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Cognitive underpinnings of beliefs and confidence in beliefs about fully automated vehicles

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ABSTRACT

A study investigated the cognitive underpinnings of consumers' beliefs and confidence in their beliefs about fully automated vehicles. Following previous research, opinions about self-driving cars tended to be mixed. The most negative views were held by consumers who had the least knowledge of self-driving cars. Low trust in technology was also associated with more negative views. Although consumers were generally confident in their views of self-driving cars, many were uninformed about them. Consumers' confidence in their beliefs was more strongly correlated with perceived knowledge and general confidence than real expertise. Thus, consumers' confidence in their opinions about fully automated vehicles appears to be driven by cognitions that are largely superfluous. A mediation analysis suggests that general self-confidence influences judgmental confidence by affecting perceived judgment relevant knowledge. Participants' confidence in negative beliefs about fully automated vehicles suggests their opinions will not be easily influenced via persuasion.

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1. Introduction

Self-driving vehicles are an emerging technology that will radically reshape transportation on our roads and highways. Fully automated, level 5 vehicles will be able to perform all aspects of driving under all roadway and environmental conditions without human control of the vehicle (SAE International, 2014). Unlike semi-automated vehicles (levels 2 and 3) that require drivers to monitor and take back operational control of the vehicle whenever system failure occurs, fully-automated driving systems will not require manual intervention. These vehicles are expected to be safer and more energy efficient than current automobiles, and reduce traffic congestion and insurance rates. Moreover, people will be better able to socialize, work, and relax as they travel because they will be freed of the task of driving. Finally, self-driving vehicles will increase the mobility of persons who are physically or visually impaired.

The views that are currently being formed of fully automated vehicles and the confidence with which these views are held are important because they will affect consumers' willingness to adopt these vehicles. Consumer opinions will also determine the support for the legal and physical infrastructure needed to put the technology on our roads.

Numerous national and local surveys have assessed public attitudes toward fully automated vehicles. The studies have revealed that there is a wide range of opinion about the technology (e.g., Bazilinskyy, Kyriakidis, & de Winter, 2015). While most consumers are willing to ride in a driverless car (e.g., Autoblog, 2013), most are not ready to buy one (Konig & Neumayr, 2017). Moreover, while the majority of consumers believe that fully automated vehicles will increase driving safety, over a

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third believe that roadways will be safer if vehicles continue to be operated by people (Kelly Blue Book, 2016). Many consumers are reluctant to relinquish control of their cars (Kelly Blue Book, 2016; Konig & Neumayr, 2017). Concerns about the expense of driverless vehicles and fears about software failure and security are also commonplace (Fagnant & Kockelman, 2015; Konig & Neumayr, 2017; Kyriakidis, Happee, & de Winter, 2015; Schoettle & Sivak, 2014).

While numerous studies have examined consumer beliefs about automated vehicles, studies have not examined consumers' confidence in their beliefs. As we discuss shortly, confidence or certainty is important because it determines the willingness of people to act on their beliefs and the extent to which their beliefs are susceptible to influence. There has also been little work on the cognitive underpinnings of consumer opinions about fully automated vehicles. In this study, we investigated how knowledge of self-driving vehicles, perceived knowledge of self-driving vehicles, general beliefs about the self, and beliefs about technology are shaping attitudes toward self-driving cars and the confidence with which these attitudes are held. As we shall see, consumers are generally confident in their opinions about fully automated vehicles. That is, they tend to be relatively certain that their beliefs about driverless cars are accurate or correct. However, their confidence is commonly grounded in cognitions that are irrelevant to their judgments. Negative views of fully automated vehicles, while confidently held, do not appear to be based on real knowledge of the technology.

1.1. Why judgmental confidence matters

Confidence is important because it affects the willingness to act on an attitude or belief. Studies have shown that attitudes are more likely to guide decision making and behavior when certainty is high (e.g., Fazio & Zanna, 1978a, 1978b; Glasman & Albarracín, 2006). Judgments that are confidently expressed are also more likely to influence others (e.g., Cramer, DeCoster, Harris, Fletcher, & Brodsky, 2011; Tenney, Small, Kondrad, Jaswal, & Spellman, 2011). More importantly, confidence or certainty affects the extent to which attitudes and beliefs are susceptible to influence and change (Babad, Ariav, Rosen, & Salomon, 1987; Krosnick & Abelson, 1992; Swann, Pelham, & Chidester, 1988; see also Briñol & Petty, 2009). Finally, confident views are often extreme views. Evaluations that are confidently held or that are perceived to be based on a large amount of information tend to be more polarized, that is, more positive or negative as opposed to middling (e.g., Sanbonmatsu, Kardes, Posavac, & Houghton, 1997). Thus, the confidence with which beliefs about fully automated vehicles are held is important because it will affect the adoption of and support for the technology. Confidence or certainty may also determine the extremity of opinions about fully automated vehicles and the degree to which these opinions can be influenced.

To what extent is confidence based on real knowledge of the judgmental topic? Research has shown that there is only a moderate to weak positive relation between confidence and accuracy in important judgmental domains such as eyewitness identification (e.g., Bothwell, Deffenbacher, & Brigham, 1987; Sporer, Penrod, Read, & Cutler, 1995), clinical assessment (e.g., Miller, Spengler, & Spengler, 2015), and impression formation (e.g., Ames, Kammrath, Suppes, & Bolger, 2010). People are generally overconfident about the accuracy of their beliefs and judgments (e.g., Lichtenstein, Fischhoff, & Phillips, 1977; Vallone, Griffin, Lin, & Ross, 1990). Although the relation between expertise and calibration is modest, individuals who are low in knowledge tend to be the most overconfident (Lichtenstein & Fischhoff, 1977). Related work has shown that individuals who are lacking in competency are most likely to overestimate their ability and performance (Dunning, Johnson, Ehrlinger, & Kruger, 2003; Kruger & Dunning, 1999). These findings suggest that consumers may be confident in their beliefs about fully automated vehicles even when they know little about the technology.

What else might contribute to confident beliefs about driverless vehicles? An important factor affecting judgmental confidence or certainty may be general self-confidence. General confidence is often conceived to be the sum of a person's confidence in specific domains (Shrauger & Schohn, 1995). General belief in the self is associated with the tendency to overestimate the favorableness of past and future performance (Morrison, Thomas, & Weaver, 1973; Shrauger, 1972). Hence, it may be associated with overconfidence in the accuracy or correctness of one's specific judgments. While general confidence may be unrelated to actual domain specific knowledge, it may contribute to greater perceived knowledge which may heighten estimations of judgmental accuracy (Trafimow & Sniezek, 1994).

1.2. A study of the cognitive underpinnings of beliefs about autonomous vehicles

A survey was conducted to measure consumers' beliefs about fully automated vehicles and their confidence in their beliefs. Consumers also expressed their intentions to purchase a driverless vehicle, and their support for legislation and policies to put these driving systems on our roadways. Additionally, consumers completed a measure of their perceived knowledge and a test of their actual knowledge of fully automated vehicles. They also filled out the general self-confidence scale developed by Shrauger and Schohn (1995). Finally, participants were asked to complete the trust in technology scale (McKnight, Carter, Thatcher, & Clay, 2011; McKnight, Choudhury, & Kacmar, 2002). Trust in technology is composed of two constructs — faith in general technology, which refers to the belief that technology is usually reliable, functional, and helpful, and trusting stance, which refers to the belief that positive outcomes will result from relying on technology. Participants completed a scale of both constructs.

The predictions of the study were grounded in previous research on automated vehicles and theory on attitudes and judgment. They were also derived from an unpublished survey we had conducted earlier in the year examining consumer attitudes toward advance driving assistance systems and fully automated vehicles. The survey of 200 consumers revealed mixed evaluations of self-driving cars. However, consumers were confident in their opinions regardless of their levels of expertise