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MULTI-STUDY PAPER

Making the Right Turn: The Association Between Political Conservatism Versus Liberalism and Attitudes Toward Automated Vehicles Over Time

Heather M. Maranges[1], Susan K. Chen[2], and Ryan M. McManus[3]

[1] Department of Psychology, Wake Forest University
[2] Department of Psychology, University of Utah
[3] Department of Psychology, Boston College

Adoption of automated vehicles (AVs) depends on political will. This work investigates how political ideology relates to attitudes toward AVs and attitude updating with new information, how knowledge plays a role, and how these processes vary across time depending on cultural context in the United States. In 2018 (Study 1), Conservatives' initial attitudes toward AVs were less positive than liberals' (i.e., less liking, trusting, and higher ratings of danger), but there was no difference in perceptions of understanding AVs. After reading the benefits of AVs, conservatives, versus liberals, demonstrated larger, positive changes in their attitudes (i.e., trusting increased and danger decreased), but also a decrease in understanding. Notably, liberals knew more about AVs than did conservatives. In 2021, when liking of Elon Musk, and hence AVs, may be polarized, we see the opposite pattern (Study 2): conservatives like Elon Musk, know much about, and report relatively positive attitudes and intentions to use and purchase AVs, compared to liberals. This work suggests that partisans' attitudes toward novel technological entities such as AVs are shaped by a complex confluence of cultural contributors, including epistemic and social ones.

Keywords: automated vehicles, political ideology, attitudes, attitude change, Elon Musk

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> . . . quite disturbing to me is the degree of media coverage of Autopilot crashes, which are basically almost none, relative to the paucity of media coverage of the 1.2 million people that die every year in manual crashes . . . if you effectively dissuade people from using an autonomous vehicle, you are killing people. —Elon Musk

> Tesla owners can now request 'Full Self-Driving' prompting criticism from regulators —Washington Post Headline

Widespread use of "self-driving cars," or automated vehicles (AVs), which can drive without human assistance, could save thousands of lives yearly, reduce carbon emissions, and improve traffic flow (Gao et al., 2014; Liu et al., 2019; Stern et al., 2018; Thompson, 2016).[1] Accordingly, some have argued for a moral imperative to persuade people to adopt AVs (e.g., Musk, 2016; Shariff et al., 2017). Adoption likely depends on the political will to support and regulate them (Kalra, 2017), which may vary across the ideological spectrum, especially in the United States. Indeed, the concerns about AVs and their regulation of local government officials in the U.S. are shaped by municipal attributes, not only of local resources but also of residents, including political ideology (Freemark et al., 2019). Although recent research has captured people's moral judgments when AVs are involved in moral dilemmas (e.g., Awad et al., 2020; Bonnefon et al., 2016; McManus & Rutchick, 2019), and some individual differences that shape attitudes toward AVs (e.g., Dixon et al., 2020; Kyriakidis et al., 2015), no work has linked individuals' political ideology to general attitudes toward and attitude change about AVs in the U.S.—the goal of this work.

[1] Note that current availability of *fully* automated vehicles is limited, and some scholars argue that there are reasons to believe we are still years away from having high availability (Dia, 2021).

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ORCID iDs: Susan K. Chen https://orcid.org/0000-0003-1746-1834.

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Contact Information: Correspondence concerning this article should be addressed to Heather M. Maranges, Department of Psychology, Wake Forest University, Greene Hall, Winston-Salem, NC 27109, United States. Email: marangeh@wfu.edu

A new literature has begun investigating individual differences that predict attitudes toward AVs. For example, people higher (vs. lower) in neuroticism and lower (vs. higher) in agreeableness trust AVs less (Kyriakidis et al., 2015). Additionally, people higher (vs. lower) in extroversion and openness to experience reported more positive attitudes toward artificial intelligence (AI) technology generally (Morsunbul, 2019). People higher (vs. lower) in individualism, who prioritize personal autonomy and limited government regulation, view AVs negatively, and support their use less (Dixon et al., 2020). Moreover, support for AVs is associated with higher trust in automotive and regulatory institutions, recognition of their benefits, and positive affect toward them (Dixon et al., 2020; Hohenberger et al., 2016).

Prior work suggests that ideology covaries with personality traits and individual differences relevant to attitudes toward AVs (e.g., Hirsh et al., 2010; Jost et al., 2008; Kerlinger, 1984), such that adoption and regulation of AVs may also depend on political orientation. For example, conservatives are higher in feelings of personal agency, religiosity, ambiguity intolerance, uncertainty avoidance, conscientiousness, and needs for order, structure, and closure, whereas liberals are higher in openness to experience and integrative complexity (Hirsh et al., 2010; Jost et al., 2008). Thus, conservatives may have stronger motives to maintain familiarity and reduce uncertainty (Jost et al., 2008). Indeed, existing research demonstrates that conservatives prefer tradition to progress, conformity to rebelliousness, order to chaos, stability to flexibility, traditional values to feminism, and hierarchy to equality, whereas liberals prefer the opposites (Jost et al., 2008; Kerlinger, 1984).

The Current Work

Given conservatives' higher levels of individualism (Van Lange et al., 2012) and lower levels of openness (Hirsh et al., 2010), and that AVs are a new technology expected to disrupt the current economic and social hierarchy (Hanna & Kimmel, 2017; Papa & Ferreira, 2018), we predicted that conservatives, compared to liberals, would have more negative initial attitudes—less liking, less trusting, and more viewing as dangerous—toward AVs. Liberals, more than conservatives, enjoy novelty and value social change, egalitarianism, and justice, including for the environment (Feinberg & Willer, 2013; Jost et al., 2008; Kerlinger, 1984). Many purported benefits of AVs reflect their potential to help solve these sorts of problems (e.g., Charness et al., 2018; Thompson, 2016). Therefore, liberals (vs. conservatives) may have thought more about the benefits of AVs (especially in light of their tendency to deliberate/think analytically; e.g., Deppe et al., 2015), resulting in better understanding of, and more positive attitudes toward, AVs.

Thus far, our predictions relate political orientation to *initial* attitudes toward AVs. We also investigated, but had more tentative hypotheses about political orientation's influencing attitude *updating* after learning about AV benefits. Perhaps liberals' attitudes will become even more positive and conservatives' even more negative, consistent with research on counter-attitudinal messaging (e.g., Clark et al., 2008; Lee & Aaker, 2004). Alternatively, conservatives may be more persuaded by information about the benefits of AVs, which increases familiarity with AVs, while liberals may not substantially change their already positive attitudes.

Given that decisions about the adoption of AVs may be viewed as moral ones, we consider that conservatives and liberals differ in the moral concerns they prioritize (Graham et al., 2009) and, hence, explore whether differences in moral foundations (i.e., Harm, Fairness, Loyalty, Authority, and Purity) account for the political orientation differences in initial and updated attitudes toward AVs (see Supplemental Materials, henceforth SM). Notably, attitudes toward AVs vary by demographic factors, namely, age (e.g., Duncan et al., 2015; Hohenberger et al., 2016), gender (e.g., Payre et al., 2014), socioeconomic status (e.g., Menon et al., 2019), and location (e.g., Freemark et al., 2019). Accordingly, we also examine the simultaneous contributions of these variables and political orientation to initial attitudes and change in attitudes about AVs. In sum, the current work examines the association between individual differences in political orientation and attitudes toward AVs before and after exposing people to information about the benefits of AVs. Study 1 provides an initial test of these ideas, and Study 2 entails a preregistered replication and extension of the first study in light of the cultural changes (e.g., views of Elon Musk of Tesla, political polarization) that occurred between 2018 and 2021.

Study 1

Method

Participants

Based on available resources, data were collected from 361 participants from the United States via Amazon's Mechanical Turk. Participants were excluded if they failed any attention check ($n = 53$) or failed to respond to the individual difference measures ($n = 16$). Our final sample included 314 individuals (133 women, 174 men, 1 other, 6 unreported; $M_{age} = 34.33$, $SD = 9.59$; 245 White, 28 Asian, 27 Black, 25 Hispanic or Latino, 6 Native American, 2 Pacific Islander). A sensitivity analysis indicated that the final sample ($N = 314$) yielded 80% power to detect effects of $r = .16$ at $\alpha = .05$ (Faul et al., 2007).

Procedure and Materials

After providing consent, participants read the definition for an AV and general instructions: "An AV is a vehicle that has the ability to sense its surroundings and drive itself without input from its human passenger. We would like to get your thoughts and intuitions on AVs." Next, participants provided ratings of their attitudes toward AVs (i.e., liking, trusting, understanding, and viewing as dangerous), read facts about AVs, and again provided their attitudes toward AVs. Finally, participants responded to individual differences in moral concern scales before reporting demographics.[2] All study materials are available in Supplemental Materials and were approved by our institution's Institutional Review Board.[3]

Attitudes Toward Automated Vehicles. Participants provided their general attitudes toward AVs via ratings on 100-point sliding scales in terms of *liking* (1 = *extreme disliking;* 100 = *extreme liking*), *trusting* (1 = *extreme distrusting;* 100 = *extreme trusting*), *understanding* (1 = *no understanding;* 100 = *complete*

[2] Between the initial attitude ratings and AV facts, participants responded to open-ended questions about AVs and did a word association task. These data are not the focus of the current investigation.

[3] IRB Approval: Florida State University, 2018.23824, Perceptions and Moral Intuitions of Automated Vehicles; Concordia University, 30014713, Political Orientation and Automated Vehicles.

understanding), and viewing as *dangerous* (1 = *extremely safe;* 100 = *extremely dangerous*) both before and after reading the AV facts.[4]

Facts About Automated Vehicles. Participants read nine facts about the benefits of AVs in the form of *Did you know AVs ___ ?* and responded yes or no.[5] These facts included the following (Gao et al., 2014; Liu et al., 2019; Stern et al., 2018; Thompson, 2016):

1. are projected to reduce traffic accidents by up to 90%
2. will eliminate injuries/fatalities due to drunk/distracted driving
3. will give people with disabilities the freedom to travel themselves
4. are going to allow people with flight anxiety an alternative way to travel long distances
5. will reduce commute times
6. will increase highway capacity by up to 500%
7. are projected to reduce carbon emissions by up to 300 tons per year
8. will allow more people to be more productive during their commutes
9. could continually learn from mistakes made by other AVs so that they all get better and better

Political Ideology. Participants indicated their political ideology using a sliding scale from 1 (*extremely liberal*) to 7 (*extremely conservative*), such that higher values indicate relatively more conservatism ($M = 3.24$, $SD = 1.92$). About 61% of our sample considered themselves liberal (20.5% *extremely liberal,* 25.1% *liberal,* 15% *slightly liberal*), 17.3% considered themselves moderate, and 22.1% considered themselves conservative (10.1% *extremely conservative,* 7.8% *conservative,* 4.2% *slightly conservative*).

Results

Initial Attitudes

First, we assessed the zero-order, bivariate correlations among ideology and initial liking, trusting, understanding, and danger ratings; these correlations are displayed in Table 1. Conservatism, versus liberalism, was associated with less liking and trusting of AVs but higher ratings of them as dangerous. Ideology was not associated with understanding of AVs.

To summarize results of mediation analyses (presented in SM), we found that the link between conservatism (vs. liberalism) and lower initial liking for AVs, was partially accounted for by higher purity concern (i.e., concern that emerges from disgust sensitivity, contamination concerns, and a desire for cultural sanctity and an elevated way of life). Additionally, the more conservative were people, the more they moralized ingroup loyalty, which in turn predicted more initial trusting of AVs.

Attitude Change

Overall, attitudes became more positive after reading about the benefits of AVs: On average, *liking* increased from the beginning of the study ($M = 63.32$, $SD = 26.77$) to the end of the study ($M = 73.62$, $SD = 25.53$), $t(313) = 11.14$, $p < .001$. On average, *trust* increased from the beginning of the study ($M = 49.56$, $SD = 27.91$) to the end of the study ($M = 62.66$, $SD = 27.45$), $t(313) = 13.86$, $p < .001$. On average, *understanding* increased from the beginning of the study ($M = 56.88$, $SD = 22.28$) to the end of the study ($M = 67.89$, $SD = 19.76$), $t(313) = 9.98$, $p < .001$. In contrast, on average, *danger* ratings decreased from the beginning of the study ($M = 48.23$, $SD = 26.05$) to the end of the study ($M = 38.70$, $SD = 27.11$), $t(161) = -5.48$, $p < .001$.

Next, we assessed the zero-order, bivariate correlations among ideology and changes in liking, trusting, understanding, and danger ratings; these correlations are displayed in Table 2. In order to examine change in attitudes, we subtracted the initial (pre) score from the end of study (post) score for each measure (see Rogosa et al., 1982, and more recently, Castro-Schilo & Grimm, 2018, for arguments about the benefits of using change scores instead of residualized change). After reading about the benefits of AVs, more conservative, versus more liberal, people displayed a marginal increase in trusting AVs, a significant decrease in understanding AVs, and a marginal decrease in ratings of them as dangerous. Conservatism was not associated with changes in liking attitudes.

To summarize results of mediation analyses (presented in SM), after people learned about the benefits of AVs, prioritization of loyalty partially mediated the association between conservatism (vs. liberalism) and decreases in liking AVs (controlling for age and gender).

Facts Known

As exploratory analyses, we examined whether the number of facts known about the benefits of AVs varied by political orientation or predicted initial attitudes, post-fact attitudes, and change in attitudes via zero-order, bivariate correlations.[6] Political Orientation was associated with facts known ($r = -.13$, $p = .024$), such that people who reported being more liberal versus conservative, knew more of the facts we presented. Knowing more facts about the benefits of AVs (i.e., sum of *yes* responses when asked if they know each of the 9 facts) was associated with more positive initial attitudes toward AVs. That is, the more facts people knew about AVs, the more they liked ($r = .41$, $p < .001$), trusted ($r = .45$, $p < .001$), and understood ($r = .26$, $p < .001$), and the less they found dangerous ($r = -.37$, $p < .001$) AVs. A similar pattern emerged for post-fact attitudes such that the more facts people knew about AVs, the more they liked ($r = .37$, $p < .001$), trusted ($r = .38$, $p < .001$), and understood ($r = .31$, $p < .001$), and the less they found dangerous ($r = -.35$, $p < .001$) AVs after reading these facts about the benefits of AVs. Less interpretable are findings with change scores: Knowing more facts was associated with less positive increases in trust ($r = -.13$, $p = .024$), no change in understanding ($r = .02$, $p = .701$), or danger ($r = .07$, $p = .396$), and marginally less positive change in liking ($r = -.10$, $p = .068$).[7]

[4] For another empirical aim, we were interested in whether asking about danger at the start of the study would prime people to consider AVs as more dangerous at the end of the study, even when learning new facts about their benefits. Accordingly, only half of our participants responded to the danger question at the beginning of the survey, resulting in fewer degrees of freedom for the danger question relative to all other questions.

[5] Of course, we cannot guarantee that participants indeed knew these facts, such that this reflects perceptions of one's knowledge or a bias to confirm one knows information. Nonetheless, we believe this is an important contributor to attitudes toward AVs.

[6] We thank an astute, anonymous reviewer for this suggestion.

[7] To make sense of the associations between facts known and change scores, we examined scatterplots. See SM.

Table 1
Correlations Among Political Ideology, Initial Attitudes Toward Automated Vehicles, and Demographics, Study 1

Variable	*M*	*SD*	1	2	3	4	5	6
1. Political ideology (higher = more conservative)	3.24	1.92	—					
2. Initial liking	63.32	26.77	**−.16****	—				
3. Initial trusting	49.56	27.91	**−.17****	**.81*****	—			
4. Initial understanding	56.88	22.28	.04	**.25*****	**.34*****	—		
5. Initial danger	48.23	26.05	**.19****	**−.55*****	**−.69*****	−.12†	—	
6. Gender (w = 1, n = 133; m = 2, n = 174)	N/A	N/A	.01	**.22*****	**.27*****	**.26*****	**−.17***	—
7. Age	34.33	9.59	.01	**−.12***	**−.15****	−.04	.04*	**−.15***

Note. For correlations among political ideology, liking, trusting, understanding, danger, and age, we conducted Pearson correlation analyses; for associations with gender, we conducted Spearman correlation analyses. Bolded values indicate statistical significance at the $p < .05$ level.
$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Discussion

We found that conservatives reported less positive initial attitudes toward AVs than liberals—less liking, trusting, and higher ratings of danger. Understanding AVs did not vary by political orientation. Exploratory analyses suggest that liberals (vs. conservatives) know more about AVs, and the more people know about AVs, the more positively they view them.

Although this study is informative about how partisans may differentially view the novel technology of AVs, it is limited by being conducted in a time when AVs were on the horizon but not quite "here" (i.e., early 2018)—since this time, discussion of AVs has become more mainstream, people in the business of "self-driving" cars (e.g., Elon Musk of Tesla) have gained celebrity, and companies have announced that full AV technology is now available (e.g., Tesla). Accordingly, there may be a more complex confluence of contributors to partisans' attitudes toward AVs. Hence, we conducted a second study to test whether this pattern would replicate or whether partisan attitudes toward AVs have shifted. We also strengthened and extended our investigation in several additional ways, such as by including a more expansive measure of political orientation, capturing intentions to ride in/use and to purchase AVs, and exploring the role of liking Elon Musk.

Study 2

The aim of Study 2 (preregistered on Open Science Framework) was to test the association between political orientation and attitudes toward AVs in the United States and in light of what may have changed since 2018. Although we found in Study 1 that conservatives, relative to liberals, held more negative attitudes toward AVs, but updated more positively when learning more facts that they did not know before, there are reasons to expect the opposite pattern. As also laid out in our preregistration, it is important to consider that conservatives (vs. liberals) tend to trust (i.e., be pro-) businesses (Cacciatore et al., 2016). Moreover, consumers appear to experience less trust toward AV technology and businesses recently, and in particular toward Elon Musk (McFarland, 2021; Poletti, 2021), likely because publicity of technological failures lowers trust (see Lee et al., 2021 for controlled experimental demonstration). Conservatives' liking of businesses, and perhaps of Elon Musk, may serve as a buffer against waning positive attitudes toward AVs. That is, theoretically, although liberals have strong ideological reasons to have positive views of AVs (i.e., environmental benefits), now so too do conservatives (i.e., business interests). Accordingly, we leverage this study to test potentially competing hypotheses.

In Study 2, we used a more comprehensive composite measure of political orientation, including economic and social ideology, and explored the role of voting behavior/candidate preferences. We also improved upon the first study by (a) clarifying what is meant by "understanding" AVs (i.e., how they work), (b) including measures for people's intentions to use and purchase AVs before and after they learn new facts about the benefits of AVs, (c) capturing attitude updating more effectively by allowing the post-fact attitude scales to begin at participants' own pre-fact attitude ratings, and (d) asking participants to what extent they like Elon Musk.

Table 2
Correlations Among Political Ideology, Change in Attitudes Toward Automated Vehicles, and Demographics, Study 1

Variable	*M*	*SD*	1	2	3	4	5	6
1. Political ideology (higher = more conservative)	3.24	1.92	—					
2. Change in liking	10.30	16.39	.08	—				
3. Change in trusting	13.10	16.64	.11†	**.58*****	—			
4. Change in understanding	11.01	19.55	**−.13***	**.12***	**.30*****	—		
5. Change in danger	−9.53	22.12	−.16†	**−.26*****	**−.36*****	−.13†	—	
6. Gender (w = 1, n = 133; m = 2, n = 174)	N/A	N/A	.01	**−.15***	**−.16*****	**−.17****	.06	—
7. Age	34.33	9.59	.01	.06	.06	−.06	.01	**−.15***

Note. For correlations among political ideology, age, and changes in liking, trusting, understanding, and danger, we conducted Pearson correlation analyses; for associations with gender, we conducted Spearman correlation analyses. Bolded values indicate statistical significance at the $p < .05$ level.
$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Method

Participants

In order to increase power from our first study, we decided a priori to collect data from at least 600 participants so that after exclusions we would have at least 500 participants, which would provide 80% power to detect $r = .12$ (Faul et al., 2007). Seven hundred and forty-one participants in the United States responded to the survey via Prolific. Participants were excluded if they failed one or more attention checks (see SM, $n = 137$). Our final sample included 603 individuals (311 men, 277 women, 14 other; $M_{age} = 34.34$, $SD = 12.08$; 501 White, 54 Black, 48 Hispanic or Latino, 31 Asian, 12 Native American, 2 Pacific Islander).

Procedure and Materials

After providing consent, participants responded to questions about their political orientation and voting behavior and preferences. Next, they read the definition for an AV and general instructions before providing their attitudes toward (i.e., liking, trusting, understanding, and viewing as dangerous) and intentions to use and purchase AVs. Participants then read and reported how many facts they knew about AVs' benefits as in Study 1 ($M_{facts} = 4$, $SD = 2.45$, out of 9), and again provided their attitude and intention ratings toward AVs. Finally, participants reported demographics. Measures new to this study are described below. All study materials are available in Supplemental Materials.

Political Orientation.

Political Ideology. Participants indicated their political ideology *in general,* on *economic issues,* and on *social issues* using sliding scales from 1 (*extremely liberal*) to 7 (*extremely conservative*). We averaged across these items (which were correlated rs > .74) to create a political orientation composite, such that higher values indicate relatively more conservatism ($M = 3.14$, $SD = 1.68$, $\alpha = .93$).

Political Policy Stances. Participants rated their feelings of positivity/negativity toward 12 political issues using a scale ranging from 0 (*greater negativity*) to 100 (*greater positivity*) with 50 indicating feeling *neutral* about the issue (Everett, 2013). Issues included *abortion* (reversed), *limited government, military and national security, religion, welfare benefits* (reversed), *gun ownership, traditional marriage, traditional values, fiscal responsibility, business, the family unit,* and *patriotism.* Scores were averaged across items after some were reverse-scored, such that higher scores indicate relatively more conservatism ($M = 49.31$, $SD = 19.27$, $\alpha = .89$).

Party Affiliation. Participants reported whether they think of themselves as *Republican, Democrat, Independent, Other* or have *no preference*. Participants who selected *Other* had the option to provide the political party with which they usually associate themselves. Seventy-eight people identified as Republican, 355 as Democrat, 122 as Independent, 29 as Other, and 19 reported no preference.

Voting. Participants reported for whom they voted in the 2020 U.S. Presidential election, with options *Joe Biden, Donald Trump, Other candidate (such as Howie Hawkins or Jo Jorgensen), I did not vote for reasons outside of my control, I did not vote but I could have,* and *I did not vote out of protest.* Eighty-three participants reported voting for Trump, 420 for Biden, 20 for other candidates, 32 did not vote for reasons outside their control, 37 could have but did not vote, and 11 did not vote out of protest. Participants also indicated their preference for candidate between Biden ($n = 488$) and Trump ($n = 115$). Given that the smallest plurality of our participants voted for Trump and to simplify analyses, we used the dichotomous Biden versus Trump item.

As preregistered, we planned to combine political orientation measures that were correlated above .65. The Likert-scale political orientation composite and policy stance scale scores were correlated highly ($r = .68$, $p < .001$), such that we standardized and combined (i.e., averaged) these measures. None of the other measures correlated with each other above .65. Therefore, we report analyses with the Political Orientation composite here and with Party Affiliation and Voting in the SM.

Attitudes Toward Automated Vehicles. Participants provided their general attitudes toward AVs in terms of ratings of *liking, trusting* and viewing as *dangerous* both before and after reading the AV facts as in Study 1. New to this Study, we clarified what we meant by understanding: participants reported the extent to which they "understand how automated vehicles work" (1 = *no understanding;* 100 = *complete understanding*). Also new to this study, the sliding scales for post-fact ratings started at the score participants initially rated them. For example, if participants initially rated their liking of AVs at a 65 out of 100, the slider started on 65 (vs. neutral 50) on the second (post-fact) item that asked about liking. They read,

> Note that the starting point to this slider is from your rating before. If you do not want to change your rating, leave the slider where it is. If you want to change your rating in either direction, slide it up or down to communicate how your rating has changed since learning more information about automated vehicles.

This approach allows us to better capture updating as it does not rely on participants accurately recalling their first ratings (see Monroe & Malle, 2019).

Intentions to Ride in and Purchase Automated Vehicles. Participants responded to the question, "To what extent do you intend to ride in/use an automated vehicle when they are available/affordable for you?" on a sliding scale (1 = *no intention to ride in/use;* 100 = *full intention to ride in/use*). Participants also responded to the question, "To what extent do you intend to purchase an automated vehicle when they are available/affordable for you?" on a sliding scale (1 = *no intention to purchase;* 100 = *full intention to purchase*). As with the attitude questions, the post-fact intention to ride in/purchase sliders started at the participants' initial response point.

Attitude Toward Elon Musk. Given that Elon Musk is a representative of automated vehicle business and may hence shape people's attitudes toward AVs, we included the following questions at the end of the survey: *Do you know who Elon Musk is?* (*No, Sort of,* or *Yes*). If participants responded *sort of* or *yes*, they also responded to the question, *To what extent do you like Elon Musk?* on 100-point sliding scale (1 = *extreme disliking;* 100 = *extreme liking*). Most people know of Musk ($n = 522$; *sort of* $n = 59$; *no* = 22). Of the people that responded *yes* or *sort of*, the average liking rating was neutral ($M = 50.01$, $SD = 29.92$). Inclusion of these items allowed us to explore the role of liking Elon Musk in attitudes toward AVs.

Results

Initial Attitudes and Intentions

First, we assessed the zero-order, bivariate correlations among ideology and initial liking, trusting, understanding, and danger ratings as well as intention to ride in/use and to purchase AVs (See Table 3). Political orientation was associated with attitudes toward AVs. However, in contrast to Study 1, more conservatism

Table 3
Correlations Among Political Ideology, Initial Attitudes Toward and Intentions to Use and Purchase Automated Vehicles, and Demographics, Study 2

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9
1. Political ideology (higher = more conservative)	.00	.91	—								
2. Initial liking	67.48	24.14	**.13****	—							
3. Initial trusting	53.78	25.15	**.13****	**.75*****	—						
4. Initial understanding	59.11	26.08	**.19*****	**.28*****	**.33*****	—					
5. Initial danger	50.79	22.91	.00	**−.52*****	**−.62*****	**−.19*****	—				
6. Initial intent to ride	60.73	32.69	.07†	**.78*****	**.72*****	**.30*****	**−.53*****	—			
7. Initial intent to purchase	50.02	35.25	**.18*****	**.72*****	**.71*****	**.37*****	**−.50*****	**.84*****	—		
8. Liking of Elon Musk	50.01	29.92	**.64*****	**.36*****	**.39*****	**.31*****	**−.26*****	**.30*****	**.41*****	—	
9. Gender (f = 1, n = 277; m = 2, n = 311)	N/A	N/A	**−.29*****	**−.34*****	**−.32*****	**−.45*****	**.16*****	**−.30*****	**−.34*****	**−.43*****	—
10. Age	34.34	12.08	**.31*****	**−.12****	**.13****	**.28*****	**−.10*****	**.19****	**.18*****	**.29*****	**−.35*****

Note. Ideology scores are composites of z-scored measures. For correlations among political ideology, liking, trusting, understanding, danger, intent to ride, intent to purchase, liking of Elon Musk, and age, we conducted Pearson correlation analyses; for associations with gender, we conducted Spearman correlation analyses. Bolded values indicate statistical significance at the $p < .05$ level.
† $p < .10$. ** $p < .01$. *** $p < .001$.

(vs. liberalism) was associated with more liking, trusting, and understanding of AVs. Perceptions of AVs as dangerous did not vary by political orientation. See Supplemental Materials for regression analyses corroborating this pattern (as preregistered). Notably, conservatives, more than liberals, liked Elon Musk, and liking Elon Musk was associated with more liking, trusting, and understanding of AVs and viewing them as less dangerous.

Attitude Change

Again, overall, people's attitudes became more positive after they read facts about AVs. On average, *liking* increased from the beginning of the study (M = 67.48, SD = 24.14) to the end of the study (M = 74.24, SD = 23.42), $t(601) = 13.43$, $p < .001$. On average, *trust* increased from the beginning of the study (M = 53.78, SD = 25.15) to the end of the study (M = 60.90, SD = 25.50), $t(601) = 14.11$, $p < .001$. On average, *understanding* increased from the beginning of the study (M = 59.11, SD = 26.08) to the end of the study (M = 66.02, SD = 22.84), $t(601) = 12.51$, $p < .001$. In contrast, on average, *danger* ratings decreased from the beginning of the study (M = 50.79, SD = 22.91) to the end of the study (M = 44.80, SD = 24.93), $t(601) = -9.81$, $p < .001$. On average, *intention to ride in/use* increased from the beginning of the study (M = 60.73, SD = 32.69) to the end of the study (M = 66.04, SD = 31.76), $t(601) = 10.22$, $p < .001$, as did *intention to purchase* from the beginning of the study (M = 50.02, SD = 35.25) to the end of the study (M = 54.55, SD = 35.48), $t(601) = 9.69$, $p < .001$.

Next, we assessed the zero-order, bivariate correlations among ideology and changes in liking, trusting, understanding, and danger ratings as well as in intentions to ride in/use and to purchase (i.e., subtracted the initial attitude score from the post-facts score for each attitude/intention). See Table 4 for correlations. In contrast to Study 1, after reading about the benefits of AVs, more conservative, versus more liberal, people displayed a marginal decrease in liking, and no significant change in trusting, understanding, danger, intentions to ride in AVs, and intentions to purchase AVs. This suggests that political orientation does not directly predict the extent to which uptake of information about the benefits of AVs shifts attitudes toward AVs. Note that liking of Elon Musk, which is associated with conservatism, is also associated with decreases in liking and understanding how AVs work after reading facts about their benefits.

Facts Known

As exploratory analyses, we examined whether the number of facts known about the benefits of AVs varied by political orientation or predicted Liking of Elon Musk, initial attitudes, post-fact attitudes, and change in attitudes via zero-order, bivariate correlations. People who knew more facts about the benefits of AVs tended to like Elon Musk ($r = .19$, $p < .001$). The association between facts known and political orientation was not significant, even if conservatives knew numerically more facts on average (r = .07, p = .084). Knowing more facts about the benefits of AVs was associated with more positive initial attitudes toward AVs. That is, the more facts people knew about AVs, the more they liked (r = .29, p < .001), trusted ($r = .30$, $p < .001$), and understood ($r = .46$, $p < .001$), the less they found dangerous ($r = -.24$, $p < .001$), and the stronger their intentions to ride in/use ($r = .30$, $p < .001$) and to purchase (r = .34, $p < .001$) AVs. A similar pattern emerged for post-fact attitudes such that the more facts people knew about AVs, the more they liked ($r = .17$, $p < .001$), trusted ($r = .20$, $p < .001$), understood ($r = .37$, p < .001), intended to ride in/use (r = .25, p < .001), intended to purchase ($r = .30$, $p < .001$), and the less they found dangerous (r = −.15, $p < .001$) AVs after reading these facts about the benefits of AVs. With respect to change in attitude ratings, knowing more facts was associated with less positive change in liking ($r = -.25$, p < .001), trusting ($r = -.20$, $p < .001$), understanding ($r = -.25$, p < .001), intentions to ride in/use ($r = -.16$, $p < .001$), and intentions to purchase ($r = -.12$, $p < .001$). The more facts people knew, the less negative the change in danger (r = .12, p = .003).[8]

[8] To make sense of the associations between facts known and change scores, we examined scatterplots. See SM.

Table 4

Correlations Among Political Ideology, Change in Attitudes Toward and Intentions to Use and Purchase Automated Vehicles, and Demographics, Study 2

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9
1. Political ideology (higher = more conservative)	.00	.91	—								
2. Change in liking	6.76	12.36	−.08†	—							
3. Change in trusting	7.12	12.37	−.03	**.47*****	—						
4. Change in understanding	6.90	13.55	−.04	**.29*****	**.31*****	—					
5. Change in danger	−5.99	14.99	.00	**−.28*****	**−.42*****	**−.23*****	—				
6. Change in intent to ride	5.31	12.76	.00	**.43*****	**.37*****	**.30*****	**−.25*****	—			
7. Change in intent to purchase	4.53	11.47	.00	**.29*****	**.30*****	**.23*****	**−.19*****	**.55*****	—		
8. Liking of Elon Musk	50.01	29.92	**.64*****	**−.11****	−.07	**−.14*****	−.02	.00	−.01	—	
9. Gender (f = 1, n = 277; m = 2, n = 311)	N/A	N/A	**−.28*****	**.20*****	**.17*****	**.29*****	−.06	**.16*****	**.10***	**−.43*****	—
10. Age	34.34	12.08	**.31*****	**−.14*****	**−.09***	**−.13*****	**.09***	**−.09***	−.08†	**.29*****	**−.31*****

Note. Ideology scores are composites of z-scored measures. For correlations among political ideology, age, and changes in liking, trusting, understanding, danger, intent to ride, intent to purchase, and liking of Elon Musk we conducted Pearson correlation analyses; for associations with gender, we conducted Spearman correlation analyses. Bolded values indicate statistical significance at the $p < .05$ level.
$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Summary of Results

People's political conservatism (vs. liberalism) was associated with more liking, trusting, understanding, and intending to ride in and purchase AVs. Perceptions of AVs as dangerous did not vary by political orientation. Attitudes became more positive after people read about the benefits of AVs on average, but did not differ by political orientation. Liking Elon Musk was associated with more positive attitudes and intentions to use and purchase AVs. Knowing more facts was associated with more positive attitudes, and liking Elon Musk was associated with knowing more facts about AVs.

General Discussion

Fully automated vehicles (AVs) could be widely available within the next decade (Litman, 2015). Politicians will have to make regulatory decisions about AVs, which will likely depend on their constituents' attitudes. We examined initial attitudes and attitude updating toward AVs across the political spectrum in 2018 and 2021. In 2018, we hypothesized that, given the personality profiles of partisans, the novelty and risk associated with AVs would shape relatively more negative views of AVs by conservatives compared to liberals. And that is what we found. In just 3 years, though, much has changed in the cultural zeitgeist when it comes to political polarization, views of technology businesses, and trust in AVs. Indeed, recently, consumers appear to experience less trust toward AVs and the businesses building them, especially Elon Musk's Tesla (McFarland, 2021; Poletti, 2021). Failures of AV tech have been largely publicized, and publicity of technological failures lowers trust (see Lee et al., 2021). Conservatives, more than liberals tend to trust (i.e., be pro-) businesses (Cacciatore et al., 2016). We considered that perhaps pro-business, and maybe pro-Elon Musk, attitudes may shape more positive attitudes in AVs today.

In Study 1, conservatives reported less positive initial attitudes toward AVs than liberals—less liking, trusting, and higher ratings of danger. This corroborates work suggesting that conservatives experience higher existential needs to manage uncertainty and threat (e.g., Cohen et al., 2005; Jones, 2003; Jost et al., 2008; Landau et al., 2004) and that the novelty of AVs entails uncertainty and threat, particularly as indicated by crashes (Shariff et al., 2017). However, liberals and conservatives did not differ in initial understanding of AVs. After reading about the potential benefits of widespread AV use—including increases in safety, mobility of people with disabilities, traffic efficiency, personal productivity, and decreases in carbon emissions—conservatives displayed a larger, positive change in their attitudes (i.e., marginally more trusting, less viewing as dangerous) compared to liberals. However, conservatives' understanding of AVs decreased significantly more than did liberals'.

With respect to exploratory mediation, we found that after learning about the benefits of AVs, conservatives' prioritization of loyalty was associated with decreases in liking. Future research is needed to understand the link between moralization of loyalty and attitudes toward AVs. Additionally, conservatives' valuing authority was associated with increases in liking and trusting AVs. This may be because the facts about AVs relayed benefits to, and protection of, the social group. Indeed, the binding foundations are associated with concerns about benefits to and protection of the social group (e.g., Janoff-Bulman, 2009; Mooijman et al., 2018).

In Study 1, liberals knew more facts about the benefits of AVs than conservatives, but in Study 2, conservatives knew more facts than liberals, though effects were small. In both cases, knowledge about AV benefits was associated with more positive attitudes, and in Study 2, also with stronger intentions to ride in/use and to purchase AVs.

In contrast to the first study, the second study suggests that conservatives' attitudes toward AVs were more positive—that is, more liking, trusting, and understanding of AVs. As one would expect given the tendency to support business and entrepreneurs, conservatives, more than liberals, liked Elon Musk, and liking Elon Musk was associated with more liking, trusting, understanding, intending to use and buy AVs and less viewing them as dangerous, as well as knowing more facts about AVs.

Positive attitudes toward, including trust in, AVs are prerequisites to their adoption. Yet, fewer than 20% of Americans trust AVs (Shariff et al., 2017). Our results suggest that not only social and cultural but also epistemic factors contribute to how partisans view AVs. Some of our results suggest one way to increase trust (and decrease perceptions of danger) is to simply and explicitly

communicate the technology's benefits. Additionally, in both studies, the more people knew about AVs, the more positive their attitudes. Accordingly, communication about the benefits of AVs may benefit people's positive attitudes and intentions to ride and purchase AVs. Yet, some of our results suggest an ironic effect of sharing knowledge about the benefits of AVs that people may already have: for people who had relatively high knowledge about (and concomitant initial positive attitudes toward) AVs, spelling out these benefits was associated with reductions in their positive attitudes toward AVs. One reason for this may be reactance—negative affect or arousal that, in this case, occurs because people are being told what they already know—which may shape reports of attitudes toward AVs via misattribution of negative affect. Although reactance is usually evoked when persuasive arguments or knowledge conflict with existing beliefs and knowledge (for review, see Steindl et al., 2015), there is some evidence that being told what you already know can be perceived as condescending (e.g., Quick & Considine, 2008) and that perceiving condescension may increase negative affect that can be misattributed (e.g., Wright, 2012). Future research should further investigate this ironic phenomenon.

The benefits of AVs are myriad; although many benefits may be particularly appealing to liberals (e.g., reduce carbon emissions, facilitate the travel of people with disabilities), others (e.g., reducing drunk driving and accidents, allowing for productivity during the ride) have broader appeal. Some AV companies are already doing this. For example, Waymo's (2021) current mission states, "We aim to bring fully self-driving technology to the world that can improve mobility by giving people the freedom to get around, and save thousands of lives now lost to traffic crashes." Our findings suggest that important figures, namely, Elon Musk, likely influence perceptions of the technology along political ideological lines, perhaps through knowledge of AV benefits.

Our findings combine with prior work on political psychology and persuasion to inform effective AV promotion. Appeals to safety, like those on Waymo and (Uber Technologies Inc, 2020), may be particularly effective in stoking the trust of conservatives, who worry about threats more than liberals (Cohen et al., 2005; Jones, 2003). However, our data also suggest conservatives may feel that they understand the technology less after learning more about their benefits. Hence, clearly explaining how the technology works is crucial. Highlighting the facilitation of novel experiences may be particularly useful for convincing liberals to adopt AVs (Jost et al., 2008), an approach evident on (Volvo Car Corporation, 2020). In sum, our data suggest that many current strategies may be helpful in persuading people to like and trust AVs more, but some strategies may be more persuasive for specific populations.

Here, we note several limitations to our study, which future research can address. First, to reiterate, our effect sizes are small. However, we do not view them as trivial given the potential implications of small effects across large populations (Funder & Ozer, 2019), as may be the case for the contributions of political ideology and attitudes to adoption of AVs. Second, we focus on attitudes of people in the United States, the political landscape of which differs from other countries, such that patterns of partisan attitudes toward AVs may differ. Relatedly, the generalizability of our conclusions is limited to relatively WEIRD populations (Western, Educated, Industrialized, Rich, Democratic; Henrich et al., 2010)—of our sample, 78% of identified as White and all were Americans. Differences in industrialization and westernization may be associated with different attitudes. For example, many non-Western cultures prioritize interdependence over independence (Markus & Kitayama, 1991); the former's focus on group harmony mirrors concerns of conservatives, such that members of interdependent cultures may be relatively distrusting of novel technology. Third, we captured people's attitudes via self-report, such that these attitudes can be described as explicit attitudes, which are attitudes to which people have conscious access and on which people can deliberate (Fazio & Olson, 2014). Although people's implicit attitudes (i.e., attitudes that are largely outside people's conscious awareness) likely cohere with their explicit attitudes, people's implicit attitudes about AVs may differ from their explicit attitudes and may also more strongly guide behavior related to AVs when people do not have the opportunity or resources to deliberate or override (i.e., according to their explicit attitudes; Fazio & Olson, 2014). Notably, we also only captured relatively short-term changes in attitudes after a brief intervention, such that future work should investigate whether such shifts in attitudes remain after a longer delay.

Last, we do not have the power to detect how attitudes toward AVs are shaped by particular clusters of conservative versus liberal partisanship; that is, self-identified partisans (i.e., "conservatives" and "liberals") who differ on policy stances or that are motivated differentially by religious, social, or economic concerns may hold different attitudes toward AVs. Relatedly, because we examined the associations between continuous measures of political orientation and continuous measures of attitudes toward AVs, we were able to detect effects of political orientation across the ideological spectrum; however, our samples contained more relatively liberal participants, such that future work should replicate the results here in samples with more conservatives. These limitations notwithstanding, and considering the future availability of AVs and subsequent legislative demands, this work is an important first step to understanding how political ideology relates to attitudes toward AVs, especially with respect to the influences that shape partisan attitudes over time.

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