In: Road Traffic: Safety, Modeling, and Impacts
Editors: S. E. Paterson and L. K. Allan, pp. 385-401
ISBN 978-1-60456-884-4

Chapter 9

SOCIAL COGNITIVE HUMAN FACTORS OF AUTOMOBILE DRIVING

Robert D. Mather
University of Central Oklahoma, USA

ABSTRACT

Social cognitive factors involved in automobile driving are generally understudied. Typically, human factors researchers who conduct research on driving examine the interaction of the driver and the vehicle, with emphasis on either the solitary driver or vehicle design. Social psychologists rarely look at the human factors of driving. However, as people must drive on roads together, social cognition plays a role in how people interact. Consequently, social cognition plays a central role in driving. Mather and DeLucia (2007) recently examined the interaction between social psychology and human factors of driving. Following their empirical study of implicit attitudes and pedestrian-vehicle collisions, the current chapter proposes various potential research topics on social cognitive human factors of automobile traffic safety. Basic and applied research in social psychology have much to contribute to research on the human factors of driving. Social interaction inside of the car can lead to distraction (e.g., cell phones; passenger interactions). Social interaction outside of the car can lead to death (e.g., teenagers tossing an item from one moving vehicle to another), injury (e.g., waving a car through when the other car is not clear), and saving lives (e.g., pointing to another driver's flat tire). Some possible areas of social psychological research that could contribute to research on the human factors of automobile driving include: motivation (e.g., need for closure), expectancies (e.g., second guessing another driver at a four-way stop), aggression (e.g., road rage), social facilitation (e.g., speeding up to pass another car or slowing down to keep from passing another car; general driving performance), attitudes and persuasion (e.g., increasing compliance with seat belt laws), and implicit racial attitudes (e.g., pedestrian-vehicle collisions). Potential contributions from these areas can be helpful to a single driver trying to drive safely and to anticipate danger from the road, obstacles, and other drivers. In summary, as automobile driving itself is an inherently social phenomenon, social psychological research is centrally relevant to research on

driving. The current chapter examines in detail various social psychological research that is relevant to the human factors of automobile driving and traffic safety.

INTRODUCTION

Humans, because they live in groups and influence each other, are inherently social beings (Mather & Romo, 2007). We even drive on roads and crash into each other. The social nature of automobile driving is illustrated by Don Cheadle's character in the opening dialogue of the movie "Crash." Cheadle's character is a passenger in a vehicle that was just involved a rear-end collision initiated by another vehicle's driver. In reference to urban life, he states that, "...nobody touches you. We're always behind this metal and glass. I think we miss that touch so much that we crash into each other just so we can feel something" (Danbury & Haggis, 2004). While it is not likely that most traffic accidents are intentional (indeed, by definition an "accident" is not "intentional"), it does emphasize the fact that human beings are social and that automobile driving is not devoid of social interaction.

Social psychology is "an attempt to understand and explain how the thought, feeling, and behavior of individuals are influenced by the actual, imagined, or implied presence of other human beings" (Allport, 1954, p. 5)[11]. Social cognition is a social psychological perspective that draws upon the application of the methods and research of cognitive psychology to examine social psychological questions about how people make sense of people (Fiske & Taylor, 2008) within the context of cognition, motivation, and affect (emotion) (Kunda, 1999). The applied area of human factors "discovers and applies information about human behavior, abilities, limitations, and other characteristics to the design of tools, machines, systems, tasks, jobs, and environments for productive, safe, comfortable, and effective human use" (Sanders & McCormick, 1993, p. 5). While social psychology and human factors are very separate fields of study, they are each relevant to the task of automobile driving.

The logic of the argument in this chapter is relatively straightforward: 1) People drive automobiles on roads together, 2) social cognition plays a role in how people interact, and thus 3) social cognition plays a role in the human factors of automobile driving. Generally, the social cognitive factors involved in automobile driving are understudied. Typically, human factors researchers examine the interaction of the driver and the vehicle, with emphasis on either the driver alone or vehicle design. Social psychologists rarely look at the human factors of automobile driving, although a number of social psychology studies investigating other social phenomena have used driving situations (e.g., Doob & Gross, 1968; Kenrick & MacFarlane, 1986). One study that specifically examined social cognitive human factors of driving was conducted by Mather and DeLucia (2007), who examined the interaction between social psychology and the human factors of automobile driving. They examined the influence of the implicit racial attitudes of drivers on reaction times to pedestrians in driving simulations. This type of research illustrates that both basic and applied social psychology research can contribute to research on human factors in automobile driving.

[1] There is a distinction between "sociological social psychology," which draws upon literature and training in sociology, and "psychological social psychology," which draws upon literature and training in psychology. This distinction will be briefly explicated later in this chapter. This chapter uses "social psychology" to refer to "psychological social psychology."

Although people participate in many social interactions, social interaction that occurs inside of a car can be distracting to the automobile driver. For example, cell phone conversations that a driver engages in while driving divert attention away from the driving task (Strayer & Johnston, 2001). Conversations that a driver has with vehicle passengers also can divert attention away from the driving task (Strayer & Drews, 2007). Even children interacting with each other in the back seat of the vehicle can be distracting to a driver. These social interactions are important because distraction increases the risk of driver error.

Social interaction outside of the car can also contribute to driver error. Consider teenagers driving separate vehicles filled with passengers on an empty highway, playfully tossing an item from one moving vehicle to another. Such distractions could prove deadly. However, even well-meaning social interaction with other drivers can cause an accident. Consider a well-meaning driver stopped behind traffic on a two-lane, one-way access road. Let us suppose that the well-meaning driver leaves a space open so that an unsuspecting driver pulling out of a parking lot can turn right onto the access road (in front of the well-meaning driver). However, also consider that the unsuspecting driver in the parking lot is only turning right so he or she can get to the left turn lane ahead, meaning that he or she must turn into the far left lane when leaving the parking lot. Next, the unsuspecting car is waved through by the well-meaning car. However, if the unsuspecting car is not clear of traffic in the left lane, an accident might occur as the result of miscommunication during a social interaction between drivers. Despite this example, it is important to note that social interactions between drivers can have positive results as well. For example, police officers use their sirens and flashing lights to communicate to drivers that they are exceeding posted speed limits, and to inform drivers that they should vacate the roadway and to pull over to the shoulder of the road. This communication occurs in an effort to change the behavior of a driver who ideally will not exceed the posted speed limit in the future. Also, drivers will often point to other drivers to indicate that a driver has a flat tire of which he or she is not aware. This type of communication increases the safety of all drivers on the road by attempting to avoid the dangers of driving with a flat tire.

On the Concurrent Influence of Social Cognition and Human Factors

As referenced earlier, one of the most recognizable social interactions in the United States is the use of a cell phone while driving. Cell phone use has been shown to disrupt driving performance (Strayer & Johnston, 2001) and has even been shown to do so to a degree comparable to driving while intoxicated (Strayer, Drews, & Crouch, 2006). Using an eyetracker to record the movements and fixation times of the eyes, Strayer and Drews (2007) examined the use by participants of a hands-free cell phone while the participants drove in a simulated motor vehicle. They found evidence for inattention blindness, in which participants could not recall objects they had looked at while driving as effectively if they had been engaged in a conversation on the hands-free cell phone compared to those who were not engaged in a conversation on a hands-free cell phone. This occurred even when fixation time was controlled, meaning that degraded memory still existed for participants engaged in a conversation on a hands-free cell phone, even when they had looked at an object for the same

amount of time as those who were not engaged in a conversation on a hands-free cell phone. They also found that participants did not reallocate their attentional resources based on an object's relevance to the safety of the driver. This failure to reallocate attention to safety is important because knowing where to look while driving helps the automobile driver to avoid risks (Pollatsek, Fisher, & Pradhan, 2006; Pollatsek, Narayanaan, Pradhan, & Fisher, 2006; Pradhan et al., 2005). Strayer and Drews also found psychophysiological evidence indicating that engaging in a conversation on hands-free cell phone degraded the encoding of the participants, as indicated by a decreased amplitude of the P300 event-related brain potential (ERP). Other evidence demonstrated that being engaged in a conversation with a passenger in the front seat leads to more effective driving behavior than being engaged in a conversation on a hands-free cell phone. The reason for this is the passenger can alter the conversation to indicate danger, approaching turns, etc. Thus, we can infer that a driver engaged in a social interaction with a passenger in his or her own car is in less danger than a driver engaged in a social interaction on a cell phone with a person who is a passenger in the front seat of another car. Such a scenario would put the driver on the cell phone at risk and the driver/passenger of the other car at risk, due to the passenger's not attending to the road for the other driver. Certainly, social interactions are quite complex, and so it follows that their influence on automobile driving is appropriately complex.

Since driving is a social phenomenon (e.g., we wouldn't need traffic lights if we were the only drivers), social psychological research is relevant to driving research. Some possible areas of social psychological research that could contribute to research on human factors of driving include motivation, expectancies, aggression, social facilitation, attitudes and persuasion, and implicit racial attitudes. This chapter will briefly examine some of the social psychology research that is relevant to human factors of automobile driving. Much of this research is related to the social cognitive perspective on social psychology.

MOTIVATION

Motivation involves defining a goal, choosing a course of action to achieve the defined goal, and carrying out the course of action in pursuit of achieving the defined goal (Geen, 1995). In other words, motivation is what orients us to do something. For instance, a person's regulatory focus helps to dictate how they are strategically inclined, with a promotion focus orienting an individual towards positive things and a prevention focus orienting an individual away from negative things (Higgins, 1998). Werth and Forster (2007) found that prevention focus (both as a personality trait and as a manipulated variable) enhanced braking speed. Thus, regulatory focus is a potentially important motivational factor that should be examined in the study of the human factors of automobile driving.

Why do people do things? People behave as they do for many different reasons. Some of the internal motivating factors that have been described by social psychologists as unique individual differences include the need for cognition (Cacioppo, Petty, Kao, & Rodriguez, 1986), the need to belong (Baumeister & Leary, 1995), the need for cognitive closure (Kruglanski, Webster, & Klem, 1993), and the need to be accurate (Chen & Chaiken, 1999; Petty & Cacioppo, 1986). In particular, the need for cognitive closure seems like it might be directly relevant to driving behaviors.

The need for cognitive closure (Kruglanski, Webster, & Klem, 1993; Kruglanski & Webster, 1996) is the level to which an individual feels that they must find a definitive answer to a question. Thus, if a person is high in need for cognitive closure, they will not tolerate uncertainty—they simply must come to a solution, regardless of whether it is right or wrong. The need for cognitive closure can be examined as an individual difference measure (people naturally vary in their stable levels of need for cognitive closure) or a manipulated variable (people with experimentally imposed deadlines effectively become high in need for cognitive closure). A person who is high in need for cognitive closure views the world as black or white and doesn't handle uncertainty well. A person who is low in need for cognitive closure can handle uncertainty better.

Since a person who is high in need for cognitive closure is willing to be decisive regardless of whether or not the decision choice is correct, perhaps this motivation has an influence on driving behavior. A driver who is high in need for cognitive closure may feel the need to complete a merge into traffic without exploring the option of slowing down and waiting, simply for the sake of being decisive and eradicating the uncertainty that accompanies exploring other potential options. It is also possible that when a driver is in close proximity to several other moving vehicles on the highway at a high rate of speed, the dynamic nature of traffic necessitates a shift to need for cognitive closure—when traveling at a high rate of speed, a driver doesn't have the luxury of being able to quietly sit down and weigh the options for their vehicular movements. Thus, the specific driving situation could induce a need for cognitive closure. In such an instance, individual differences in need for cognitive closure would not influence performance on the task, although a mild induction of cognitive closure might augment existing tendencies. It is worth examining motivation from both the perspective of individual differences, as well as the role of the driving situation, in order to determine its influence on automobile driver behavior.

EXPECTANCIES

Our social behaviors do not occur in the isolation of our minds, and they certainly are not characterized by objective, rational thought. As humans, we bring our expectancies along to help make sense of our social world. That is, we interpret information based on the previous experiences and intuitive theories that we have developed over the course of our lives.

Sometimes a driver's memory is faulty due to expectations. Loftus and Palmer (1974) demonstrated that estimates of the speed of an automobile in an accident were influenced by inquiries that used different verbs. For example, after watching a film of an accident, the question "How fast were the cars going when they *smashed* into each other?" elicited higher estimates of automobile speed than the question "How fast were the cars going when they *hit* each other?" Additionally, subjects tested a week after viewing the accident were more likely to misremember broken glass as having been present at the accident when they had been asked the question with the verb of "smashed" a week earlier rather than the verb "hit".

Loftus, Miller, and Burns (1978) conducted a study examining eyewitness memory for an automobile accident involving a pedestrian. Participants viewed a series of 30 slides at 3 second a piece. The slides showed the collision occurring after the car either drove through a stop sign or a yield sign, and participants subsequently answered questions and selected the

slides that they had seen from various pairs. Half of the participants were asked the question of, "Did another car pass the red Datsun while it was stopped at the stop sign?" while the other half of the participants were asked, "Did another car pass the red Datsun while it was stopped at the yield sign?" Participants were nearly twice as accurate in selecting the correct slides when the question embedded among other questions in the task between the presentation and paired-choice was congruent with what they had really seen. That is, many participants had memories that had been rewritten by the seemingly inconsequential question. This indicates that memory for what happens in a driving encounter can be malleable.

While expectancies can influence our perceptions, conformity can lead those who misperceive to the same erroneous conclusions based on their informational reliance on another observer's misperceptions. For instance, the autokinetic effect is a perceptual illusion that occurs when an individual stares at a spot of light in a dark room and sees it moving, though the spot of light does not actually move. Sherif's (1966) studies on the autokinetic effect found that when the autokinetic effect was tested in groups, the groups of people had different norms of actually reporting the existence of light movement. Additionally, Asch's (1952) studies showed that people are more likely to conform when faced with a unanimous majority, but will break from the group when they have a fellow dissenter.

There are several implications of conformity for driving behavior. First, if everyone else is exceeding the posted speed limit, a driver may conform to the norm of excessive speeding and will thus be more likely to speed. Second, if everyone else misperceives who is at fault in an accident (because of their expectations), it can be speculated that a person with the correct information (that is contrary to what the other witnesses believe that they perceived) will be unlikely to volunteer the information. Since people are very poor at understanding and reporting their own cognitive processes (Nisbett & Wilson, 1977), it is unlikely that most people would be aware of the biasing influences on their perceptions (Wilson & Brekke, 1994) in reporting information about an accident.

Additionally, expectations influence what people generally think about other people's interpersonal behaviors, intentions, characteristics, capabilities, and outcomes (Reich, Casa de Calvo, & Mather, 2008). For instance, when a driver reaches a four-way stop around the same time as other drivers, they must negotiate who will proceed through the intersection and in what order the vehicles will do so. The rule to yield to the car on the right is pointless if they all arrive simultaneously, or if the interpretations of when the vehicles actually arrive create differential perceptions within each of the drivers as to what the order should be. Necessarily, each individual driver is left to try and guess the intentions of the other drivers at the four-way stop. That is, each driver must attempt to predict the behavior of the other drivers. A driver might not trust other people in general, so he or she might wave the other driver through the intersection. Conversely, a driver might be quite trusting of other people in general, and wave the other drivers through the intersection. Finally, a driver with high generalized interpersonal expectations might decide to be assertive and proceed through the intersection, assuming that the others will yield to him or her. What motivates a driver in this decision? It is quite possible that such decisions are motivated by their expectancies of others, particularly their interpersonal expectancies. Future research is needed to examine the role of interpersonal expectancies in automobile driving behavior.

AGGRESSION

One driving behavior that has garnered much attention in the past few years but which has been around as long as drivers have shared roads is aggression. Aggression is defined by Geen (1990) as having three main elements: the delivery of a noxious stimulus to a victim, the intent to harm the victim, and the expectation that the behavior will harm the victim. Frustration, defined as "interference with the occurrence of goal responses at their accustomed time in the response sequence" (Berkowitz, 1969, p. 67) can lead to aggression.

As long as drivers compete for resources such as space, and do so as a function of time, aggressive drivers will stalk the roads. Indeed, Parry (1968) attempted to examine aggression in drivers, indicating that the issue itself is not a new problem. Some forms of aggression are relatively harmless, such as honking a horn to prompt a fellow driver or angrily muttering to a passenger about another driver. Other forms are more insidious, such as physical altercations resulting from undesired driver interactions on the road. Two high profile examples of road rage in the United States include Mike Tyson and Bob Gibson. Tyson, the former Heavyweight Boxing Champion, was convicted in 1999 of two counts of misdemeanor assault after a road rage incident (Branch, 1999). Gibson, a member of the National Baseball Hall of Fame, was involved in a road rage incident in 2002 ("Hall of Fame," 2002).

But what is road rage? Galovski, Malta, and Blanchard (2006) closely examined road rage and aggression in drivers. They suggested that the most common forms of aggressive driving include both verbal aggression (e.g., shouting insults) and gestural aggression (e.g., honking, making obscene gestures). Vehicular aggression (e.g., a driver using his or her vehicle to block other vehicles, following too closely or tailgating) is less common. Physical aggression (e.g., throwing objects, shooting another driver) occurs even less frequently. Galovski et al. found evidence that internationally, aggressive driving has a prevalence of fewer than 25% of all drivers. They suggested that longitudinal research is needed to answer the question of whether or not aggressive driving is increasing in prevalence. Why does it matter if drivers are aggressive or not? The answer is that aggressive driving contributes to motor vehicle fatalities.

How do the uses of the terms hostility, anger, and aggression differ in the research literature? Galovski et al. (2006) found that these terms were not consistently defined in their usage. Hostility generally referred to negative cognitive components that are associated with preemptive acts of interpersonal aggression, while anger generally dealt with the emotional component. For example, two individual difference measures can be used to examine anger toward other drivers. The Driving Anger Scale (DAS; Deffenbacher, Oetting, & Lynch, 1994) measures the amount of anger experienced while driving, and the Driving Vengeance Questionnaire (Wiesenthal, Hennesy, & Gibson, 2000) measures a driver's use of vengeance (revenge) to perceived threats in driving situations.

Deffenbacher, Deffenbacher, Lynch, and Richards (2003) used computer simulations to examine individual differences among drivers in terms of anger and aggression. They found that high anger drivers became angry more frequently than low anger drivers in a driving simulation, as well as in real life driving situations. Additionally, high anger drivers reported riskier driving behavior and more frequent loss of concentration, close calls, and moving violations compared to low anger drivers. Thus, anger as an individual difference measure was related to cognitive, affective and behavioral measures of driving behavior. Deffenbacher

(2008) found no evidence that driving anger differs for urban and rural drivers, but did find evidence that different driving situations evoked more anger, such as rush hour traffic situations.

Road rage is an obvious escalation of aggression in drivers. But what leads to road rage? Smaller aggressive acts of driving may escalate into road rage. One aggressive act that is common in driver interactions is the honking of an automobile horn. Additionally, temperature has been previously demonstrated to be related to aggression (Anderson, Anderson, Dorr, DeNeve, & Flanagan, 2000; Baron & Bell, 1976; Reifman, Larrick, & Fein, 1991). Kenrick and MacFarlane (1986) conducted a study of horn honking behavior in which the experimenters positioned a female confederate in a car at a one-lane exit of an intersection in a Phoenix, AZ, USA residential area, at which the traffic light had a 12 second green light. The study was conducted in the spring and summer. The confederate pulled the car to the intersection and remained there in front of exiting cars for 12 seconds while the observer recorded the honking behavior of the unsuspecting driver of the automobile stuck behind the confederate. The latency of the honk, number of honks, and total time honking were recorded by the observer. The researchers examined drivers who had their windows rolled down, with the rationale that they were not using their air conditioner during the trial, as well as drivers who had their windows rolled up. The researchers found that as the temperature outside of the automobile increased, horn honking also increased. This was only found to be the case for participants who had their windows rolled down. That is, temperature was positively correlated with horn honking.

Doob and Gross (1968) conducted a similar field study in which they varied the status of the car and driver that served as frustrating objects on the road. Using a high status car with high status driver attire and a low status car with low status driver attire, they found that drivers were more likely to honk at the low status car than they were to honk at the high status car, and men honked faster than women. Interestingly, two participants who found themselves behind the low status car at the intersection did not have their trials counted as aggressive because Doob and Gross operationally defined aggression as horn honking. These two automobiles actually hit the bumper of the low status car while attempting to prompt the low status car to proceed through the intersection. Thus, the low status car elicited extreme forms of aggression that were not included in the study!

In Salt Lake City, Utah, USA, Turner, Layton, and Simons (1975) conducted three field studies of honking behavior based on the paradigm used by Doob and Gross (1968). In their first study, Turner et al. found that women (92%) and men (58%) answered affirmatively to the statement, "If someone suddenly turns without signaling, I get annoyed." Additionally, men (77%) and women (56%) both answered affirmatively to the statement "I swear under my breath at other drivers." Thus, the majority of drivers who were sampled admitted that other drivers have the power to annoy them and that they swear (albeit privately) at other drivers. This research provides further evidence that driving is indeed a social event.

In their second study, Turner et al. (1975) replicated the Doob and Gross (1968) study with an additional manipulation in which a rifle was placed in a gun rack of a purportedly stalled older model pickup truck along with a bumper sticker with an aggressive label ("Vengeance") or nonaggressive label ("Friend"). They examined the reactions of 92 male drivers of relatively newer cars that were less than six years of age. Additionally, a "victim visibility" manipulation existed, in which a curtain in the back of the pickup truck either obstructed the view of the driver of the pickup truck (but not the gun rack) or did not obstruct

the view of the driver. Results indicated that the closed curtain increased honking, and the rifle and vengeance bumper sticker combination increased honking when the curtain was closed, but not when it was open. Using a newer vehicle that was purportedly stalled, a third study examining both men and women separated the effects of the rifle from the bumper sticker. This study found that male drivers of new vehicles (high status) were more likely to honk with the rifle and vengeance bumper sticker combination than any of the other conditions, while this same condition produced lower rates of honking for male drivers of old vehicles (low status). Turner et al. speculated that lower status drivers might have inhibited their aggressive impulses in the presence of a high status vehicle decorated with aggressive stimuli.

SOCIAL FACILITATION

The first social psychology study was conducted by Norman Triplett in 1897 (Coats & Feldman, 2001). Triplett's work on social facilitation indicated that the presence of others increased performance (Triplett, 1897). Social facilitation occurs when a person performs better on easy tasks and worse on difficult tasks in the presence of other people. Research has indicated that social facilitation occurs due to arousal (Bond & Titus, 1983) and also due to the opportunity for evaluation by other people (Aiello & Douthitt, 2001). Social facilitation has been shown to occur for impression formation (Thomas, Skitka, Christen, & Jurgena, 2002), and has even been demonstrated in species other than humans, such as cockroaches (Zajonc, Heingartner, & Herman, 1969).

There are several conditions under which social facilitation could potentially play a role in automobile driving behavior. For instance, traffic consists of other drivers, creating a situation in which other people are present. Compared to a driver in little or no traffic, a driver who merges into heavy traffic might speed up more than necessary to pass another car, or decelerate more than necessary to keep from passing another car. The driver's performance might be influenced by the mere presence of other drivers. Both of these cases would present potential dangers to the driver and to other drivers. If the merging lane ends abruptly, mistaking the magnitude of necessary acceleration and deceleration could result in collision with a wall or another car. Naturally, the complexity of the task increases with the addition of other cars in traffic. Each car in traffic is another time-to-contact (TTC) that must be estimated by the driver to successfully execute the merge. TTC refers to the rate of optical expansion of the other cars (DeLucia, Kaiser, Bush, Meyer, & Sweet, 2003). However, it is possible that the mere presence of other drivers can contribute to the driver's ability to execute the complex task.

Another straightforward hypothesis in which social facilitation might influence driving behavior is the possibility that social facilitation should degrade the performance of new drivers that have a passenger in the car who acts as a "backseat driver." A backseat driver would increase both the arousal of the novice driver, as well as create a situation in which the novice driver's performance is evaluated. In fact, social facilitation has been shown to be related to rated performance on driver's licensure tests (Rosenbloom, Shahar, Perlman, Estreich, & Kirzner, 2007). Additionally, the presence of a backseat driver should improve

the performance of experienced drivers, assuming that the backseat drivers are not overly distracting.

ATTITUDES AND PERSUASION

An attitude is "a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor" (Eagly & Chaiken, 1993, p. 1). An attitude is essentially an evaluation of something—Does a person like something or does he or she dislike it? An attitude is an evaluation with cognitive, emotional, and behavioral components (Mather & Romo, 2007). Persuasion is the act of changing an attitude (Petty, 1995).

Basic attitude and persuasion research from social psychology is used in applications of consumer psychology (Czellar, 2006) to advertising (Lucas & Britt, 1963), both for profit and for public service announcements (e.g., litter prevention; Cialdini, 2003). Indeed, Petty and Cacioppo (1996) discuss altruistic marketing as the use of basic behavioral research to contribute to society. As one of the most influential models of persuasion, the Elaboration Likelihood Model of Persuasion (Petty & Cacioppo, 1986) has found support for a central route to persuasion (persuasive processes requiring a great deal of thought) and a peripheral route to persuasion (persuasive processes requiring very little thought). When using the central route, people are influenced more by strong and high quality arguments. While using the peripheral route, people are more influenced by superficial cues such as the attractiveness of the messenger. The ELM has been used in AIDS prevention (Petty, Gleicher, & Jarvis, 1993) and drug abuse prevention (Petty, Baker, & Gleicher, 1991). Similarly, attitude and persuasion research is relevant to enforcing seat belt laws (Durbin, Smith, Kallan, Elliott, & Winston, 2007; Kim & Yamashita, 2007; Reinfurt, Williams, Wells, & Rodgman, 1996; Shin, Hong, & Waldron, 1999; Stasson & Fishbein, 1990; Trafimow & Fishbein, 1994; Ulmer, Preusser, Preusser, & Cosgrove, 1995), reducing driving under the influence of alcohol (Dula, Dwyer, & LeVerne, 2007), increasing driver acceptance of distraction mitigation strategies (Donmez, Boyle, Lee, & McGehee, 2006), reducing personal car use (Eriksson, Garvill, & Nordlund, 2008), and increasing airbag safety (Nelson, Sussman, & Graham, 1999). The ELM is useful in crafting effectively persuasive messages for many driver safety issues.

Leon Festinger (1957) proposed the theory of cognitive dissonance in which people strive to have consistency (consonance) among their attitudes, beliefs, and behaviors. When these elements are not consistent with each other, an aversive state of dissonance occurs. Changing one of the elements is one way to reduce the dissonance, such as changing an attitude to match a behavior. Stone et al. (1997) examined cognitive dissonance in a study on HIV prevention and condom usage. Results indicated that participants were more likely to use condoms after being induced with a hypocrisy in which they indicated personal reasons for which they had failed to use condoms in the past and then subsequently recorded a videotaped speech promoting the use of condoms for safe sex. The dissonance was aroused due to the hypocrisy and a behavior (condom purchase) was influenced. In an attempt to generalize the findings to aid in the reduction of road rage incidents, Takaku (2006) also applied a hypocrisy manipulation to examine the influence of dissonance arousal on the reduction of negative emotions. Similarly, such a paradigm could be used to examine hypocrisy conditions for

individuals who believe that cell phone use while driving is dangerous, but who continue to engage in the risky behavior nonetheless.

IMPLICIT RACIAL ATTITUDES

In presenting the argument for implicit social cognition, Greenwald and Banaji (1995) proposed the concept of an implicit attitude. Implicit attitudes are essentially evaluative associations that are based on past experience and are not open to our awareness, while explicit attitudes are the attitudes of which we are aware. Implicit attitudes are measured with implicit measures, such as reaction times, that are relatively impervious to social desirability effects. Explicit measures are measured with explicit measures, such as self-report, that are subject to social desirability effects. Implicit measures predict nonverbal behavior while explicit attitudes predict verbal behavior (Dovidio, Kawakami, Johnson, Johnson, & Howard, 1997; Fiske & Taylor, 2008).

One implicit measure that is widely used is the Implicit Association Test (IAT) (Greenwald, McGhee, & Schwartz, 1998), which is based on the fact that people respond faster to concepts that are more highly associated with each other than to those that are less associated. One of the first attempts to use social cognitive methods to assess implicit attitudes in drivers was conducted by Harre and Sibley (2007) using the IAT. Harre and Sibley used both implicit and explicit measures to assess driver's attitudes towards their own driving abilities relative to those of other drivers. They found that both implicit and explicit measures of attitudes regarding their own driving abilities predicted a driver's optimism about being in a crash.

Another recent application of social cognitive methods and theory to driving performance was conducted by Mather and DeLucia (2007). Mather and DeLucia proposed that racial differences in pedestrian-vehicle collisions may be due, in part, to contributions of implicit associations to reaction times as well as to effects of visual contrast that may differ due to skin color. Previous research had shown support for visual contrast as a factor in pedestrian conspicuity (Sleight, 1972), but no research had previously examined the effects of a driver's implicit racial attitudes on reaction times to pedestrians in a driving simulation. In driving simulations, Mather and DeLucia found evidence for visual contrast contributing to detection of pedestrian stimuli that had previously been shown to activate racial attitudes, even when the stimuli were presented to the participant below the threshold of awareness. Although they did not find evidence to support their hypothesis that implicit racial attitudes influenced reaction times in driving simulations, other methods of measurement may still find an effect of implicit racial attitudes. Another way of testing this hypothesis would be to use IAT scores to predict a participant's reaction times to pedestrians of different ethnicities and skin tones in a driving simulation, or to correlate explicit racial attitudes with driving performance. Regardless of measurement, the series of studies by Mather and DeLucia represented a scientific step towards integrating traditional social cognition research with human factors research on automobile driving.

CONCLUSION

Although each of the social psychological areas discussed in this chapter can be examined from the social cognition perspective, some are more frequently examined from such a perspective than others. Specifically, motivation, expectancies, attitudes/persuasion, and implicit racial attitudes are often examined from the social cognitive perspective within traditional social psychological literature. Potential contributions from each of these areas in social psychology can be helpful to automobile drivers trying to drive safely and anticipate danger from the road, obstacles, and other drivers. Particularly, social cognition research has the potential to contribute to the area of research concerned with human factors of automobile driving.

There are, however, publication difficulties of such interdisciplinary research. In this chapter, many of the specific social psychology studies that made interesting examinations of the interface between social psychology and automobile driving behavior were not published in the top mainstream social psychology journals (e.g., *Journal of Personality and Social Psychology*, *Personality and Social Psychology Bulletin*, *Journal of Experimental Social Psychology*), but rather were published in other outlets (e.g., *Journal of Applied Social Psychology*, *Environment and Behaviour*, *Psychological Reports*, *The Journal of Social Psychology*). The lack of such studies in the top mainstream publication outlets of social psychology indicate that the interdisciplinary application of basic social psychology findings to research on human factors of automobile driving is not of much importance to the field of social psychology. In this chapter, many of the applied psychology studies that made interesting examinations of the interface between social psychology and automobile driving behavior were found in *Accident Analysis and Prevention* and *Transportation Research Part F*. This indicates that the social aspect of human factors research of automobile driving is an important issue to the transportation research community. However, applied experimental psychology and research on the human factors of transportation safety are necessarily interdisciplinary research ventures, as they focus on improving the complex task of automobile driving. Thus, it is important for the social element to be considered in research on automobile driving. Since automobile driving is a complex task composed of complex driver behaviors that include social interactions both within and between vehicles, it is important to take many elements of the automobile driving task into account and to develop theories that explore this complex task at different levels of analysis.

As an example of the importance of such theory development, Factor, Mahalel, and Yair (2007) recently made the argument that sociological explanation is necessary to appropriately understand automobile driver behavior. In their "Social Accident" model, they emphasized the study of the manner in which group factors such as culture and society influence the interaction between automobile drivers. Their premise was that many traffic accidents occur when drivers bring unique understandings of the rules of automobile driving to the social context of the road. They stated that, "the interaction between two or more drivers could be examined as a function of the reciprocal relationship between society and culture at the macro level and attitudes and behaviors of drivers at the micro level" (p. 915). Thus, their sociological model of traffic safety differs from the current social cognitive perspective in that their model examines the macro level of social interaction, while the social cognitive perspective proposed in this chapter examines the micro level of social interaction. Such a

distinction in the unit of measurement is fundamental to understanding the divergent perspectives of "social psychology" as conceptualized by sociologists and psychologists. Sociologists emphasize theories about society, while social psychologists emphasize theories addressing individual susceptibility to social influence (Aronson, Wilson, & Akert, 2007). This chapter outlined a social cognitive perspective that emphasized the manner in which the social world of an individual automobile driver influences how a driver navigates a social interaction with other drivers and pedestrians. The logic of this chapter is based on the idea that people drive automobiles on roads together, and that social cognition plays a role in how people interact. Consequently, social cognition plays a central role in automobile driving. Social cognitive factors involved in automobile driving have not been studied sufficiently and have not been integrated into current discussions of transportation safety with regard to the human factors research of automobile driving. This chapter suggests that social cognition research is important to the understanding of the complex task of automobile driving and can subsequently contribute to traffic safety.

ACKNOWLEDGMENTS

Preparation of this chapter was supported in part by a grant from the Joe C. Jackson College of Graduate Studies and Research at the University of Central Oklahoma. I also thank Jamie Gill for her assistance in the preparation of this chapter.

REFERENCES

Aiello, J. R., & Douthitt, E. A. (2001). Social facilitation from Triplett to electronic performance monitoring. *Group Dynamics: Theory, Research, and Practice, 5*, 163-180.

Allport, G. W. (1954). The historical background of modern social psychology. In G. Lindzey (Ed.), *Handbook of social psychology* (pp. 3-56). Reading, MA: Addison Wesley.

Anderson, C. A., Anderson, K. B., Dorr, N., DeNeve, K. M., & Flanagan, M. (2000). Temperature and aggression. In M. P. Zanna (Ed.) *Advances in experimental social psychology* (Vol. 32, pp. 63-133). San Diego: Academic Press.

Aronson, E., Wilson, T. D., & Akert, R. M. (2007). *Social psychology* (6th ed.). Upper Saddle River, NJ: Pearson Prentice Hall

Asch, S. E. (1952). *Social psychology*. New York: Prentice Hall.

Baron, R. A., & Bell, P. A. (1976). Aggression and heat: The influence of ambient temperature, negative affect, and a cooling drink on physical aggression. *Journal of Personality and Social Psychology, 33*, 245-255.

Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin, 117*, 497-529.

Berkowitz, L. (1969). Social motivation. In G. Lindzey & E. Aronson (Eds.), *The handbook of social psychology* (2nd ed., Vol. 3, pp. 50-135). Reading, MA: Addison Wesley.

Bond, C. F., Jr., & Titus, L. J. (1983). Social facilitation: A meta-analysis of 241 studies. *Psychological Bulletin, 94*, 264-292.

Branch, G. E. III. (1999, February 8). Tyson considers whether to appeal case, sentence. *USA Today*, p. 11C

Cacioppo, J. T., Petty, R. E., Kao, C. F., & Rodriguez, R. (1986). Central and peripheral routes to persuasion: An individual difference perspective. *Journal of Personality and Social Psychology, 51*, 1032-1043.

Chen, S., & Chaiken, S. (1999). The heuristic-systematic model in its broader context. In S. Chaiken & Y. Trope (Eds.), *Dual-process theories in social psychology* (pp. 73-96). New York: Guilford.

Cialdini, R. B. (2003). Crafting normative messages to protect the environment. *Current Directions in Psychological Science, 12,* 105-109.

Coats, E. J., & Feldman, R. S. (Eds.) (2001). *Classic and contemporary readings in social psychology* (3rd. ed.). Upper Saddle River, NJ: Prentice Hall.

Czellar, S. (2006). Self-presentational effects in the Implicit Association Test. *Journal of Consumer Psychology, 16*, 92-100.

Danbury, B. (Producer), & Haggis, P. (Director). (2004). *Crash* [Motion picture]. United States: Lion's Gate Entertainment.

Deffenbacher, J. L. (2008). Anger, aggression, and risky behavior on the road: A preliminary study of urban and rural differences. *Journal of Applied Social Psychology, 38*, 22-36.

Deffenbacher, J. L., Deffenbacher, D. M., Lynch, R. S., & Richards, T. L. (2003). Anger, aggression, and risky behavior: A comparison of high and low anger drivers. *Behavior Research and Therapy, 41*, 701-718.

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

DeLucia, P. R., Kaiser, M. K., Bush, J. M., Meyer, L. E., & Sweet, B. T. (2003). Information integration in judgments of time to contact. *The Quarterly Journal of Experimental Psychology, 56A(7)*, 1165-1189.

Donmez, B., Boyle, L. N., Lee, J. D., & McGehee, D. V. (2006). Drivers' attitudes toward imperfect distraction mitigation strategies. *Transportation Research Part F, 9*, 387-398.

Doob, A. N., & Gross, A. E. (1968). Status of frustrator as an inhibitor of horn-honking responses. *The Journal of Social Psychology, 78*, 213-218.

Dovidio, J. F., Kawakami, K., Johnson, C., Johnson, B., & Howard, A. (1997). On the nature of prejudice: Automatic and controlled processes. *Journal of Experimental Social Psychology, 33*, 510-540.

Dula, C. S., Dwyer, W. O., & LeVerne, G. (2007). Policing the drunk driver: Measuring law enforcement involvement in reducing alcohol-impaired driving. *Journal of Safety Research, 38*, 267-272.

Durbin, D. R., Smith, R., Kallan, M. J., Elliott, M. R., & Winston, F. K. (2007). Seat belt use among 13-15 year olds in primary and secondary enforcement law states. *Accident Analysis and Prevention, 39*, 524-529.

Eagly, A. E., & Chaiken, S. (1993). *The psychology of attitudes.* Fort Worth, TX: Harcourt Brace.

Eriksson, L., Garvill, J., & Nordlund, A. M. (2008). Interrupting habitual car use: The importance of car habit strength and moral motivation for personal car use reduction. *Transportation Research Part F, 11*, 10-23.

Factor, R., Mahalel, D., & Yair, G. (2007). The social accident: A theoretical model and a research agenda for studying the influence of social and cultural characteristics on motor vehicle accidents. *Accident Analysis and Prevention, 39*, 914-921.

Festinger, L. (1957). *A theory of cognitive dissonance*. Evanston, IL: Row, Peterson, & Company.

Fiske, S. T., & Taylor, S. E. (2008). *Social cognition: From brains to culture*. New York: McGraw-Hill.

Galovski, T. E., Malta, L. S., & Blanchard, E. B. (2006). *Road rage: Assessment and treatment of the angry, aggressive driver*. Washington, D.C.: American Psychological Association.

Geen, R. G. (1990). *Human aggression*. Pacific Grove, CA: Brooks/Cole.

Geen, R. G. (1995). *Human motivation: A social psychological approach*. Pacific Grove, CA: Brooks/Cole.

Greenwald, A. G., & Banaji, M. R. (1995). Implicit social cognition: Attitudes, self-esteem, and stereotypes. *Psychological Review, 102*, 4-27.

Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: The Implicit Association Test. *Journal of Personality and Social Psychology, 74*, 1464-1480.

Hall of Fame pitcher Gibson won't face charges in fight. (2002, March 9). *St. Petersburg Times*, p. 5C.

Harre, N., & Sibley, C. G. (2007). Explicit and implicit self-enhancement biases in drivers and their relationship to driving violations and crash-risk optimism. *Accident Analysis and Prevention, 39*, 1155-1161.

Higgins, E. T. (1998). Promotion and prevention: Regulatory focus as a motivational principle. In M. P. Zanna (Ed.) *Advances in experimental social psychology* (Vol. 30, pp. 1-46). San Diego: Academic Press.

Kenrick, D. T., & MacFarlane, S. W. (1986). Ambient temperature and horn honking: A field study of the heat/aggression relationship. *Environment and Behaviour, 18*, 179-191.

Kim, K., & Yamashita, E. Y. (2007). Attitudes of commercial motor vehicle drivers towards safety belts. *Accident Analysis and Prevention, 39*, 1097-1106.

Kruglanski, A. W., & Webster, D. M. (1996). Motivated closing of the mind: "Seizing" and "freezing". *Psychological Review, 103*, 263-283.

Kruglanski, A. W., Webster, D. M, & Klem, A. (1993). Motivated resistance and openness to persuasion in the presence or absence of prior information. *Journal of Personality and Social Psychology, 65*, 861-876.

Kunda, Z. (1999). *Social cognition: Making sense of people*. Cambridge, MA: MIT Press.

Loftus, E. F., Miller, D. G., & Burns, H. J. (1978). Semantic integration of verbal information into visual memory. *Journal of Experimental Psychology: Human Learning and Memory, 4*, 19-31.

Loftus, E. F., & Palmer, J. C. (1974). Reconstruction of automobile destruction: An example of the interface between language and memory. *Journal of Verbal Learning and Verbal Behavior, 13*, 585-589.

Lucas, D. B., & Britt, S. H. (1963). *Measuring advertising effectiveness*. New York: McGraw-Hill.

Mather, R. D., & DeLucia, P. R. (2007). Testing for effects of racial attitudes and visual contrast on the speed of a driver's response to a pedestrian. *Transportation Research Part F, 10*, 437-446.

Mather, R. D., & Romo, A. (2007). *Automaticity and cognitive control in social behavior.* Southlake, TX: Fountainhead.

Nelson, T. F., Sussman, D., & Graham, J. D. (1999). Airbags: An exploratory survey of public knowledge and attitudes. *Accident Analysis and Prevention, 31*, 371-379.

Nisbett, R. E., & Wilson, T. D. (1977). Telling more than we know: Verbal reports on mental processes. *Psychological Review, 84*, 231-259.

Parry, M. H. (1968). *Aggression on the road.* New York: Tavistock.

Petty, R. E. (1995). Attitude change. In A. Tesser (Ed.), *Advanced social psychology* (pp. 194-255). New York: McGraw-Hill.

Petty, R. E., Baker, S. M., & Gleicher, F. (1991). Attitudes and drug abuse prevention: Implications of the Elaboration Likelihood Model of persuasion. In L. Donohew, H. E. Sypher, & W. J. Bukoski (Eds.), *Persuasive communication and drug abuse prevention* (pp. 71-90). Hillsdale, NJ: Lawrence Erlbaum.

Petty, R. E., & Cacioppo, J. T. (1986). The elaboration likelihood model of persuasion. In L. Berkowitz (Ed.), *Advances in Experimental Social Psychology* (Vol. 19, pp. 123-205). New York: Academic Press.

Petty, R. E., & Cacioppo, J. T. (1996, February). Addressing disturbing and disturbed consumer behavior: Is it necessary to change the way we conduct behavioral science? *Journal of Marketing Research,* 1-11.

Petty, R. E., Gleicher, F., & Jarvis, W. B. G. (1993). Persuasion and AIDS prevention. In J. B. Pryor & G. D. Reeder (Eds.), *The social psychology of HIV infection* (pp. 155-182). Hillsdale, NJ: Lawrence Erlbaum.

Pollatsek, A., Fisher, D. L., & Pradhan, A. (2006). Identifying and remedying failures of selective attention in younger drivers. *Current Directions in Psychological Science, 15*, 255-259.

Pollatsek, A., Narayanaan, V., Pradhan, A., & Fisher, D. L. (2006). Using eye movements to evaluate a PC-based risk-awareness and perception training program on a driving simulator. *Human Factors, 48*, 447-464.

Pradhan, A. K., Hammel, K. R., DeRamus, R., Pollatsek, A., Noyce, D. A., & Fisher, D. L. (2005). Using eye movements to evaluate effects of driver age on risk perception in a driving simulator. *Human Factors, 47*, 840-852.

Reich, D. A., Casa de Calvo, M. P., & Mather, R. D. (2008). *The role of interpersonal expectancies in predicting social judgments: The Interpersonal Expectancy Scale.* Manuscript in preparation, Texas Tech University.

Reifman, A. S., Larrick, R. P., & Fein, S. (1991). Temper and temperature on the diamond: The heat-aggression relationship in major league baseball. *Personality and Social Psychology Bulletin, 17*, 580-585.

Reinfurt, D., Williams, A., Wells, J., & Rodgman, E. (1996). Characteristics of drivers not using seat belts in a high belt use state. *Journal of Safety Research, 27*, 209-215.

Rosenbloom, T., Shahar, A., Perlman, A., Estreich, D., & Kirzner, E. (2007). Success on a practical driver's license test with and without the presence of another testee. *Accident and Analysis Prevention, 39*, 1296-1301.

Sanders, M. S., & McCormick, E. J. (1993). *Human factors in engineering and design* (7th ed.). New York: McGraw Hill.

Sherif, M. (1966). *The psychology of social norms*. New York: Harper & Row.

Shin, D., Hong, L., & Waldron, I. (1999). Possible causes of socioeconomic and ethnic differences in seat belt use among high school students. *Accident and Analysis Prevention, 31*, 485-496.

Stasson, M., & Fishbein, M. (1990). The relation between perceived risk and preventive action: A within-subject analysis of perceived driving risk and intentions to wear seatbelts. *Journal of Applied Social Psychology, 20*, 1541-1557.

Stone, J., Wiegand, A. W., Cooper, J., & Aronson, E. (1997). When exemplification fails: Hypocrisy and the motive for self-integrity. *Journal of Personality and Social Psychology, 72*, 54-65.

Strayer, D. L., & Drews, F. A. (2007). Cell-phone--induced driver distraction. *Current Directions in Psychological Science, 16*, 128-131.

Strayer, D. L., Drews, F. A., & Crouch, D. J. (2006). A comparison of the cell phone driver and the drunk driver. *Human Factors, 48*, 381-391.

Strayer, D. L., & Johnston, W. A. (2001). Driven to distraction: Dual-task studies of simulated driving and conversing on a cellular telephone. *Psychological Science, 12*, 462-466.

Takaku, S. (2006). Reducing road rage: An application of the dissonance-attribution model of interpersonal forgiveness. *Journal of Applied Social Psychology, 36*, 2362-2378.

Thomas, S. L., Skitka, L. J., Christen, S., & Jurgena, M. (2002). Social facilitation and impression formation. *Basic and Applied Social Psychology, 242*, 67-70.

Trafimow, D., & Fishbein, M. (1994). The importance of risk in determining the extent to which attitudes affect intentions to wear seatbelts. *Journal of Applied Social Psychology, 24*, 1-11.

Triplett, N. (1897). The dynamogenic factors in pacemaking and competition. *American Journal of Psychology, 9*, 507-533.

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.

Ulmer, R. G., Preusser, C. W., Preusser, D. F., & Cosgrove, L. A. (1995). Evaluation of California's safety belt law change from secondary to primary enforcement. *Journal of Safety Research, 26*, 213-220.

Werth, L., & Forster, J. (2007). The effects of regulatory focus on braking speed. *Journal of Applied Social Psychology, 37*, 2764-2787.

Wiesenthal, D. L., Hennesy, 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.

Wilson, T. D., & Brekke, N. (1994). Mental contamination and mental correction: Unwanted influences on judgments and evaluations. *Psychological Bulletin, 116*, 117-142.

Zajonc, R. B., Heingartner, A., & Herman, E. M. (1969). Social enhancement and impairment of performance in the cockroach. *Journal of Personality and Social Psychology, 13*, 83-92.

Reviewed by Mario Casa de Calvo, Texas A&M University - Kingsville