time romantic interest, with whom you are also acquainted. The friend's romantic interest sees the pair of you talking, and calls your friend away, thus ending the conversation. As your friend walks away, their boyfriend/girlfriend seems to give you a stern look. You overhear the conversation between them, and it includes several pointed remarks about you. You can see how some of your gestures toward your friend could have been interpreted as flirtatious. As the evening goes on, you sense the friend's romantic interest "keeping an eye" on you.

How sure are you that the other person's motives were hostile?

	1	2	3	4	5	6	7	8	9
Not at									
all sure				Moderately					Very
				sure					sure

5. You are contemplating marriage, and are about to meet the family of the potential spouse. You want to make a good impression, and are anxious about undergoing so close a scrutiny. The conversation turns to education, and you reluctantly acknowledge having completed only one year of college, with no intent to continue. One family member, who has a graduate degree, responds with surprise, saying "One year? Hmmm!". Your friend has warned you that this particular relative is good-hearted, but socially clumsy. Your friend has also warned you that the relative is elitist concerning education. The relative has previously commented on how bright you seem. The tone of the relative's voice appears judgmental.

How sure are you that the relative's motives were hostile?

	1	2	3	4	5	6	7	8	9
Not at				Moderately					Very
all sure				sure					sure

6. You are climbing the stairs to your dormitory room. In passing, you and a fellow student bump into each other. The other student continues walking without acknowledging the contact. You are certain that you allowed enough room for the person to pass. The person is in an animated conversation, and may have been distracted. You say "excuse me", but the person does not reply. You hear the person chuckle after they have passed.

How sure are you that the other person's motives were hostile?

	1	2	3	4	5	6	7	8	9
Not at				Moderately					Very
all sure				sure					sure

7. You are in the library, carrying an armful of books to the librarian for check-out. In the narrow aisle, you must get past a person who is stooped on one knee. You say "Excuse me." The person says "Just a second.", and moves a half-minute later. You did not see the person look up when they answered you. The aisle is clearly too narrow to allow you to pass the kneeling person. The individual is reading a book on the lower shelf, a task that can readily be done elsewhere. When the person sees that your arms are full, no apology is forthcoming.

How sure are you that the other person's motives were hostile?

	1	2	3	4	5	6	7	8	9
Not at				Moderately					Very
all sure				sure					sure

8. You are home, alone, in the late afternoon. You were awake most of the previous night and are very tired. You have come home early to get some rest. Minutes after going to sleep, you are awakened by the sound of the television set. The person with whom you live has come home and switched the set on with the volume high, then walked out, leaving the set on. The room in which you are sleeping is not visible from the TV room. You are not normally home this time of day. Your roommate mentioned that you had kept them awake with noise last night. You mentioned to your roommate that your intention was to come home early and sleep.

How sure are you that the roommate's motives were hostile?

	1	2	3	4	5	6	7	8	9
Not at				Moderately					Very
all sure				sure					sure

9. You are applying for a job. To qualify, you need several letters of recommendation. You ask a former professor to write one, and that person agrees to submit it by the required date. Later, you find out that someone else got the job. You are told that your application was incomplete, lacking this letter of recommendation, and was not screened. The professor led you to believe that the letter was mailed. The professor has a reputation for making commitments without following through. You recall an incident where your comments embarrassed the professor in class. The professor's office staff has a reputation for inefficiency, and may have lost the letter.

How sure are you that the professor's motives were hostile?

	1	2	3	4	5	6	7	8	9
Not at									
all sure				Moderately					Very
				sure					sure

10. You have just returned home from a trip to the supermarket. You are unpacking your purchases, and you find that several items are damaged--eggs broken, bread and tomatoes crushed. You notice that the bags were poorly packed at the market, with several heavy items on top. An emergency stop may have jostled the packages on the way home. You had cross words for the bagger due to slow service. The bagger is familiar with, and does not like, a member of your family. The bagger spoke to you with an irritated tone of voice.

How sure are you that the bagger's motives were hostile?

	1	2	3	4	5	6	7	8	9
Not at									
all sure				Moderately					Very
				sure					sure

11. You are a student who has just completed an undergraduate psychology course. You have attended the class regularly, and participated in class discussions frequently and vocally. Half your grade rests on a term paper. You receive a score on the paper that lowers your average in the class by a full letter grade. Opinions you expressed in class have frequently been at odds with the professor. You do not feel that the paper reflects your best work. You can see some truth in the professor's negative comments. You have heard that the professor is biased against persons of your gender or ethnic background.

How sure are you that the professor's motives were hostile?

	1	2	3	4	5	6	7	8	9
Not at				Moderately					Very
all sure				sure					sure

12. You are in a doctor's office for a 9:00 appointment. You arrive on time, and notify the receptionist of your arrival. At 9:30, not having been seen yet, you ask the receptionist about the delay. You are informed that the doctor booked several appointments for the same time, and is seeing one of those patients presently. You recall that you were late for a previous appointment, and the doctor was kept waiting. The receptionist is apologetic, and offers you coffee. You are told that multiple bookings are routine, but were not informed of this policy before you made the appointment. You arrived before the other 9:00 patient.

How sure are you that the doctor's motives were hostile?

	1	2	3	4	5	6	7	8	9
Not at				Moderately					Very
all sure				sure					sure

13. You are shopping, and return to your parked car to "feed the meter". As you approach, you can see a parking authority employee writing you a ticket. You call out, saying that you are only a few minutes late. You are told that, once the officer has begun writing the ticket, there is no option but to finish it. Several other cars on the block were ticketed, not just yours. The ticket did not identify your car at the time you called out. When you ask why the ticket must be finished once begun, the officer ignores you. The officer is very respectful when speaking to you.

How sure are you that the officer's motives were hostile?

	1	2	3	4	5	6	7	8	9
Not at all sure				Moderately sure					Very sure

Appendix B: Attributions in Driving Situations Scale

For the following driving scenarios, please imagine that the incident is actually happening to you, then rate how sure you are that the offending actions of the other person in each scenario were intended to be hostile (i.e., intended to bring some harm or discomfort to you). Circle a number on the rating scale to indicate how you **generally** respond in this situation (1=I am not at all sure the action was hostile to 9= I am very sure the action was hostile). Next, rate how angry you would be if this happened to you. Circle a number on the rating scale to indicate how angry you **generally** are in this situation (1=not at all angry to 9= very angry).

1. While driving on an expressway/highway, someone cuts in front of you causing you to brake suddenly.

How sure are you that the other driver's actions were hostile?

1	2	3	4	5	6	7	8	9
Not at all sure				Moderately sure				Very sure

How angry would you be if this happened to you?

1	2	3	4	5	6	7	8	9
Not at all angry				Moderately angry				Very angry

2. Someone notices that you are trying to pass them and they immediately speed up preventing you from passing.

How sure are you that the other driver's actions were hostile?

1	2	3	4	5	6	7	8	9
Not at all sure				Moderately sure				Very sure

How angry would you be if this happened to you?

1	2	3	4	5	6	7	8	9
Not at all angry				Moderately angry				Very angry

3. Someone in front of you does not start up when the light turns green.

How sure are you that the other driver's actions were hostile?

1	2	3	4	5	6	7	8	9
Not at all sure				Moderately sure				Very sure

How angry would you be if this happened to you?

1	2	3	4	5	6	7	8	9
Not at all angry				Moderately angry				Very angry

4. Someone makes an obscene gesture toward you about your driving.

How sure are you that the other driver's actions were hostile?

1	2	3	4	5	6	7	8	9
Not at all sure				Moderately sure				Very sure

How angry would you be if this happened to you?

1	2	3	4	5	6	7	8	9
Not at all angry				Moderately angry				Very angry

5. Someone yells at you about your driving.

How sure are you that the other driver's actions were hostile?

1	2	3	4	5	6	7	8	9
Not at all sure				Moderately sure				Very sure

How angry would you be if this happened to you?

1	2	3	4	5	6	7	8	9
Not at all angry				Moderately angry				Very angry

6. While you are waiting to turn right on a red light someone in the vehicle behind you honks at you.

How sure are you that the other driver's actions were hostile?

1	2	3	4	5	6	7	8	9
Not at all sure				Moderately sure				Very sure

How angry would you be if this happened to you?

1	2	3	4	5	6	7	8	9
Not at all angry				Moderately angry				Very angry

7. You wish to turn right at a red light and the vehicle in front of you, which is also making a right turn, does not proceed when the way is clear.

How sure are you that the other driver's actions were hostile?

1	2	3	4	5	6	7	8	9
Not at all sure				Moderately sure				Very sure

How angry would you be if this happened to you?

1	2	3	4	5	6	7	8	9
Not at all angry				Moderately angry				Very angry

8. Someone gets out of his/her car at a traffic light and approaches you in a threatening manner.

How sure are you that the other driver's actions were hostile?

1	2	3	4	5	6	7	8	9
Not at all sure				Moderately sure				Very sure

How angry would you be if this happened to you?

1	2	3	4	5	6	7	8	9
Not at all angry				Moderately angry				Very angry

9. A vehicle directly in front of you frequently applies the brakes although there are no vehicles or pedestrians in front of it.

How sure are you that the other driver's actions were hostile?

1	2	3	4	5	6	7	8	9
Not at				Moderately				Very
all sure				sure				sure

How angry would you be if this happened to you?

1	2	3	4	5	6	7	8	9
Not at				Moderately				Very
all angry				angry				angry

10. Someone in the lane beside you glares at you and then rams his/her vehicle into your vehicle.

How sure are you that the other driver's actions were hostile?

1	2	3	4	5	6	7	8	9
Not at				Moderately				Very
all sure				sure				sure

How angry would you be if this happened to you?

1	2	3	4	5	6	7	8	9
Not at				Moderately				Very
all angry				angry				angry

11. You are waiting for a parking space but the driver in the space is slow in leaving.

How sure are you that the other driver's actions were hostile?

1	2	3	4	5	6	7	8	9
Not at all sure				Moderately sure			Very sure	

How angry would you be if this happened to you?

1	2	3	4	5	6	7	8	9
Not at all angry				Moderately angry			Very angry	

12. The driver of the vehicle behind you rear-ends you.

How sure are you that the other driver's actions were hostile?

1	2	3	4	5	6	7	8	9
Not at all sure				Moderately sure			Very sure	

How angry would you be if this happened to you?

1	2	3	4	5	6	7	8	9
Not at all angry				Moderately angry			Very angry	

13. You switch lanes to get away from someone who is tailgating you only to have the same person continue to tailgate you.

How sure are you that the other driver's actions were hostile?

1	2	3	4	5	6	7	8	9
Not at all sure				Moderately sure				Very sure

How angry would you be if this happened to you?

1	2	3	4	5	6	7	8	9
Not at all angry				Moderately angry				Very angry

14. You are backing into a parking spot, only to find that another driver is also trying to get the spot.

How sure are you that the other driver's actions were hostile?

1	2	3	4	5	6	7	8	9
Not at all sure				Moderately sure				Very sure

How angry would you be if this happened to you?

1	2	3	4	5	6	7	8	9
Not at all angry				Moderately angry				Very angry

Appendix C: Telephone Recruitment Script for Pilot Study

My name is Dan Antonowicz. I am a Ph.D. student in Psychology at Carleton University. I am trying to recruit students to participate in my thesis study on driving behaviors among university students. Your name and phone number were obtained through the mass testing procedure you took part in at the beginning of the semester. There was a question on whether you had driven a motor vehicle in the last three months. If you indicated that you had driven in this time period, then you met the requirement for my study.

If you agree to participate in my study, you will be asked to fill out two self-report questionnaires on driving behaviors. It will require one session of approximately 15 minutes and will take place in a seminar room on campus. As you know, you will receive research credit for your participation. You are free to withdraw from this study at any time; or you can simply refuse to participate in the study, or you can refuse to answer specific questions without any risk of penalty. All your responses will be confidential.

Appendix D: Informed Consent for Pilot Study

INFORMED CONSENT FORM

Project: Attributions of Hostile Intent among University Students

Investigators: Daniel Antonowicz, Department of Psychology,
Carleton University
Dr. Ian Shields, Ottawa-Carleton Detention Centre

The purpose of this informed consent form is to ensure that you understand the purpose of the study and the nature of your involvement. The informed consent must provide you with enough information such that you have the opportunity to determine whether you wish to participate in the study. Please ask the researcher to clarify any concerns you may have.

I hereby consent to participate in a study examining attributions of hostile intent (i.e., the belief that another person has done something hostile or malicious to you). I understand that this study will involve one session of approximately 15 minutes.

I understand that the study will include two questionnaires which cover the following areas: attributions of hostile intent in (1) driving situations, and (2) general situations. The information I give will be used for research purposes only. I understand that I do not have to answer any questions that I do not wish to and I have been given the option to withdraw from this study at anytime without penalty.

Any information I give will be strictly confidential. My answers will be coded in such a way that I cannot be identified in any report of the results.

For more information about this study contact one of the investigators listed below:

- (1) Dan Antonowicz 567-1013; e-mail: dantonow@chat.carleton.ca
- (2) Dr. Ian Shields 824-6080

If you have any concerns regarding the ethics of this research study, you may contact:

- (1) Chair, Department of Psychology, Carleton University
Dr. Kim Matheson, 520-2600, ext. 7513
- (2) Chair of the Ethics Committee, Department of Psychology,
Carleton University
Dr. Mary Gick, 520-2664

My signature below indicates that I have read the above, and that I agree to take part.

Participant's Name: _____ **Date:** _____

Participant's Signature: _____

Researcher's Signature: _____ **Date:** _____

Appendix E: Debriefing Form for Pilot Study

DEBRIEFING FORM

Thank you for participating in this study. The main objective of this research was to develop a test for examining attributions of hostile intent (i.e., the belief that another person has done something hostile or malicious to you) in driving situations among university students. Your responses to the questionnaires will be examined in order to assess the reliability and validity of the test. This test will then be used in a larger study to determine its relationship to driving anger and roadway aggression. In the future, this test could potentially be used to identify drivers at high risk for roadway aggression. This may subsequently help reduce the number of injuries and deaths resulting from roadway aggression.

If you think of any questions after the study is completed or you want more information, please feel free to contact either Dan Antonowicz (567-1013) or Dr. Ian Shields (824-6080).

If you have any concerns regarding the ethics of this research study, you may contact:

- (1) Chair, Department of Psychology, Carleton University
Dr. Kim Matheson, 520-2600, ext. 7513
- (2) Chair of the Ethics Committee, Department of Psychology,
Carleton
University
Dr. Mary Gick, 520-2664

Appendix F: Driving Anger Scale

Age: _____

Gender (circle one): Male Female

Directions: Below are several situations you may encounter when you are driving. Try to imagine the incident described is actually happening to you, then indicate the extent to which it would **anger or provoke you**. Indicate your response by circling a number below the statement.

Not at all	A little	Some	Much	Very Much
1	2	3	4	5

1. Someone is weaving in and out of traffic.
1 2 3 4 5
2. A slow vehicle on a mountain road will not pull over and let people by.
1 2 3 4 5
3. Someone backs right out in front of you without looking.
1 2 3 4 5
4. You pass a radar speed trap.
1 2 3 4 5
5. Someone makes an obscene gesture toward you about your driving.
1 2 3 4 5
6. A police officer pulls you over.
1 2 3 4 5
7. A truck kicks up sand or gravel on the car you are driving.
1 2 3 4 5
8. Someone runs a red light or stop sign.
1 2 3 4 5

9. Someone honks at you about your driving.

1 2 3 4 5

10. You are driving behind a large truck and you cannot see around it.

1 2 3 4 5

11. A bicyclist is riding in the middle of the lane and slowing traffic.

1 2 3 4 5

12. You are stuck in a traffic jam.

1 2 3 4 5

13. Someone speeds up when you try to pass them.

1 2 3 4 5

14. Someone is slow in parking and holding up traffic.

1 2 3 4 5

Appendix G: Trait Anger Scale

Directions: A number of statements which people have used to describe themselves are given below. Read each statement and then circle the response indicating how you **generally feel**. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you **generally feel**.

almost never	sometimes	often	almost always
1	2	3	4

1. I am quick tempered.

1 2 3 4

2. I am a hotheaded person.

1 2 3 4

3. I have a fiery temper.

1 2 3 4

4. I get angry when I am slowed down by others' mistakes.

1 2 3 4

5. I feel annoyed when I am not given recognition for doing good work.

1 2 3 4

6. I fly off the handle.

1 2 3 4

7. When I get mad, I say nasty things.

1 2 3 4

8. When I get frustrated, I feel like hitting someone.

1 2 3 4

9. I feel infuriated when I do a good job and get a poor evaluation.

1 2 3 4

10. It makes me furious when I am criticized in front of others.

1 2 3 4

Appendix H: Barratt Impulsiveness Scale

Please circle the number to the right of the statement that best characterizes you.

	1	2	3	4
	Rarely/Never	Occasionally	Often	Almost Always/Always
1. I plan tasks carefully.			1	2 3 4
2. I do things without thinking.			1	2 3 4
3. I make up my mind quickly.			1	2 3 4
4. I am happy-go-lucky.			1	2 3 4
5. I don't "pay attention".			1	2 3 4
6. I have "racing" thoughts.			1	2 3 4
7. I plan trips well ahead of time.			1	2 3 4
8. I am self-controlled.			1	2 3 4
9. I concentrate easily.			1	2 3 4
10. I save regularly.			1	2 3 4
11. I "squirm" at plays or lectures.			1	2 3 4
12. I am a careful thinker.			1	2 3 4
13. I plan for job security.			1	2 3 4
14. I say things without thinking.			1	2 3 4
15. I like to think about complex problems.			1	2 3 4
16. I change jobs.			1	2 3 4
17. I act "on impulse".			1	2 3 4
18. I get easily bored when solving thought problems.			1	2 3 4
19. I act on the spur of the moment.			1	2 3 4

20.	I am a steady thinker.	1	2	3	4
21.	I change residences.	1	2	3	4
22.	I buy things on impulse.	1	2	3	4
23.	I can only think about one problem at a time.	1	2	3	4
24.	I change hobbies.	1	2	3	4
25.	I spend or charge more than I earn.	1	2	3	4
26.	I often have extraneous thoughts when thinking.	1	2	3	4
27.	I am more interested in the present than the future.	1	2	3	4
28.	I am restless at the theater or lectures.	1	2	3	4
29.	I like puzzles.	1	2	3	4
30.	I am future oriented.	1	2	3	4

Appendix I: Paulhus Deception Scale

Using the scale below as a guide, circle a number below each statement to indicate how much you agree with it.

1 2 3 4 5 6 7

Not true

somewhat true

very true

1. My first impressions about people usually turn out to be right.
1 2 3 4 5 6 7
2. It would be hard for me to break any of my bad habits.
1 2 3 4 5 6 7
3. I don't care to know what other people really think of me.
1 2 3 4 5 6 7
4. I have not always been honest with myself.
1 2 3 4 5 6 7
5. I always know why I like things.
1 2 3 4 5 6 7
6. When my emotions are aroused, it biases my thinking.
1 2 3 4 5 6 7
7. Once I've made up my mind, other people can seldom change my opinion.
1 2 3 4 5 6 7
8. I am not a safe driver when I exceed the speed limit.
1 2 3 4 5 6 7
9. I am fully in control of my own fate.
1 2 3 4 5 6 7
10. It's hard for me to shut off a disturbing thought.
1 2 3 4 5 6 7
11. I never regret my decisions.
1 2 3 4 5 6 7
12. I sometimes lose out on things because I can't make up my mind soon enough.
1 2 3 4 5 6 7

13. The reason I vote is because my vote can make a difference.
1 2 3 4 5 6 7
14. My parents were not always fair when they punished me.
1 2 3 4 5 6 7
15. I am a completely rational person.
1 2 3 4 5 6 7
16. I rarely appreciate criticism.
1 2 3 4 5 6 7
17. I am very confident of my judgments.
1 2 3 4 5 6 7
18. I have sometimes doubted my ability as a lover.
1 2 3 4 5 6 7
19. It's all right with me if some people happen to dislike me.
1 2 3 4 5 6 7
20. I don't always know the reasons why I do the things I do.
1 2 3 4 5 6 7
21. I sometimes tell lies if I have to.
1 2 3 4 5 6 7
22. I never cover up my mistakes.
1 2 3 4 5 6 7
23. There have been occasions when I have taken advantage of someone.
1 2 3 4 5 6 7
24. I never swear.
1 2 3 4 5 6 7
25. I sometimes try to get even rather than forgive and forget.
1 2 3 4 5 6 7
26. I always obey laws, even if I'm unlikely to get caught.
1 2 3 4 5 6 7
27. I have said something bad about a friend behind his or her back.
1 2 3 4 5 6 7

28. When I hear people talking privately, I avoid listening.
1 2 3 4 5 6 7
29. I have received too much change from a salesperson without telling him or her.
1 2 3 4 5 6 7
30. I always declare everything at customs.
1 2 3 4 5 6 7
31. When I was young I sometimes stole things.
1 2 3 4 5 6 7
32. I have never dropped litter on the street.
1 2 3 4 5 6 7
33. I sometimes drive faster than the speed limit.
1 2 3 4 5 6 7
34. I never read sexy books or magazines.
1 2 3 4 5 6 7
35. I have done things that I don't tell other people about.
1 2 3 4 5 6 7
36. I never take things that don't belong to me.
1 2 3 4 5 6 7
37. I have taken sick-leave from work or school even though wasn't really sick.
1 2 3 4 5 6 7
38. I have never damaged a library book or store merchandise without reporting it.
1 2 3 4 5 6 7
39. I have some pretty awful habits.
1 2 3 4 5 6 7
40. I don't gossip about other people's business.
1 2 3 4 5 6 7

Appendix J: Driving Vengeance Questionnaire

The following are some common driving situations encountered by drivers. Please circle the response that you would most likely make in that situation.

1. After stopping at a STOP sign, a motorist fails to yield the right of way to you when it is your turn to proceed through the intersection. You would:
 - (a) Pull out quickly to block their way.
 - (b) Give the driver an obscene gesture (e.g., the finger).
 - (c) Honk your horn.
 - (d) Do nothing.
 - (e) Other: _____
2. While driving on an expressway a vehicle cuts in front of you, forcing you to apply the brakes. You would:
 - (a) Cut in front of their vehicle forcing them to apply the brakes.
 - (b) Give the driver an obscene gesture.
 - (c) Honk your horn.
 - (d) Do nothing.
 - (e) Other: _____
3. A driver passes you and makes an obscene gesture at you. You would:
 - (a) Force the other vehicle off the road.
 - (b) Give the driver an obscene gesture.
 - (c) Honk your horn.
 - (d) Do nothing.
 - (e) Other: _____
4. Immediately after passing you, the driver slows down or applies his/her brakes. You would:
 - (a) Pull in front of the other vehicle and slow down.
 - (b) Give the driver an obscene gesture.
 - (c) Honk your horn.
 - (d) Do nothing.
 - (e) Other: _____

5. While driving at night, the vehicle immediately behind you has its high beam headlights on. You would:
- (a) Let the vehicle pass and turn on your high beams.
 - (b) Apply your brakes.
 - (c) Honk your horn.
 - (d) Do nothing.
 - (e) Other: _____
6. A driver persistently honks at you. You would:
- (a) Force the other vehicle off the road.
 - (b) Give the driver an obscene gesture.
 - (c) Honk your horn.
 - (d) Do nothing.
 - (e) Other: _____
7. A driver gets out of his/her vehicle at a traffic signal and approaches you in a threatening manner. You would:
- (a) Get out of your vehicle and confront him/her.
 - (b) Give the driver an obscene gesture.
 - (c) Honk your horn.
 - (d) Drive away.
 - (e) Other: _____
8. A vehicle bypasses a queue of vehicles and remains in the merge lane until the lane ends, and then tries to cut in front of your vehicle. You would:
- (a) Block the vehicle so that it can't get in.
 - (b) Give the driver an obscene gesture.
 - (c) Honk your horn.
 - (d) Do nothing.
 - (e) Other: _____
9. A slowly moving vehicle is occupying the left lane on an expressway, slowing traffic. You would:
- (a) Tailgate the vehicle until it moves.
 - (b) Give the driver an obscene gesture.
 - (c) Honk your horn.
 - (d) Do nothing.
 - (e) Other: _____

10. A vehicle directly in front of yours frequently applies the brakes, although no vehicle or pedestrian(s) is in front of it. You would:
- (a) Pass the vehicle and apply your brakes.
 - (b) Give the driver an obscene gesture.
 - (c) Honk your horn.
 - (d) Do nothing.
 - (e) Other: _____
11. Garbage thrown from another vehicle hits your vehicle. You would:
- (a) Throw garbage at the offending vehicle.
 - (b) Give the driver an obscene gesture.
 - (c) Honk your horn.
 - (d) Do nothing.
 - (e) Other: _____
12. Another driver takes a parking space that you have been waiting for. You would:
- (a) Get out of your vehicle and tell the driver to move his/her vehicle.
 - (b) Give the driver an obscene gesture.
 - (c) Honk your horn.
 - (d) Do nothing.
 - (e) Other: _____
13. The car in front of you doesn't proceed on an advanced green signal. You would:
- (a) Bump into the other car.
 - (b) Give the driver an obscene gesture.
 - (c) Lean on the horn.
 - (d) Do nothing.
 - (e) Other: _____
14. You want to turn right at a red light and the car in front of you, also making a right turn, does not proceed when the way is clear. You would:
- (a) Bump into the other car.
 - (b) Give the driver an obscene gesture.
 - (c) Lean on the horn.
 - (d) Do nothing.
 - (e) Other: _____

15. A vehicle stops on the roadway to pick up, or let out, a passenger causing a traffic delay. You would:
- (a) Stop and tell the driver off.
 - (b) Give the driver an obscene gesture.
 - (c) Honk your horn.
 - (d) Do nothing.
 - (e) Other: _____

Appendix K: Driving Anger Expression Inventory

Directions: Everyone feels angry or furious from time to time when driving, but people differ in the ways that they react when they are angry while driving. A number of statements are listed below which people have used to describe their reactions when they feel angry or furious. Read each statement and then circle the number to the right of the statement indicating how often you generally react or behave in the manner described when you are angry or furious while driving.

	Almost Never	Sometimes	Often	Almost Always
	1	2	3	4
1.	I give the other driver the finger.			
2.	I think about things that distract me from thinking about the other driver.			
3.	I drive right up on the other driver's bumper.			
4.	I drive a little faster than I was.			
5.	I think things through before I respond.			
6.	I try to cut in front of the other driver.			
7.	I tell myself its not worth getting all mad about.			
8.	I call the other driver names aloud.			
9.	I make negative comments about the driver aloud.			
10.	I follow right behind the other driver for a long time.			
11.	I try to get out of the car and tell the other driver off.			
12.	I yell questions like "Where did you get you license?"			
13.	I roll down the window to help communicate my anger.			
14.	I shake my fist at the other driver.			

15.	I try to think of positive things to do.	1	2	3	4
16.	I speed up to frustrate the other driver.	1	2	3	4
17.	I purposely block the other driver from doing what he/she wants to do.	1	2	3	4
18.	I leave my brights on in the other driver's rear view mirror.	1	2	3	4
19.	I drive recklessly.	1	2	3	4
20.	I try to force the other driver to the side of the road.	1	2	3	4
21.	I try to scare the other driver.	1	2	3	4
22.	I do to other drivers what they did to me.	1	2	3	4
23.	I try to think of positive solutions to deal with the situation.	1	2	3	4
24.	I drive a lot faster than I was.	1	2	3	4
25.	I swear at the other driver aloud.	1	2	3	4
26.	I decide not to stoop to their level.	1	2	3	4
27.	I swear at the other driver under my breath.	1	2	3	4
28.	I turn on the radio or music to calm down.	1	2	3	4
29.	I flash my lights at the other driver.	1	2	3	4
30.	I make hostile gestures other than giving the finger.	1	2	3	4
31.	I tell myself it's not worth getting involved in.	1	2	3	4
32.	I yell at the other driver.	1	2	3	4
33.	I make negative comments about the other driver under my breath.	1	2	3	4
34.	I just try to accept that there are bad drivers on the road.	1	2	3	4

35.	I call the other driver names under my breath.	1	2	3	4
36.	I just try to accept that there are frustrating situations while driving.	1	2	3	4
37.	I slow down to frustrate the other driver.	1	2	3	4
38.	I think about things that distract me from the frustration on the road.	1	2	3	4
39.	I tell myself to ignore it.	1	2	3	4
40.	I think about revenge.	1	2	3	4
41.	I put other drivers down in my thoughts.	1	2	3	4
42.	I keep my cool.	1	2	3	4
43.	I think about getting even.	1	2	3	4
44.	I become mentally very judgmental of others.	1	2	3	4
45.	I am secretly quite critical of others.	1	2	3	4
46.	I do things like take deep breaths to calm down.	1	2	3	4

Appendix L: Roadway Aggression Scale

Please circle the number reflecting how many times you have engaged in the following behaviors. If this has happened more than five times, circle 5+.

In the LAST THREE MONTHS, how many times have you...

1. Had a verbal argument with the driver of another vehicle?
0 1 2 3 4 5+
2. Had a physical fight with the driver of another vehicle?
0 1 2 3 4 5+
3. Made a hostile or rude gesture at another driver?
0 1 2 3 4 5+
4. Flashed your headlights at another driver in anger?
0 1 2 3 4 5+
5. Honked your horn in annoyance at another driver?
0 1 2 3 4 5+
6. Yelled at another driver?
0 1 2 3 4 5+
7. Deliberately drove up on another driver's bumper or tailgated?
0 1 2 3 4 5+
8. Deliberately cut another driver off?
0 1 2 3 4 5+
9. Chased another driver who annoyed you?
0 1 2 3 4 5+

10. Deliberately blocked or obstructed another driver?

0 1 2 3 4 5+

11. Swore out loud at another driver?

0 1 2 3 4 5+

General Driving Questions:

1. Number of kilometres driven in past three months

2. In the past three months, where did you drive mostly? (please circle one)

Urban

Rural

3. In the past three months, did you drive during rush-hour traffic regularly? (please circle one)

Yes

No

Appendix M: Telephone Recruitment Script for Main Study

My name is Dan Antonowicz. I am a Ph.D. student in Psychology at Carleton University. I am trying to recruit students to participate in my thesis study on driving behaviors among university students. Your name and phone number were obtained through the mass testing procedure you took part in at the beginning of the semester. There was a question on whether you had driven a motor vehicle in the last three months. If you indicated that you had driven in this time period, then you met the requirement for my study.

If you agree to participate in my study, you will be asked to fill out a number of self-report questionnaires on driving behaviors. It will require one session of approximately 50 minutes and will take place in a seminar room on campus. As you know, you will receive research credit for your participation. You are free to withdraw from this study at any time; or you can simply refuse to participate in the study, or you can refuse to answer specific questions without any risk of penalty. All your responses will be confidential.

Appendix N: Informed Consent Form for Main Study

INFORMED CONSENT FORM

Project: Driving Anger and Roadway Aggression among University Students

Investigators: Daniel Antonowicz, Department of Psychology,
Carleton University
Dr. Ian Shields, Ottawa-Carleton Detention Centre

The purpose of this informed consent form is to ensure that you understand the purpose of the study and the nature of your involvement. The informed consent must provide you with enough information such that you have the opportunity to determine whether you wish to participate in the study. Please ask the researcher to clarify any concerns you may have.

I hereby consent to participate in a study examining driving anger and roadway aggression. I understand that this study will involve one session of approximately 50 minutes.

I understand that the study will include a number of questionnaires which cover the following areas: driving anger, driving anger expression, impulsivity, general anger, attributions of hostile intent (i.e., the belief that another person has done something hostile or malicious to you), and social desirability (i.e., answering questions in a manner that makes one look good or favorable to others). The information I give will be used for research purposes only. I understand that I do not have to answer any questions that I do not wish to and I have been given the option to withdraw from this study at anytime without penalty.

Any information I give will be strictly confidential. My answers will be coded in such a way that I cannot be identified in any report of the results.

For more information about this study contact one of the investigators listed below:

(1)	Dan Antonowicz	567-1013
	e-mail:	dantonow@chat.carleton.ca
(2)	Dr. Ian Shields	824-6080

If you have any concerns regarding the ethics of this research study, you may contact:

(1)	Chair, Department of Psychology, Carleton University
	Dr. Kim Matheson, 520-2600, ext. 7513

- (2) Chair of the Ethics Committee, Department of Psychology,
Carleton University
Dr. Mary Gick, 520-2664

My signature below indicates that I have read the above, and that I agree to take part.

Participant's Name: _____

Participant's Signature:_____ **Date:**_____

Researcher's Signature:_____ **Date:**_____

Appendix O: Debriefing Form for Main Study

DEBRIEFING FORM

Thank you for participating in this study. The main objective of this research was to examine the role of attributions of hostile intent (i.e., the belief that another person has done something hostile or malicious to you), general anger, driving anger, and impulsivity in the commission of roadway aggression among university students. Previous research has found that attributions of hostile intent, general anger, and impulsivity are related to aggression in general. The purpose of the questionnaires you completed was to gain a better understanding of the role that the abovementioned factors may play in the occurrence of the different types of roadway aggression. This information could prove to be useful in screening drivers who may potentially commit roadway aggression, and in developing intervention programs for them. This may subsequently help reduce the number of injuries and deaths resulting from roadway aggression.

If you think of any questions after the study is completed or you want more information, please feel free to contact Daniel Antonowicz (567-1013) or Dr. Ian Shields (824-6080).

If you have any concerns regarding the ethics of this research study, you may contact:

- (1) Chair, Department of Psychology, Carleton University
Dr. Kim Matheson, 520-2600, ext. 7513
- (2) Chair of the Ethics Committee, Department of Psychology,
Carleton
University
Dr. Mary Gick, 520-2664

**Appendix P: Results of the path analysis delineating the driving paths
found to be non-significant in predicting roadway aggression as
measured by the RAS**

Results of the path analysis delineating the driving paths found to be non-significant in predicting roadway aggression as measured by the RAS.

Note. ADSS-A=Attributions in Driving Situations Scale - Ambiguous; Attributions in Driving Situations Scale - Hostile; DAS=Driving Anger Scale; DACS=Driving Anger Coping Scale; RAS=Roadway Aggression Scale.

Appendix Q: Results of the path analysis delineating the driving paths

**found to be non-significant in predicting roadway aggression as
measured by the DVQ**

**Appendix R: Results of the path analysis delineating the general paths
found to be non-significant in predicting roadway aggression as
measured by the RAS**

**Appendix S: Results of the path analysis delineating the general paths
found to be non-significant in predicting roadway aggression as
measured by the DVQ**

Results of the path analysis delineating the general paths found to be non-significant in predicting roadway aggression as measured by the DVQ.

Note. AGSS-A=Attributions in General Situations Scale - Ambiguous; AGSS-H=Attributions in General Situations Scale - Hostile; TAS=Trait Anger Scale; BIS-11=Barratt's Impulsiveness Scale; DVQ=Driving Vengeance Questionnaire.