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The Prosocial and Aggressive Driving Inventory (PADI): A Self-Report Measure of Safe and Unsafe Driving Behaviors

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Abstract

Surveys of 1217 undergraduate students supported the reliability (inter-item and test-retest) and validity of the Prosocial and Aggressive Driving Inventory (PADI). Principal component analyses on the PADI items yielded two scales: Prosocial Driving (17 items) and Aggressive Driving (12 items). Prosocial Driving was associated with fewer reported traffic accidents and violations, with participants who were older and female, and with lower Boredom Susceptibility and Hostility scores, and higher scores on Agreeableness, Conscientiousness, Openness, and Neuroticism. Aggressive Driving was associated with more frequent traffic violations, with female participants, and with higher scores on Competitiveness, Sensation Seeking, Hostility, and Extraversion, and lower scores on Conscientiousness, Agreeableness, and Openness. The theoretical and practical implications of the PADI's dual focus on safe and unsafe driving are discussed.

Keywords: aggressive driving; prosocial driving; driver safety; Five Factor Model

1. Introduction

In 2010, according to the U. S. Department of Transportation (2012), the number of registered motor vehicles in the United States exceeded 250 million. With this volume of traffic, accidents are a major national concern; the National Highway Traffic Safety Administration (2012) estimates that there were over 5.4 million automobile accidents in the United States in 2010 resulting in 2.2 million injuries and 32,885 deaths. Naumann, Dellinger, Zaloshnia, Lawence, and Miller (2010) reported that, in 2005, lifetime costs for medical care and productivity loss due to motor vehicle accidents in the United States totaled over $99 billion. These statistics, and the pain and suffering they reflect, suggest a current and ongoing need for research on driver behavior, particularly in relation to safe driving practices.

The Prosocial and Aggressive Driving Inventory (PADI) is a self-report questionnaire that includes two scales measuring safe (prosocial) and unsafe (aggressive) driving practices. The purpose of our research was to develop this measure, establish its reliability (i.e., both inter-item and test-retest), and assess its validity by relating the PADI scales to conceptually relevant outcomes (i.e., self-reported traffic accidents and violations) and personality characteristics (e.g., trait hostility, conscientiousness). In developing the PADI, our hope is to contribute to research which promotes safety for drivers, pedestrians, and others who share the road.

While traffic accidents and deaths have a number of causes, research on driving behavior has focused primarily on risky forms of driving. Over the last two decades, researchers have developed a number of assessment instruments designed to measure different aspects of unsafe driving practices including aggressive driving (Dula & Ballard, 2001; Glendon, Dorn, Matthews, Gulian, Davies, & Debney, 1993), angry driving (Deffenbacher, Oetting, & Lynch, 1994; Dula & Ballard, 2001), vengeful driving (Hennessy & Wiesenthal, 2005; Wiesenthal, Hennessy, & Gibson, 2000), distracted driving (Bone & Mowen, 2006), stressed driving (Larson, 1996),

anxious driving (Clapp, Olsen, Beck, Palyo, Grant, Gudmundsdottir, & Marques, 2011), and risky driving (Dula & Ballard, 2001). Although all of these approaches provide useful perspectives on unsafe driving, they overlook effective forms of driving behavior that help motorists avoid traffic accidents and successfully cooperate with others within the driving environment. Taubman-Ben-Ari, Mikulincer, and Gillath (2004) offer a notable exception by assessing a variety of driving styles including "patient" and "careful" driving. However, even measures utilizing broad assessment strategies often focus on clusters of variables associated with driving (e.g., mood states, cognitions, and coping responses) rather than driving behavior itself.

The PADI measures self-report driving behavior for both safe and unsafe driving behaviors. By assessing the frequency of specific driving behaviors, this new measure builds on the conceptual and methodological framework of the Aggressive Driving Behavior Scale (ADBS; Houston, Harris, & Norman, 2003). Like the ADBS, the PADI is based on a definition of aggressive driving as "a pattern of unsafe driving behavior that puts the driver and others at risk" (Houston, et al., 2003, p. 270). Note that this definition does not reference anger or intention to harm (Ellison-Potter, Bell, & Deffenbacher, 2001) and the "aggressive" behaviors assessed by the ADBS and the PADI are not overtly violent as much as they are risky (e.g., speeding, tailgating) or expressions of displeasure (e.g., horn honking, rude gestures).

We define prosocial driving, a dimension not assessed by the ADBS, as a pattern of safe driving behaviors that potentially protect the well-being of passengers, other drivers, and pedestrians, and that promotes effective cooperation with others in the driving environment. This definition is consistent with more general conceptualizations of prosocial behavior which, as noted by Batson (2012), include a "broad range of actions intended to benefit one or more people other than oneself – behaviors such as helping, comforting, sharing, cooperation, philanthropy,

and community service" (p. 243). As was the case with aggressive driving, our conceptualization of prosocial driving does not refer to the emotional states (e.g., concern, empathy) or motivations (e.g., self-interest, altruism) of the driver. This emphasis on behavior rather than intent is consistent with Piliavin, Dovidio, Gaertner, and Clark's (1981) definition of prosocial behavior as actions that are "defined by society as generally beneficial to other people and to the ongoing political system" (p. 4).

As with most driving measures, the PADI shares an underlying assumption that driving behavior represents a relatively stable and enduring characteristic of the driver. Given this common assumption in the literature, it is surprising how few studies have assessed the test-retest reliability of driving measures to determine their stability over time. Instead, studies generally report internal consistency of measures to demonstrate the cohesiveness of scale items but fail to provide compelling evidence that the construct being measured represents a stable individual difference. While adequate internal consistency is an important psychometric property for all scales, test-retest reliability evidence is necessary to determine if a measure is assessing a stable trait or a variable state (Zuckerman, 1976).

In this study we relate the PADI to expected criteria such as traffic accidents and violations. We also relate the PADI scales to personality characteristics previously associated with unsafe driving behavior such as competitiveness (Harris & Houston, 2010), hostility (Blankenship & Nesbit, 2013; Deffenbacher et al., 2001; Dula & Ballard, 2003; Houston et al., 2003), and sensation seeking (Dahlen & White, 2006; Iversen & Rundmo, 2002; Jonah, Thiessen, & Au-Yeung, 2001; Yagil, 2001; Zuckerman & Neeb, 1980). Since driving is based on cooperative principles of social interaction as well as prescriptive rules that emphasize courtesy, restraint, and respect for the rights of others, engaging in competitive, hostile, and sensation seeking actions should be positively associated with aggressive driving behavior. Conversely,

these personality traits tend to interfere with effective patterns of cooperative behavior and should be negatively associated with prosocial driving behavior.

Several studies have also linked unsafe driving behavior to broader personality dimensions that make up the Five Factor Model such as neuroticism (Dahen & White, 2006; Taubman-Bar-Ari et al., 2004), extraversion (Fine, 1963; Lajuen, 2001; Loo, 1979; Shaw & Sichel,1971), and openness (Arthur & Graziano, 1996). However, the pattern of results is somewhat mixed and difficult to interpret due to differences in operational definitions of driving behavior. Also, as Dahlen and White (2006) point out, different combinations of predictors may account for different types of unsafe driving behavior.

The relationship between "Big Five" traits and prosocial driving behavior is largely unknown since researchers have not systematically investigated prosocial driving. However, research utilizing indicators of unsafe driving suggest that it may be less likely among drivers high in conscientiousness and agreeableness (Arthur & Doverspike, 2001; Arthur & Graziano, 1996; Bogg & Roberts, 2004; Cellar, Nelson & Yorke, 2000; Dahlen, Edwards, Tubre, Zyphur, & Warren, 2012; Jovanovic, Lipovac, Stanojevic, & Stanojevic, 2011). Researchers have also linked openness with certain types of unsafe driving, though the findings are less clear. For example, Benfield, Szlemko, and Bell (2007) found an inverse relationship between openness and the aggressive use of a vehicle, while Cellar et al. (2000) found a negative relationship between openness and traffic accidents. Although these findings are suggestive, there is still a need to determine if the relationship between the Five Factor Model and lower levels of unsafe driving equates to higher levels of prosocial driving.

In the current study, we assessed the PADI in two rounds of data collection broken into three studies: 1) Study 1 used an online questionnaire to identify scales within the PADI and assess the inter-item reliability of these scales; 2) Study 2 used a paper and pencil version of the

questionnaire, replicating the results of Study 1, and assessing the test-retest reliabilities of the PADI scales, and; 3) Study 3 combined the data from the first two studies to correlate PADI scales with self-reported traffic accidents and violations, and with personality measures of competitiveness, hostility, sensation seeking, and the Big Five traits of conscientiousness, agreeableness, extraversion, neuroticism, and openness (John, Naumann, & Soto, 2008).

2. Method

2.1. Participants and Procedures

Participants for Study 1 completed an online questionnaire hosted on the SurveyMonkey® Web site. They were provided a link to access the survey, completed the measures unsupervised on their own time, and received course credit in exchange for their participation. Volunteers included 854 students (627 female and 227 male) enrolled in undergraduate psychology classes at a large state university (n = 809) or a small liberal arts college (n = 45), both in Central Florida. Although the majority of participants (90%) were under the age of 25 years, ages ranged from 18 to 61 years (Mdn = 19). All of the participants were licensed drivers, having held a license for anywhere from less than a year up to 33 years (Mdn = 3).

Participants for Study 2 completed a paper and pencil version of the same questionnaire at two separate times (test and retest). Administration was controlled, with small groups completing the questionnaires in classroom settings, again for course credit. Volunteers for the first administration (test) included 363 students (212 female and 151 male) enrolled in undergraduate psychology classes at a large state university in Minnesota (n = 195) or a small liberal arts college in Central Florida (n = 168). Again, the majority of participants (90%) were under the age of 25 years, but the overall range was from 18 to 49 years (Mdn = 20). All of the participants were licensed drivers, having held a license for anywhere from less than a year up to 30 years (Mdn = 4 years).

Of the initial 363 test participants in Study 2, 274 (163 female, 111 male) returned for the retest session (75.48% return rate). This group ranged in age from 18 to 35 (*Mdn* = 20) and had held a driver's license ranging from less than a year to 19 years (*Mdn* = 4 years). Our goal was to schedule retest sessions 20-30 days, or approximately 3-4 weeks, after the original test sessions. Although most of our participants (91.97%) fell into this window, we allowed some flexibility to accommodate student schedules, extending the test-retest range from 17 to 43 days (*Mdn* = 23). When assessing test-retest reliabilities, we conducted an initial set of partial correlations controlling for test-retest lag time; these tests indicated that the time lag between test and retest sessions did not influence reliabilities (partial and simple correlations, within rounding, were identical).

In Study 3 we aggregated the data from Study 1 and Study 2 (pretest only) and removed participants with missing data on measures to be used in regression analyses. Participants included 1181 students (819 female and 362 male) ranging in age from 18 to 61 years (*Mdn* = 20) and who had held driver's licenses for anywhere from less than 1 year to 33 years (*Mdn* = 4). Again, the majority of participants (90%) were under 25 years of age.

2.2. Measures

Measures of interest were the same for all three studies, including PADI items, driving incidents (accidents and tickets), and personality measures.

Our initial set of PADI questions included the 11 items from the Aggressive Driving Behavior Scale (Houston et al., 2003) which the authors report were "generated following a series of peer focus groups in which undergraduate students discussed their own driving behaviors and those of others" (p. 271). To these 11, we added an additional 25 items that were generated by reviewing safe and unsafe driving practices described in DMV driving manuals/handbooks from a number of different U.S. states. A preliminary set of analyses of the

Study 1 data pared this item pool down to 29 items (see Table 1), with 7 questions dropped because of low variability or because they dampened inter-item reliabilities of scales. Driving items were preceded by the stem, "Using the response scale provided, indicate how often you engage in each of these driving behaviors." The items were rated on a 6-point scale: *never*, *almost never*, *sometimes*, *fairly often*, *very often*, and *always*.

To assess driving incidents, we asked participants "During the last three years how many accidents have you had?" and "During the last three years how many traffic violations (tickets) have your received?" In both cases, the response was open so that participants could put in any number of their choosing. Because the responses to these two questions were so highly skewed (see Results section), we dichotomized the two measures so that 0 indicated no accidents or violations, and 1 indicated some (at least 1) accidents or violations.

Personality measures including those previously found to be related to the Aggressive Driving Behavior Scale (Harris & Houston, 2010; Houston, Harris, & Norman, 2003): 1) competitiveness was measured using the Revised Competitiveness Index (Houston, Harris, McIntire, & Francis, 2002); 2) sensation seeking was measured using the Thrill and Adventure Seeking and the Boredom Susceptibility subscales from Form V of the Sensation Seeking Scale (Zuckerman, Eysenck, & Esenck, 1978), and; 3) hostility was measured using the Cook Medley Hostility Scale (Cook & Medley, 1954). In order to relate the PADI to the Five Factor Model traits, we also included the Big Five Index (BFI; John, Donahue, & Kentle, 1991; John, Naumann, & Soto, 2008).

3. Results

For Study 1, we conducted a principal component analysis with varimax rotation of the 29 PADI items. This analysis yielded 5 components with eigenvalues greater than 1, a solution that was neither parsimonious nor interpretable. Cattell's (1966) scree test revealed a pattern with

2 components "above the elbow" of the scree plot. A second principal components analysis specifying a 2 factor solution accounted for 37.98% of the variance. As the first two columns of loadings in Table 1 illustrate, the first component loaded high on safe driving practices, while the second component loaded high on the unsafe practices.

The same analytic strategy was used on the Study 2 pretest data. A principal component analysis with varimax rotation of the 29 PADI items yielded 8 components with eigenvalues greater than 1 (again uninterpretable), but a scree test revealed a pattern with 2 components "above the elbow" of the scree plot. A second principal components analysis specifying a 2 factor solution accounted for 31.55% of the variance. The second two columns of loadings in Table 1 illustrate a similar pattern as Study 1 with first component loading high on safe driving practices and the second component loading high on unsafe practices.

To verify the exploratory findings of the two principal component analyses, we combined the results of the two studies and submitted the aggregate data to confirmatory factor analyses using maximum likelihood estimation. The 29 PADI items were tested for fit within a two-factor model representing safe and unsafe driving behaviors: these proposed factors were composed of items 1-17 and 18-29, respectively. An initial model (N =1122) was tested in which all items had independent error terms and in which only the two latent variables were proposed to covary, but this model yielded an unsatisfactory fit to the data (χ^2 (376) = 2792.10, $p < .001$, CFI = .77, SRMR = .06, RMSEA = .08).

A rational analysis of the content of the items was conducted to identify items that could be reasonably expected to have covarying residuals based on the similarity of their content. In all, 11 covariances were added to the model. Among the safe driving items, covariances between the following items' error terms were specified: Items 7, 11, and 13 relating to decreasing speed; items 1, 3, and 9 relating to caution around pedestrians; items 4 and 17 relating to safety making

on turns, and; items 2 and 5 relating to vigilance/attention. Among the unsafe driving items, covariances between the following items' error terms were specified: Items 26 and 27 relating to expressions of anger; items 21 and 28 relating to unsafe passing, and; items 19 and 20 relating to preventing others from passing.

After specifying these covariances between item residuals, the second iteration of the model (N =1122) yielded an acceptable fit (χ^2 (365) = 1316.67, $p < .001$, CFI = .91, SRMR = .05, RMSEA = .05). The second model demonstrated a statistically significant improvement in fit over the first model (χ^2 (11) = 1475.43, $p < .001$). These results provided support for the two-factor structure of the PADI.

Based on these analyses, we divided the PADI items into two scales: Prosocial Driving and Aggressive Driving. The Prosocial Driving scale included items 1-17 in Table 1 which assessed safe driving behaviors that could help protect the participant, other drivers, and pedestrians, from harm on the roadways. The Aggressive Driving scale included items 18-29 in Table 1 which assessed unsafe driving behaviors that exhibit hostility (e.g., horn honking, rude gestures) or that could harm the participant, other drivers, and pedestrians (e.g., speeding, weaving in and out of lanes). The Aggressive Driving scale included 10 of the 11 items (1 item was dropped to increase reliability) from the original Aggressive Driving Behavior Scale (Houston, Harris, & Norman, 2003) along with 2 new items (weaving in and out of lanes and passing in the right lane).

As illustrated in Table 2, both PADI scales demonstrated acceptable inter-item reliabilities (Cronbach's α) ranging from .77 to .90 across Studies 1 and 2. The test-retest reliabilities (Pearson's r) of .79 for Prosocial Driving and .77 for Aggressive Driving indicated that these two scales are relatively stable over the span of time used in the study.

The means in Table 2 also suggest that participants were more likely to report prosocial

as opposed to aggressive driving behavior. This difference was significant for both Study 1, $t(853) = 59.80$, $p < .01$, $\eta^2 = .81$, and Study 2, $t(362) = 42.72$, $p < .01$, $\eta^2 = .83$.

When examining gender differences, we treated age as a covariate since females were significantly younger ($M = 20.15$, $SD = 3.07$) than males ($M = 21.21$, $SD = 2.95$) in Study 2, $t(361) = -3.28$, $p < .01$, $\eta^2 = .03$ (this was not the case for Study 1). Results indicated that females had higher Prosocial Driving scores for Study 1, $F(1, 851) = 15.09$, $p < .01$, $\eta^2 = .02$, and Study 2, $F(1, 360) = 5.16$, $p = .02$, $\eta^2 = .01$. We did not find significant gender differences in Aggressive Driving scores for either study (both F values < 1).

Study 3 regression analyses were conducted on the aggregate of data sets for Studies 1 and 2 following the list-wise removal of participants with missing data. Table 3 reports the results of two logistic regression analyses predicting self-reported traffic accidents and violations. These two criterion variables were dichotomized (0 = no accidents or tickets, 1 = some accidents or tickets) because of their highly skewed distributions; 65.4% of participants reported 0 accidents in the past 3 years, another 22.9% reported 1 accident, and the remaining 11.7% reported 2 to 5 accidents. For violations, 57.3% of participants reported 0 tickets, another 25.6% reported 1 ticket, and the remaining 17.1% reported 2 to 10 tickets. As illustrated in Table 3, both regression models were statistically significant. Traffic accidents were more likely to be reported by participants who were younger, female, and who scored lower on Prosocial Driving. Traffic violations were more likely to be reported by participants with lower scores on Prosocial Driving and higher scores on Aggressive Driving; age and gender were not significant predictors.

Previous research on the Aggressive Driving Behavior Scale (Harris et al., 2010; Houston et al., 2003) showed a relationship between unsafe driving and measures of competitiveness, sensation seeking, and hostility. The top half of Table 4 shows the results of two multiple regressions predicting PADI scales with these personality measures along with gender and age.

Participants who scored higher on Prosocial Driving were more likely to be female and to have lower scores on Boredom Susceptibility and Hostility. Participants who scored higher on Aggressive Driving were also more likely to be female and to have higher scores on Hostility, Competiveness, Boredom Susceptibility, and Thrill and Adventure Seeking.

The second set of multiple regression analyses, presented in the bottom half of Table 4, predicted PADI scores with the Big Five Index (John et al., 1991, 2008) along with gender and age. Participants who scored higher on Prosocial Driving were more likely to be female, older, and to score higher on Agreeableness, Conscientiousness, Openness, and Neuroticism. The effect of Neuroticism was the result of suppression from its relationship with Agreeableness; when partialling out Agreeableness, the correlation between Neuroticism and Prosocial Driving jumps from $r = -.03$, $p = .35$, to $r_{ab.c} = .10$, $p < .01$. Turning to Aggressive Driving, participants with higher scores were more likely to be female, to have higher Extraversion scores, and to have lower scores on Agreeableness, Conscientiousness, and Openness.

Finally, in examining the relationship between Prosocial and Aggressive Driving, scores for the two scales yielded significant negative correlations for Study 1, $r(852) = -.33$, $p < .01$, Study 2, $r(351) = -.38$, $p < .01$, and the omnibus data set for Study 3, $r(1179) = -.31$, $p < .01$. Therefore, while safe driving is negatively related to unsafe driving, the relationship is far from perfect, with the two variables sharing less that 15% of their variability in common.

4. Discussion

Our research resulted in a new questionnaire, the Prosocial and Aggressive Driving Inventory (PADI), that includes two scales measuring self-reported safe driving practices (Prosocial Driving scale) and unsafe driving practices (Aggressive Driving scale). Analyses indicated that these two scales are correlated but distinct measures that demonstrate acceptable inter-item and test-retest reliabilities, and that relate in meaningful ways to driving outcome and

personality measures. Although our analyses provided evidence for the reliability and validity of the PADI, they also raised questions and suggested avenues for future investigation.

One question, relating to construct validity, is to what extent the PADI items represent two distinct latent variables that we have labeled Prosocial Driving and Aggressive Driving? Supporting construct validity, two separate principal component analyses independently indicated a two-component solution for the PADI items and this solution was further supported by a confirmatory factor analysis. On the other hand, for both principal component analyses, the two components accounted for less than 40% of total variance. One possible explanation for the error in in this model relates the behavioral nature of the items; the PADI measures self-reported frequency of overt behaviors without reference to motivation or intent. Research on aggressive driving, and to a lesser extent, prosocial driving, indicates that there are a multitude of latent psychological constructs that potentially motivate these behaviors. In the current study alone we found eight separate personality variables relating to aggressive driving and six related to prosocial driving. It is also reasonable to assume that these latent variables relate differentially to different behaviors. For example, sensation seeking may be a strong motivator for speeding but less so for expressions of anger like horn honking and rude gestures (Harris & Houston, 2010). In short, given the broad based sampling of safe and unsafe behaviors represented in the PADI (i.e., its content validity), and the multiple sources of motivation for these behaviors, it is not surprising that there is considerable error in a two-component model. However, the two-component model may still be the best fit for an omnibus measure of aggressive and prosocial driving that utilizes behavioral self-report. We maintain that such a broad-based instrument, particularly one that appears to have stable properties, can have considerably utility as a research or diagnostic tool.

Moving to criterion validity, when predicting self-reported accidents and violations, our

results showed expected relationships with both PADI scales for traffic violations, but only with Prosocial Driving for accidents. It is possible, though unlikely, that safe driving is the sole predictor of accidents; it is more likely that our lack of variability in self-reported violations and accidents resulted in more modest relationships for these analyses. These findings indicate a need for additional research relating the PADI to driving outcomes. This could involve expanding the sample beyond the college population – an older, more diverse sample, would likely have greater variability in accidents and violations. In addition to sampling, the use of self-report presents validity problems measuring accidents, violations, and driving practices. For example, individuals may not always be the best judge of their driving (e.g., see West, French, Kemp, & Elander, 1993) or their answers may be influenced by contextual factors such as social desirability (e.g., see Lajunen & Summala, 2003). Future research is needed to confirm these results using more objective methods such as controlled simulator studies, direct observation of driving behavior in the field, and/or relating PADI scores to public driving records.

The pattern of results from the multiple regression predicting unsafe driving with measures of competitiveness, hostility, and sensation seeking support the hypothesis that unsafe driving is positively related to these personality traits. These findings are also consistent with previous research linking competitiveness (Harris et al., 2010), hostility (Deffenbacher et al., 2001; Galovski & Blanchard, 2002; Houston et al., 2003) and sensation seeking (Iverson & Rundmo, 2002; Jonah et al., 2001; Zuckerman & Neeb, 1980) to various forms of unsafe driving behavior. Although these same personality traits were hypothesized to negatively relate to prosocial driving, multiple regression results indicated that only hostility and the boredom susceptibility subscale of the sensation seeking measure predicted prosocial driving. Due to the dearth of research on safe driving, it is difficult to frame these results within the context of previous research. However, Taubman-Ben-Ari et al. (2004) found that careful driving, a driving

style emphasizing cautiousness, was negatively related to impulsive sensation seeking. While the measures used to assess both sensation seeking and safe driving differ, these findings support the proposition that safe driving and sensation seeking are negatively related. As a whole, these findings highlight the need for further research to identity the unique personality correlates for prosocial driving.

Given the mixed pattern of results from previous research investigating the relationship between unsafe driving and personality dimensions from the Five Factor Model, this study adopted an exploratory approach to this research question. Multiple regression results indicate that conscientiousness, agreeableness, and openness are all negatively related to aggressive driving while extraversion is positively related. The inverse relationships between conscientiousness and agreeableness and aggressive driving are consistent with previous research (Dahlen et al., 2012, and Jovanovic et al., 2011) and conceptually link to patterns of social behavior generally associated with these personality traits.

In keeping with the conflicting results from previous research, the negative relationship between openness and aggressive driving is consistent with only some of the research. More specifically, the finding is consistent with studies focusing on specific aspects of unsafe driving such as risky driving (Dahlen et al., 2006) and aggressive use of vehicle and provocation to anger (Benfield, Szlemko, & Bell, 2007). However, the findings differ from research using broader measures of aggressive driving which report no significant relationship between openness and aggressive driving (e.g., Dahlen et al., 2012; Jovanovic et al, 2011). While Dahlen et al (2012) offer a plausible connection between openness and aggressive driving by proposing that individuals high in openness are more likely to be tolerant and make situational attributions of other drivers' behavior thus reducing the likelihood of invoking hostile reactions, empirical support for this proposition remains sparse and inconclusive.

Based on previous research, extraversion may be the most enigmatic of the Big Five dimensions to relate to aggressive driving. Despite the fact that extraversion is defined, in part, by assertive and impulsive behavior and positively associated with a variety of unsafe driving outcomes including moving violations (Lev, Hershkovitz, & Yechiam, 2008) and traffic fatalities (Lajunen, 2001), the relationship between extraversion and aggressive driving remains fragmented and contradictory. Consequently, the finding that extraversion is positively related to aggressive driving is consistent with results from Benfield et al. (2007) and Jovanovic et al. (2011) involving physically aggressive gestures (e.g., giving the other driver the finger) but inconsistent with Dahlen et al. (2012) and Dahlen et al. (2006) who found no relationship using more general measures of driver anger and aggression. While Taubman-Ben-Ari et al. (2004) report that extraversion is negatively related to anxious and dissociative driving styles, these forms of unsafe driving may be too different from the aggressive driving behavior assessed in this study to allow for meaningful comparison. These divergent findings suggest that more research is needed to develop a comprehensive understanding of the relationship between extraversion and aggressive driving.

The results from the final multiple regression analysis indicate that conscientiousness, agreeableness, neuroticism and openness are all positively related to prosocial driving. Since agreeableness is associated with cooperative, trusting, and courteous behavior, the positive relationship with prosocial driving conceptually makes sense. Likewise, the construct definition of conscientiousness stresses carefulness and thoroughness which correspond to key requirements of safe driving and logically link to prosocial driving behaviors. Conscientiousness is also positively related to safe behavior in other social domains including the workplace (Wallace & Vodanovich, 2003). While the positive relationship between openness and prosocial driving may be linked to greater tolerance and sensitivity, the conceptual link between

neuroticism and prosocial driving is less clear. Overall, the combination of predictors for prosocial driving represents a new and distinctive pattern of relationships that is not simply the inverse of aggressive driving predictors. More research is needed to clarify and refine the nature of these relationships as well as the relationship between prosocial driving and other individual difference variables.

One relatively unique aspect of our study was establishing test-retest reliabilities for the PADI. As mentioned in the introduction, most driving measures focus on unsafe practices and most treat driving as a stable and enduring individual difference, but very few researchers have actually tracked scores on their measures over time. While our research supports the consistency of PADI scores over time, this time was limited several weeks. Given that age is often related to accidents (Akerstedt & Kecklund, 2001; Lourens, Vissers, & Jessurum, 1999), it is likely that driving behavior does change over the lifespan. If driving behavior is relatively stable and enduring, we need a better understanding of how stable and enduring, not just for the PADI, but for other measures that tap into emotional and motivational components as well.

Since the PADI does not measure intention, research is also needed to determine if factors that motivate other forms of prosocial and aggressive behavior also motivate driving behavior. This is particularly true for safe driving since it has been more widely ignored in the literature compared to unsafe practices. For example, Batson, Ahmad, and Stocks (2011) propose that prosocial behavior stems from four sources of motivations: 1) self-interest (i.e., egoism) where the behavior results in gaining reward or avoiding punishment; 2) interest in helping others without benefit to one's self (i.e., altruism); 3) interest in promoting the welfare of one's group (i.e., collectivism), or; 4) the desire to remain consistent to morals or ideals (principlism). One could imagine people who drive safely because they want to help themselves (e.g., avoid a ticket), help others (avoid hurting others in an accident), to conform to group norms regarding

safe driving, or because their principles involve obeying the "rules of the road."

The World Health Organization (2009) estimates that there are 20-50 million traffic related injuries and 1.2 million deaths worldwide each year, leading them to list traffic related injuries as the 9th leading cause of death worldwide in 2004 and predicting that they would rise to the 5th leading cause by 2030. Like most of our colleagues who study driving, we are motivated to conduct research that will improve safety on our roads. The PADI might eventually be used as a screening tool to identify "at risk" drivers in need of intervention, or might be used as an evaluation tool to monitor the progress of driver interventions. Given the expanding global culture of the automobile, there is a current and continuing need for interventions that promote, and measures that assess, safe and unsafe driving practices.

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Table 1

Item Loadings for Principal Component Analysis with Varimax Rotation for PADI Items

	Study 1		Study 2	
Scales/Items	1	2	1	2
Prosocial Driving				
1. Drive with extra care around pedestrians	.72	-.11	.64	-.13
2. Pay special attention when approaching intersections	.72	.05	.67	-.15
3. Drive with extra care around bicyclists	.70	-.11	.62	-.11
4. Pay special attention when making turns	.70	.02	.64	.05
5. Pay attention to traffic and my surroundings while driving	.65	-.02	.68	-.04
6. Break slowly enough to alert drivers behind me	.65	-.02	.58	-.14
7. Decrease speed to accommodate poor road conditions	.64	-.12	.62	-.04
8. Use mirrors and check blind spots when changing lanes	.64	-.04	.62	-.16
9. Drive more cautiously to accommodate people or vehicles on the side of the road (e.g., slow down, move over)	.61	-.14	.47	-.23
10. Maintain a safe distance when following other vehicles	.60	-.18	.50	-.34
11. Slow down in a construction zone	.59	-.12	.41	-.21
12. Come to a complete stop at a stop sign	.57	-.15	.39	-.19
13. Decrease speed to accommodate poor weather conditions	.57	-.09	.53	.04
14. Yield when the right of way belongs to other drivers	.56	-.08	.49	-.04
15. Obey traffic signs	.55	-.18	.52	-.15
16. Obey posted speed limits in a school zone	.55	-.13	.49	-.04
17. Use turn signals (blinkers) to notify other drivers of my intention to turn	.53	-.15	.42	-.19
Aggressive Driving				
18. Weave in and out of lanes to overtake traffic	-.24	.69	-.17	.64
19. Speed up when another vehicle tries to overtake me	-.15	.65	-.09	.61
20. Follow the vehicle in front of me closely to prevent another vehicle from merging in front of me	-.16	.64	-.17	.59
21. Pass in front of a vehicle at less than a car length	-.16	.64	-.19	.52
22. Merge into traffic even when another driver tries to close the gap between vehicles	-.14	.58	-.11	.50
23. Accelerate into an intersection when the traffic light is changing from yellow to red	-.11	.56	-.18	.50
24. Drive 15 miles per hour faster than the posted speed limit	-.24	.56	-.19	.52
25. Flash my high beams at a slower vehicle so that it will get out of my way	-.20	.53	-.07	.56
26. Make rude gestures at other drivers when they do something I don't like	-.11	.53	-.12	.49
27. Honk when another driver does something inappropriate	.13	.50	.08	.50
28. Pass other vehicles using the right lane	.10	.44	.13	.45
29. Follow a slower vehicle at less than a car length	.02	.43	-.12	.35

Table 2

Statistics for PADI Scales for Studies 1 and 2

	Study 1[a]			Study 2[b]		
Scale statistics	Total	Female	Male	Total	Female	Male
Prosocial Driving (17 items)						
M	5.08	5.13	4.93[*]	4.82	4.86	4.75
SD	0.64	0.61	0.69	0.58	0.56	0.59
α (inter-item reliability)	.90			.86		
r (test-retest reliability)[c]				.79		
Aggressive Driving (12 items)						
M	2.81	2.82	2.79	2.62	2.63	2.61
SD	0.72	0.73	0.71	0.60	0.60	0.62
α (inter-item reliability)	.81			.77		
r (test-retest reliability)[c]				.77		

[a]n = 854 (627 females, 227 males). [b]n = 363 (212 females, 151 males). [c]n = 274.
[*]$p < .01$ for difference between female and male means

Table 3

Logistic Regressions Predicting Accidents and Violations with PADI Scales, Gender, and Age

Model/Variables	χ^2	R^2	*r*	*B*	*SE B*	e^B
Predicting Accidents	38.87**	.04				
Prosocial Driving scale			-.12**	-0.40**	0.11	0.67
Aggressive Driving scale			.08*	0.09	0.09	1.10
Gender (0=Female, 1=Male)			-.06	-0.34*	0.14	0.71
Age			-.11**	-0.06**	0.02	0.94
Constant				2.72		
Predicting Violations (Tickets)	29.76**	.03				
Prosocial Driving scale			-.12**	-0.29**	0.10	0.75
Aggressive Driving scale			.13**	0.30**	0.09	1.35
Gender (0=Female, 1=Male)			.04	0.15	0.13	1.16
Age			.00	0.01	0.01	1.01
Constant				-0.05		

Note. Analyses were conducted separately for accidents and violations with variables entered simultaneously for each analysis. R^2 = Nagelkerke pseudo R^2. e^B = exponentiated *B*.
*$p < .05$. **$p < .01$.

Table 4

Multiple Regressions Predicting PADI Scales with Personality Measures, Gender, and Age

	Predicting Prosocial Driving			Predicting Aggressive Driving		
Analysis/Predictor Variables	R^2	*r*	β	R^2	*r*	β
Analysis of Previous Predictors	.08**			.14**		
Competitiveness Index		-.07*	-.00		.18**	.13**
Thrill and Adventure Seeking		-.11**	-.05		.14**	.07*
Boredom Susceptibility		-.22**	-.15**		.25**	.14**
Cook-Medley Hostility Scale		-.19**	-.11**		.29**	.22**
Gender (0=Female, 1=Male)		-.16**	-.12**		-.04	-.11**
Age		.09**	.05		-.08**	-.01
Analysis of Big Five Index Scales	.20**			.13**		
Conscientiousness		.31**	.21**		-.19**	-.15**
Agreeableness		.34**	.28**		-.26**	-.24**
Extraversion		.09**	-.01		.14**	.20**
Neuroticism		-.03	.12**		.10**	.01
Openness		.20**	.14**		-.08**	-.06*
Gender (0=Female, 1=Male)		-.16**	-.06*		-.04	-.06*
Age		.09**	.06*		-.08**	-.05

Note. Four separate analyses were conducted, each with predictors entered simultaneously.
*$p < .05$. **$p < .01$.