Perceived Knowledge Moderates the Relation Between Subjective Ambivalence and the "Impact" of Attitudes: An Attitude Strength Perspective

Laura E. Wallace[1] , Kathleen M. Patton[1], Andrew Luttrell[2],
Vanessa Sawicki[4] , Leandre R. Fabrigar[3], Jacob Teeny[1],
Tara K. MacDonald[3], Richard E. Petty[1], and Duane T. Wegener[1]

Abstract

Previous work has reliably demonstrated that when people experience more subjective ambivalence about an attitude object, their attitudes have less impact on strength-related outcomes such as attitude-related thinking, judging, or behaving. However, previous research has not considered whether the amount of perceived knowledge a person has about the topic might moderate these effects. Across eight studies on different topics using a variety of outcome measures, the current research demonstrates that perceived knowledge can moderate the relation between ambivalence and the impact of attitudes on related thinking, judging, and behaving. Although the typical Attitude × Ambivalence effect emerged when participants had relatively high perceived knowledge, this interaction did not emerge when participants were lower in perceived knowledge. This work provides a more nuanced view of the effects of subjective ambivalence on attitude impact and highlights the importance of understanding the combined impact of attitude strength antecedents.

Introduction

When will consumers be willing to purchase products they like? When will voters talk to others about their preferred candidate? When will people especially like or approach others with whom they agree rather than disagree? Understanding when attitudes influence related thinking and behavior has been an important question for attitudes theory in general and for specific content areas such as consumer science, political science, health psychology, and environmental psychology. This research has examined several relevant outcomes, including behavior (Armitage & Conner, 2000), perceived behavioral likelihood (Sengupta & Johar, 2002), behavioral willingness (Gibbons, Gerrard, Ouellette, & Burzette, 2007), attraction toward agreeing others (Sawicki & Wegener, 2018), and support for candidates who share policy preferences (Holbrook & Krosnick, 2005), among others. As such, since the 1970s, considerable effort has been put toward attempting to identify individual properties of attitudes that influence attitude strength (for a review, see Petty & Krosnick, 1995).

According to this approach, some attitudes are "stronger" than others in that they are (a) more durable (i.e., they persist longer over time or better resist attempts at change) or (b) more impactful (i.e., they influence related thinking, judging, and behaving to a greater degree; see Petty & Krosnick, 1995). As implied by the opening section, the current research was focused on attitude impact, although we return to durability in the discussion section. Over the years, several isolated antecedents to attitude impact have been identified. One of these commonly studied antecedents has been the extent to which people have *subjective* or *felt ambivalence* about an attitude object (Thompson, Zanna, & Griffin, 1995).

[1]The Ohio State University, Columbus, USA
[2]Ball State University, Muncie, IN, USA
[3]Queen's University, Kingston, Ontario, Canada
[4]The Ohio State University, Marion, USA

Corresponding Author:
Laura E. Wallace, Department of Psychology, The Ohio State University,
1835 Neil Avenue, Columbus, OH 43210, USA.
Email: wallace.748@osu.edu

Subjective Ambivalence

Subjective ambivalence refers to feeling "mixed" or "conflicted" about an attitude object, which often stems from recognizing that an object has both positive and negative qualities (i.e., objective or structural ambivalence; Priester & Petty, 1996). Even when people are ambivalent, they generally still have an overall positive or negative evaluation, with the one exception being the true middle of the attitude scale in which they are perfectly neutral (e.g., because of seeing the object as equally positive and negative). Previous research seems to have reliably demonstrated that the more an overall evaluation is accompanied by ambivalence, the weaker it tends to be, cohering less with relevant outcomes (see van Harreveld, Nohlen, & Schneider, 2015 for a review). As just one example, Conner and Flesch (1998, as reported in Conner & Sparks, 2002) found that when people felt ambivalent about having casual sex, their attitudes were less predictive of engagement in casual sex.

Although the attitude strength literature has almost exclusively studied each strength antecedent in isolation of the others, new evidence is accumulating that some attitude strength antecedents can interact to predict strength-related impact of attitudes (Visser, Krosnick, & Simmons, 2003). This interactive approach highlights the limitations of the single-antecedent approach by demonstrating that a given strength antecedent can have different effects when considered in conjunction with other strength indicators. Although the prior attitude impact work has been limited to examining interactions between certainty and importance, the current work considers whether the effect of subjective ambivalence on attitude impact might differ depending on the level of *perceived knowledge* that the person has about the attitude object. That is, we question whether researchers should expect to observe the traditional Attitude × Subjective Ambivalence interaction across levels of perceived knowledge.

Perceived Knowledge

People's sense of how much knowledge they have about a topic is measured through self-reported perceptions of knowledge (Wegener, Downing, Krosnick, & Petty, 1995). Only a moderate relation exists between perceptions of knowledge and measures of the amount of knowledge people have in working memory (i.e., objective knowledge; Wood, 1982), and objective and subjective knowledge have been treated as separate constructs (Bassili, 1996; Fabrigar, Petty, Smith, & Crites, 2006). In the current article, we focus on perceptions of knowledge because research has demonstrated that perceptions of attitude strength properties can be particularly influential (Barden & Petty, 2008), and we thought that the perception of knowledge was particularly likely to play a role in our hypotheses. Previous research has established that in isolation of other strength indicators,

perceived knowledge increases attitude impact (Davidson, Yantis, Norwood, & Montano, 1985; Kallgren & Wood, 1986). For example, Davidson and colleagues found that people's voting attitudes tended to be more predictive of their voting behavior when they perceived that they had more information about the candidates in an election.

Relations Between Subjective Ambivalence and Perceived Knowledge

Previous research has generally observed small negative associations between subjective ambivalence and perceived knowledge (Smith, Fabrigar, MacDougall, & Wiesenthal, 2008; see Fabrigar, MacDonald, & Wegener, 2005, 2019, for further discussion), though a number of relations between ambivalence and knowledge could exist depending on the context. That is, one might imagine that high levels of ambivalence would require enough knowledge to allow for a substantial mixture of positive and negative reactions, which would push toward a positive relation between perceived knowledge and subjective ambivalence. However, there should also be times when people start off somewhat ambivalent but receive or seek out additional information that is univalent (cf. Sawicki et al., 2013), which would push toward a negative relation between perceived knowledge and ambivalence. Finally, when all information is relatively univalent, there should be no relation between knowledge and ambivalence. However, even when people's current knowledge is relatively univalent, if they believe that information of the other valence is being withheld from them, they can experience subjective ambivalence (Priester, Petty, & Park, 2007), which would further disengage the level of subjective ambivalence from the level of perceived knowledge. Thus, when these possibilities are taken together, it would seem to make sense that observed relations between perceived knowledge and subjective ambivalence tend to be relatively weak.

Additive or Multiplicative Effects of Perceived Knowledge and Subjective Ambivalence?

To date, studies examining the consequences of subjective ambivalence and perceived knowledge have exclusively studied each in isolation of the other. Thus, based on the previous literature, one would likely assume that subjective ambivalence and perceived knowledge would have additive effects on thinking, judging, and behaving. If this were the case, the less a person is conflicted and the more they perceive themselves as knowledgeable about the attitude object, the more their attitude would impact various strength-related outcomes. Consistent with previous single-antecedent examinations of attitude impact, this would manifest as two separate two-way interactions: an Attitude × Perceived Knowledge interaction and an Attitude × Subjective

Ambivalence interaction when predicting strength outcomes. To the extent that researchers have found an Attitude × Ambivalence interaction at different levels of perceived knowledge, it might seem likely that ambivalence effects on attitude-outcome consistency would be independent of the effects of perceived knowledge.

Alternatively, it is possible that subjective ambivalence and perceived knowledge would have interactive effects on attitude impact. Specifically, subjective ambivalence might primarily undermine attitude–outcome relations when people perceive that they have a lot of knowledge about the object, and subjective ambivalence might be less likely to undermine attitude–outcome relations when people perceive that they have little knowledge (i.e., researchers should not always expect to find an Attitude × Ambivalence interaction). One possible reason for this pattern would be that low levels of knowledge limit the room for ambivalence effects. That is, regardless of the extent of conflict people feel, with low levels of perceived knowledge, they might feel that they should not use their attitudes, resulting in weak impact of those attitudes with both high and low levels of ambivalence. With higher levels of perceived knowledge, however, there is substantial room for the level of subjective ambivalence to affect the extent to which the attitude is used.

To layout another reason for this interactive prediction, it might first be useful to highlight the opposing effects that subjective ambivalence can have. On one hand, as mentioned above, feeling conflicted can reduce attitude impact, perhaps because feelings of conflict indicate that there is no clear guide to action. On the other hand, for some people or situations, feeling conflicted can actually increase the use of attitudes as a way to reduce the discomfort of ambivalence (Sawicki et al., 2013) or other related attitude properties, such as doubt (see Sawicki & Wegener, 2018; van Harreveld, van der Pligt, & de Liver, 2009). For example, when gathering information, ambivalent people may selectively seek information that supports their current attitude and avoid information that conflicts with their existing attitude. Previous research has demonstrated that this type of "attitude bolstering" pattern is primarily present when ambivalence (or doubt) is high and available information is capable of bolstering the attitude (Sawicki et al., 2011; Sawicki et al., 2013). This occurs when the person perceives that they have little knowledge about the issue or the available information is novel. Research on doubt has also suggested that this attitude bolstering is particularly likely to occur when people focus on the implications of the judgment they are making for the strength of their attitude ("meta-cognitive reflection"; Sawicki & Wegener, 2018). If some portion of people spontaneously engage in meta-cognitive reflection, such forces would weaken the typical strength-related Attitude × Subjective Ambivalence pattern when perceived knowledge is low.

This previous evidence for different effects of attitudes when held with low-knowledge and high-ambivalence has exclusively examined effects on selective exposure to information that could directly strengthen the attitude (Sawicki et al., 2013). However, it remains unclear *a priori* if we would expect this same interaction on attitude-relevant thinking, judgment, and behaviors that would not directly provide informational support or opposition for that attitude. As mentioned earlier, researchers have examined a wide variety of attitude impacts, including judgments of how willing and likely people are to engage in an attitude-related behavior (Gibbons et al., 2007; Sengupta & Johar, 2002), how willing they would be to talk to someone about the topic (Teeny & Petty, 2018), attraction toward agreeing others (Sawicki & Wegener, 2018), actual behavior (Armitage & Conner, 2000), and many others. Because these other settings for attitudinal impact would not seem as directly informative as receipt of novel information supporting one's attitude, we thought clarifying the joint impact of subjective ambivalence and perceived knowledge on these alternative types of outcomes would provide a more comprehensive and accurate view of the effects of subjective ambivalence on attitude impact.

In sum, the multiplicative perspective predicts a three-way interaction between attitudes, perceived knowledge, and subjective ambivalence on attitude-related thinking, judgment, or behavior. Specifically, the typical Attitude × Subjective Ambivalence interaction should be particularly likely when perceived knowledge is high, but that pattern should attenuate and could even sometimes reverse when perceived knowledge is low (Fabrigar et al., 2005). Notably, prior research that has most strongly documented the "bolstering" effects of ambivalence (where its effects are *opposite* those predicted by a typical attitude strength account) has examined selective exposure contexts that drew attention to influences of environmental stimuli on attitudes (Sawicki et al., 2011; Sawicki et al., 2013) or deliberately encouraged participants to focus on the properties of their own attitudes (e.g., Sawicki & Wegener, 2018). Under less-constrained conditions, such reversals of typical subjective ambivalence effects might be weaker or less likely, but any portion of the participants engaging in such processes would weaken the typical subjective ambivalence strength-related pattern. If this occurs, the multiplicative account would provide a more nuanced view of the effects of ambivalence on attitude-related thinking, judging, and behaving.

Overview of Studies

In the current article, we report in detail three studies (Studies 1-3) testing the hypothesis that the effects of subjective ambivalence on attitude impact are moderated by perceived knowledge. In the discussion, we report a mini-meta-analysis of eight total studies (Studies 1-8) that comprise all the studies in which we could test the core hypotheses and were conducted between 2010 and 2016 by students or faculty in the Ohio State Attitudes and Persuasion Lab. Each reported study included measures of attitudes, subjective ambivalence,

Table 1. Topic and Outcome for Each Study in the Overall Package.

Study	Topic	Attitude-related outcome
Study 1	Junk Food Tax	Attraction to a junk food tax advocate
Study 2	Biofuels	Likelihood of using biofuels if owned flex-fuel vehicle
Study 3	Same-Sex Marriage	Likelihood of voting for a political candidate who *favors* same-sex marriage
Study 4	Alcohol	Self-report of the amount of alcohol consumed in the past month and week
Study 5	Organic Food	Self-report of organic food purchased in the past month
Study 6	Plastic Bag Ban	Will to wear a t-shirt, attend a rally, and sign a petition supporting the plastic bag ban in Columbus
Studies 7 and 8	Novel Person (Bob)	Will to work with Bob on a group project

perceived knowledge, and some index of attitude-related thinking, judgment, or behavior. Across our studies, we tested a variety of outcomes from the attitude strength literature, including judgments of attraction toward a person expressing a particular viewpoint, will to engage in a relevant behavior, judged likelihood of taking a relevant action, and self-reported behavior. Testing these effects on a variety of attitudinal impacts allows us to address more of the "impact" facet of attitude strength than has been represented in the attitude-behavior literature per se.

Although the topics and measures vary across studies, we report all measures in a given study intended to capture our constructs of interest. Consistent with the Jones and Tukey (2000) approach to hypothesis testing (in which significant results are interpreted as providing a clearer case for an effect in one direction or another than do nonsignificant results), we chose to report the first three studies in detail because they provided the clearest results regarding the direction of effect. Even so, nonsignificant results can also provide evidence to strengthen or weaken the overall case for the effect (see Fabrigar & Wegener, 2016 for discussion). Therefore, we also meta-analytically examined the full set of eight studies that included the relevant measures. Because this transparent manner of presenting the studies is somewhat unorthodox, we list the topics and types of outcomes for each study in Table 1. Although nonsignificant studies can strengthen or weaken the overall case for a hypothesis, including the nonsignificant studies will likely result in a smaller effect size estimate than if researchers only report the studies with the smallest p values. Because of this, the average reported effect size in a literature based purely on significant effects is inflated. We hope to avoid this bias in effect size estimate by including our nonsignificant studies in the meta-analysis, even though the meta-analytic effect size will likely be smaller than similar effects reported in the attitude strength literature.

Study 1

In the first study, we examined our hypotheses in the context of people's attitudes toward a junk food tax and their attraction to a junk food tax advocate. Research has robustly

demonstrated that people's attitudes predict attraction toward agreeing others (Byrne, 1997). However, similar to other "impact" effects, the effect of attitudes on attraction depends on the meta-cognitive properties that accompany that attitude (Sawicki & Wegener, 2018). Because previous work had demonstrated an Ambivalence × Knowledge interaction on attitude-consistent selective exposure, we thought that attraction would be a reasonable outcome with which to begin to test our hypotheses. Attraction might not directly provide information about an attitude object the way that selective exposure would, but if a person talked to the target, they could gain attitude-relevant information.

As mentioned above, we predicted a three-way interaction between attitudes, perceived knowledge, and subjective ambivalence (cf. Fabrigar et al., 2005). That is, when people feel that they know a lot about junk food taxes, we should observe a significant Attitude × Subjective Ambivalence interaction on attraction toward a junk food tax advocate; specifically, those who feel less conflicted should be the most likely to report attraction consistent with their attitudes, whereas this should be attenuated for those who feel more mixed. However, this Attitude × Subjective Ambivalence interaction should be weaker, nonexistent, or perhaps even reversed among people relatively low in perceived knowledge about the tax.

Method

Participants. One hundred forty-nine Introduction to Psychology students enrolled in Ohio State University's Research Experience Program participated in the study. For all the studies in this package, sample size was determined by several factors, including past experience with similar paradigms, field norms at the time of data collection, and availability of resources. Importantly, we did not analyze the data prior to completing data collection for any study.[1]

Procedure. After consenting to participate, participants responded to attitude, subjective ambivalence, and perceived knowledge questions about a junk food tax. After responding to these measures, participants received a pro-junk food tax message from a novel person and reported their attraction to
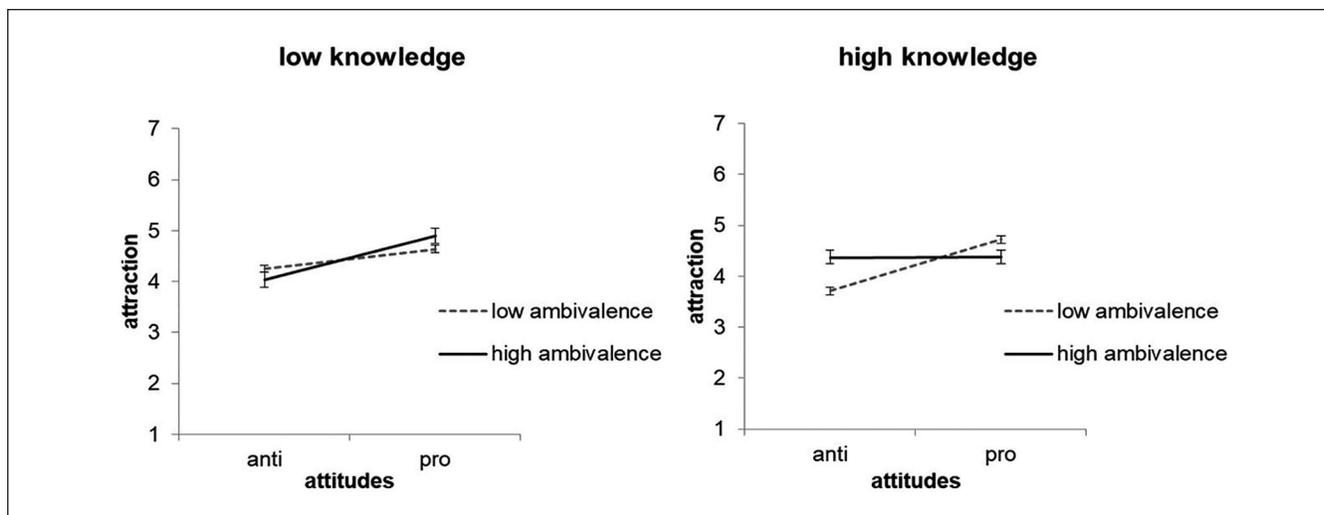
Figure 1. Attraction to a junk food tax advocate as a function of attitudes, perceived knowledge, and subjective ambivalence in Study 1. *Note.* All predictors are graphed at $+1SD$ and $-1SD$ from the mean for each predictor. Error bars represent the mean standard error for each slope.

him. Finally, participants were debriefed and thanked for their time.

Measures

Attitudes. Participants reported how much "Taxing junk food is . . ." (1 = *bad, harmful*, and *unfavorable* to 9 = *good, beneficial*, and *favorable*) on three semantic differential scales ($\alpha = .85$).

Subjective ambivalence. To index subjective ambivalence, participants reported the extent to which they felt *conflicted, mixed*, and *indecision* (Priester & Petty, 1996) about taxing junk food ($\alpha = .84$). As example item was, "How mixed are your thoughts and feelings about taxing junk food?" (1 = *I feel completely one-sided reactions*, 11 = *I feel completely mixed reactions*).

Perceived knowledge. Participants were asked, "How much knowledge do you have about taxing junk food?" (1 = *very little*, 7 = *a lot*), "In thinking about what I know about taxing junk food, I feel that . . ." (1 = *I know essentially nothing about it*, 7 = *I know essentially everything about it*), and "How well informed are you about taxing junk food" (1 = *completely uninformed*, 7 = *completely informed*; $\alpha = .92$).

Attraction to junk food tax advocate. Participants received a message in support of a junk food tax from a novel person, Keith Brown. His message in support of the junk food tax included arguments such as taxing junk food would encourage healthy eating and help address the nation's obesity problem. After reading the message, participants were asked, "How much do you like Keith Brown?" and "To what extent would you like spending time talking with Keith Brown?" both anchored with 1 = *not at all*, to 7 = *very much*.

Results and Discussion

The means and standard deviations for each variable as well as the covariances between the variables for each study are available in the Supplemental Material.

First, to replicate previous research, we regressed attraction to the junk food tax advocate on centered attitudes, subjective ambivalence, and their interaction. That analysis did not result in the traditional Attitude $\times$ Subjective Ambivalence interaction, $b = -.02$, $t(145) = -1.07$, $p = .29$, 95% confidence interval [CI] = [$-.04$, .01], $r = -.09$. When we conducted similar single-antecedent analyses with perceived knowledge instead of ambivalence, there was a significant Attitude $\times$ Perceived Knowledge interaction, $b = .06$, $t(145) = 2.16$, $p = .03$, 95% CI = [.005, .11], $r = .18$. Replicating previous research, attitudes held with higher ($+1SD$) perceived knowledge, $b = .24$, $t(145) = 4.74$, $p < .001$, 95% CI = [.14, .34], $r = .37$, predicted attraction more strongly than those held with lower amounts ($-1SD$) of perceived knowledge, $b = .09$, $t(145) = 1.52$, $p = .13$, 95% CI = [$-.03$, .20], $r = .13$. Although we replicated the previously observed Attitude $\times$ Knowledge interaction, that we did not significantly replicate the Attitude $\times$ Ambivalence interaction speaks to the importance of examining potential moderators of this effect.

Next, we conducted a centered regression analysis using the centered attitude, perceived knowledge, and subjective ambivalence measures, along with their corresponding two- and three-way interactions to predict participants' attraction to Keith Brown. This three-way interaction examined whether the traditional attitude moderation by ambivalence primarily predicts attraction when knowledge is relatively high. Indeed, the Attitude $\times$ Knowledge $\times$ Ambivalence interaction was statistically significant, $b = -.03$, $t(141) = -2.55$, $p = .01$, 95% CI = [$-.05$, $-.01$], $r = -.21$, full model $R^2 = .19$ (Figure 1; for each study, the full model results can be found in the

Supplemental Material). The three-way interaction was decomposed by examining the Attitude × Subjective Ambivalence simple two-way interactions at high and low levels of perceived knowledge. At low levels of knowledge ($-1SD$), the Attitude × Subjective Ambivalence simple two-way interaction was not statistically significant, $b = .03$, $t(141) = 1.18$, $p = .24$, 95% CI = $[-.02, .07]$, $r = .20$. Attitudes held with high ambivalence ($+1SD$) marginally predicted attraction to the junk food advocate, $b = .22$, $t(141) = 1.92$, $p = .06$, 95% CI = $[-.01, .45]$, $r = .16$, but were not stronger in predicting this outcome compared with attitudes held with low ambivalence ($-1SD$), $b = .10$, $t(141) = 1.74$, $p = .08$, 95% CI = $[-.01, .21]$, $r = .15$. Note, however, that greater ambivalence was actually associated with somewhat stronger relations between attitudes and attraction to the junk food tax advocate, which is directionally opposite of the traditional strength-related pattern (cf. Sawicki et al., 2013). In contrast, at high levels of perceived knowledge ($+1SD$), there was a significant Attitude × Subjective Ambivalence interaction, $b = -.05$, $t(141) = -2.66$, $p = .009$, 95% CI = $[-.09, -.01]$, $r = -.22$. That is, relatively univalent attitudes ($-1SD$) were more predictive of participants' attraction to Keith Brown, $b = .26$, $t(141) = 4.99$, $p < .001$, 95% CI = $[.16, .36]$, $r = .39$, than were more ambivalent attitudes ($+1SD$), $b = .00$, $t(141) = 0.00$, $p = .996$, 95% CI = $[-.21, .21]$, $r = .00$. Thus, in this study, the typical Attitude × Subjective Ambivalence interaction on attitudinal impact only appeared at relatively high levels of knowledge. These findings support an interactive view of subjective ambivalence and perceived knowledge relations. Importantly, they identify the level of perceived knowledge as a critical factor for traditional strength effects of subjective ambivalence on attitude impact.

Study 2

Study 1 used attraction to a person who expresses a particular opinion as the outcome reflecting attitude impact. Because one of our attraction items involved reporting how much they would like to talk with the advocate, this is a context that could provide attitude-related information if participants imagined that they would be talking with Keith Brown (similar to Sawicki et al., 2013). Therefore, it seemed important to examine outcomes that would not directly provide support for one's attitude to ensure that these patterns would generalize to other judgments and behaviors. For example, Study 2 tested these same hypotheses using the topic of biofuels and self-reported likelihood of filling up one's car with biofuels as the outcome measure. Study 2 also provided the opportunity to test our hypotheses in a much larger and representative national sample.

Method

Participants. This study used a representative sample of 1,800 U.S. citizens older than 18 years matched by state on gender,

age, race, education, party identification, and political interest. In this study, participants also had a "don't know" response option for each measure. When participants responded with "don't know" on any of the measures, it was treated as a missing response, leaving 1,335 participants for analyses.

Procedure. Participants were contacted by telephone through random digit dialing by YouGov Polimetrix. The company initially interviewed 2,022 respondents and then matched those respondents down to a sample of 1,800 to produce the final data set. Among questions about other environment-related attitude objects, participants responded to questions regarding their attitudes, subjective ambivalence, and perceived knowledge of biofuels, and later reported their likelihood of filling up their tank with biofuels if they were to own a vehicle capable of using the fuel.

Measures

Attitudes. Participants were asked whether "using biofuels, such as ethanol is a good idea." They were given the response options of 1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, and 5 = *strongly agree*, as well as a "don't know" response option.

Subjective ambivalence. Participants reported the extent to which they had "mixed or conflicted feelings about biofuels." They were given the response options of 1 = *not at all mixed*, 2 = *somewhat mixed*, 3 = *moderately mixed*, and 4 = *very mixed*, as well as a "don't know" response option.

Perceived knowledge. Participants were asked the extent to which they were "informed about biofuels, such as ethanol" and given the response options: 1 = *not at all informed*, 2 = *somewhat informed*, 3 = *moderately informed*, and 4 = *very informed*, as well as a "don't know" response option.

Likelihood of purchasing biofuels. Participants were asked, "If you owned a car capable of running on either gasoline or biofuels, how likely would you be to fill up your tank with biofuels instead of regular gasoline?" (1 = *very unlikely*, 2 = *somewhat unlikely*, 3 = *neither likely nor unlikely*, 4 = *somewhat likely*, and 5 = *very likely*, as well as a "don't know" response option).[2]

Results and Discussion

First, to replicate previous work, we regressed behavioral likelihood on centered attitudes, subjective ambivalence, and their interaction. In this study, there was an overall significant interaction between attitudes and subjective ambivalence, $b = -.13$, $t(1,332) = -3.81$, $p = .0001$, 95% CI = $[-.20, -.66]$, $r = -.10$. This interaction reflected that attitudes were more predictive of self-reported likelihood of filling up one's car with biofuels when the participants were
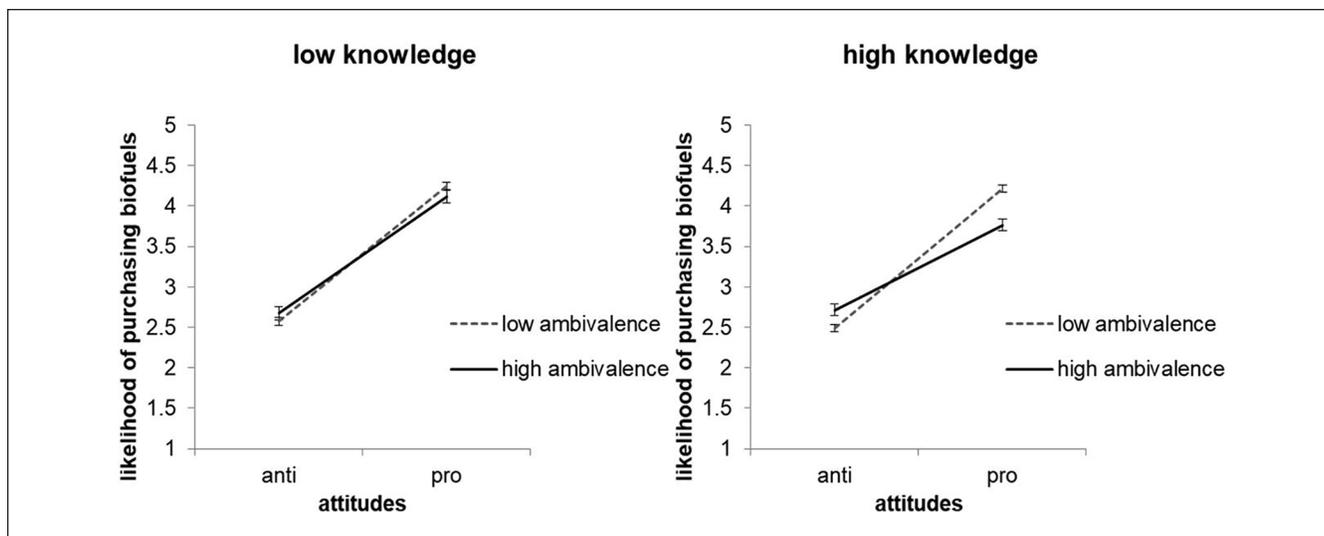
Figure 2. Judged likelihood of using biofuels as a function of attitudes, perceived knowledge, and subjective ambivalence in Study 2.
Note. All predictors are graphed at $+1SD$ and $-1SD$ from the mean for each predictor. Error bars represent the mean standard error for each slope.

less, $b = .78$, $t(1,332) = 22.59$, $p < .001$, 95% CI = [.71, .85], $r = .53$, rather than more subjectively ambivalent, $b = .55$, $t(1,332) = 10.26$, $p < .001$, 95% CI = [.44, .65], $r = .27$. However, when we regressed behavioral intentions on centered attitudes, perceived knowledge, and their interaction, there was not a significant interaction, $b = -.008$, $t(1,331) = -0.24$, $p = .81$, 95% CI = [−.08, .06], $r = -.01$.

Although we replicated the attitude by ambivalence interaction that prior research has observed, the presence of the overall two-way interaction does not preclude that this two-way interaction is further moderated. As such, we conducted a regression analysis using the centered attitude, perceived knowledge, and subjective ambivalence measures, along with their corresponding two- and three-way interactions to predict the self-reported likelihood that people would use biofuels. The overall Attitude × Perceived Knowledge × Subjective Ambivalence interaction was marginal, $b = -.07$, $t(1,327) = -1.82$, $p = .07$, 95% CI = [−.15, .01], $r = -.05$, full model $R^2 = .31$ (Figure 2). At low levels of perceived knowledge ($-1SD$), there was not significant evidence of an Attitude × Subjective Ambivalence interaction, $b = -.06$, $t(1,327) = -1.07$, $p = .29$, 95% CI = [−.16, .05], $r = .03$. Attitudes held with high ambivalence ($+1SD$), $b = .66$, $t(1,327) = 8.02$, $p < .001$, 95% CI = [.50, .82], $r = .22$, and with low ambivalence ($-1SD$), $b = .76$, $t(1,327) = 14.06$, $p < .001$, 95% CI = [.65, .87], $r = .36$, similarly predicted judgments of behavioral likelihood.

In contrast, for higher levels of perceived knowledge ($+1SD$), there was a significant Attitude × Subjective Ambivalence interaction, $b = -.18$, $t(1,327) = -4.12$, $p < .001$, 95% CI = [−.26, −.09], $r = -.11$. Lower levels of ambivalence ($-1SD$) were associated with attitudes being more predictive of behavior, $b = .79$, $t(1,327) = 19.20$, $p < .001$, 95% CI = [.71, .87], $r = .47$, than were higher

levels of ambivalence, $b = .48$, $t(1,327) = 7.11$, $p < .001$, 95% CI = [.35, .61], $r = .19$, once again only providing support for the typical Attitude × Ambivalence interaction at relatively high levels of perceived knowledge. This moderation pattern suggests a previously incomplete understanding of when subjective ambivalence is most likely to moderate attitude-behavior consistency. Thus, Study 2 conceptually replicated the three-way interaction finding of Study 1 in a nationally representative sample and with an outcome that is less likely to represent directly seeking support for one's attitude when ambivalent and lacking knowledge. Once again, these results seem more consistent with the interactive rather than the additive hypothesis.

Study 3

In Study 3, we wanted to again conceptually replicate and extend the findings of Studies 1 and 2. Recent work has demonstrated a certainty by ambivalence interaction on "durability" indices of attitude strength: resistance and stability (Clarkson, Tormala, & Rucker, 2008; Luttrell, Petty, & Briñol, 2016). Given the previously observed Ambivalence × Certainty interactions, one might wonder whether our knowledge measures are having their effects through an increase in certainty. Indeed, some researchers have speculated that perceived knowledge might have its effects on attitude-behavior consistency due to an increase in certainty (Berger, Ratchford, & Haines, 1994), and prior research has shown reliable correlations between perceived knowledge and attitude certainty (e.g., Prislin, 1996; Smith et al., 2008). In addition, despite clearly separating the two (Luttrell, Stillman, Hasinski, & Cunningham, 2016), previous research has also demonstrated a reliable association between ambivalence and certainty, allowing for the possibility that the

observed ambivalence effects are due to certainty (van Harreveld, Rutjens, Rotteveel, Nordgren, & van der Pligt, 2009). As such, in Study 3, we wanted to test whether the Attitude × Perceived Knowledge × Subjective Ambivalence pattern occurred because of associations of perceived knowledge or subjective ambivalence with certainty or whether perceived knowledge and subjective ambivalence had independent effects beyond those of certainty.

Method

Participants. Five hundred fifty-four Introduction to Psychology students enrolled in Ohio State University's Research Experience Program participated in this study. Several participants failed to respond to one or more of the questions that were a part of our primary analyses. These missing responses left 501 participants for analyses.

Procedure. Participants responded to questions regarding their attitudes, subjective ambivalence, structural ambivalence, certainty, and perceived knowledge of same-sex marriage, and later their will to vote for a political candidate who favored same-sex marriage.[3] This study took place before the United States Supreme Court decision that legalized same-sex marriage. Participants responded to the measures of interest among other attitude strength questions about same-sex marriage.

Measures

Attitudes. Participants were instructed as follows: "Please rate SAME-SEX MARRIAGE on the following scale" with three items corresponding to 1 = *bad, negative,* and *against,* and at 7 = *good, positive,* and *in favor* (α = .97).

Subjective ambivalence. Participants reported the extent to which they felt *conflicted, mixed,* and *indecision* regarding same-sex marriage on five-point scales (α = .85).

Perceived knowledge. Participants reported the extent to which they were "well-informed" and "knowledgeable" about same-sex marriage on a five-point scale (1 = *not at all,* 5 = *extremely; r* = .84).

Certainty. Participants' certainty in their attitudes was measured with three items measured on five-point scales: "How confident are you in your attitude toward same-sex marriage?" (1 = *not at all confident;* 5 = *extremely confident*), "How sure are you that your attitude toward same-sex marriage is correct?" (1 = *not at all sure;* 5 = *extremely sure*), and "How certain are you in your attitude toward same-sex marriage?" (1 = *not at all certain;* 5 = *extremely certain;* α = .93), consistent with standard items in the attitude strength literature (Wegener et al., 1995).
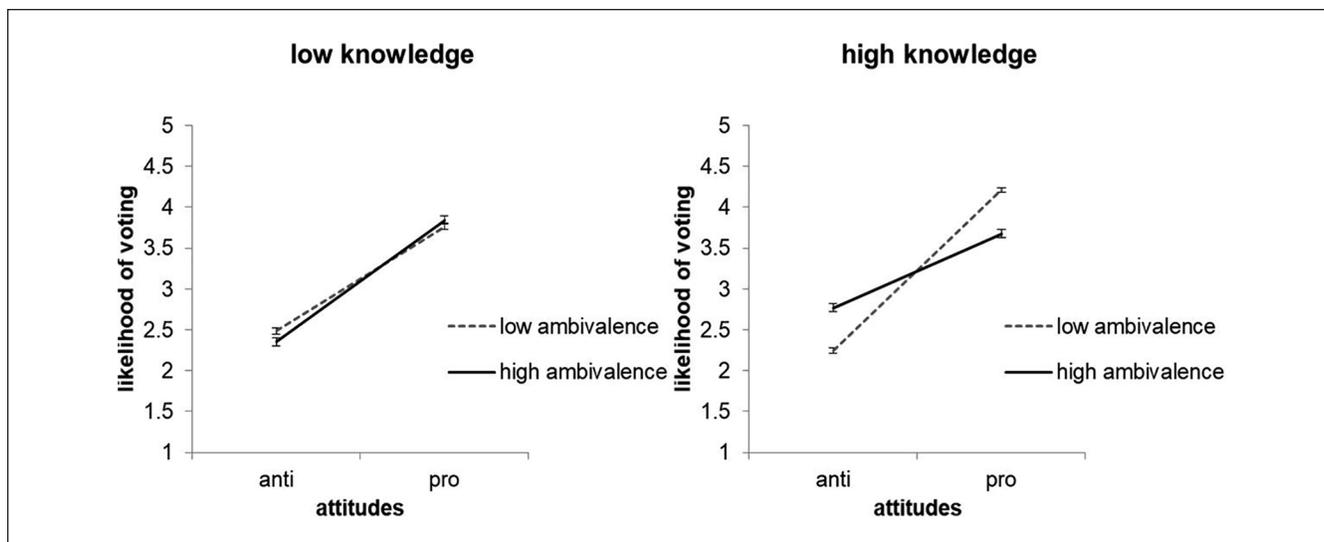
Likelihood of voting for pro-same-sex marriage candidate. Participants were asked, "How likely would you be to vote for a political candidate who *favors* same-sex marriage? (1 = *not at all likely;* 5 = *very likely*)."

Results and Discussion

First, to test for the traditional Attitude × Subjective Ambivalence interaction, we regressed voting intentions on centered attitudes and subjective ambivalence, as well as their interaction. Consistent with previous research, we found a significant two-way interaction between ambivalence and attitudes, $b = -.08$, $t(497) = -3.55$, $p = .0004$, 95% CI = [−.12, −.04], $r = -.16$. Attitudes held with low subjective ambivalence, $b = .45$, $t(497) = 18.81$, $p < .001$, 95% CI = [.40, .50], $r = .64$, were more predictive of voting likelihood than those held with high subjective ambivalence, $b = .29$, $t(497) = 8.12$, $p < .001$, 95% CI = [.22, .36], $r = .34$. There was also a significant interaction between knowledge and attitudes on voting likelihood, $b = .05$, $t(497) = 2.63$, $p = .009$, 95% CI = [.01, .10], $r = .12$. Attitudes held with high knowledge, $b = .43$, $t(497) = 19.18$, $p < .001$, 95% CI = [.39, .47], $r = .65$, were more predictive of voting likelihood than those held with low knowledge, $b = .34$, $t(497) = 12.22$, $p < .001$, 95% CI = [.28, .39], $r = .48$. However, as we predicted that perceived knowledge and subjective ambivalence could interact when predicting attitude impact, we also conducted a centered regression analysis using the attitude, perceived knowledge, and subjective ambivalence measures, along with their corresponding two- and three-way interactions to predict the likelihood that people would vote for a political candidate who favored same-sex marriage. The overall Attitude × Perceived Knowledge × Subjective Ambivalence interaction was significant, $b = -.10$, $t(493) = -3.67$, $p < .001$, 95% CI = [−.15, −.04], $r = -.16$, full model $R^2 = .54$ (Figure 3). The three-way interaction was decomposed by examining the two-way interactions at relatively high and low levels of knowledge. At low levels of perceived knowledge ($-1SD$), there was not a significant Attitude × Subjective Ambivalence interaction, $b = .03$, $t(493) = 0.77$, $p = .44$, 95% CI = [−.04, .09], $r = .03$. Attitudes held with high ambivalence ($+1SD$), $b = .38$, $t(493) = 7.23$, $p < .001$, 95% CI = [.27, .48], $r = .31$, and with low ambivalence ($-1SD$), $b = .32$, $t(493) = 8.35$, $p < .001$, 95% CI = [.25, .40], $r = .35$, predicted judged likelihood of voting similarly. In contrast, at higher levels of knowledge ($+1SD$), there was a significant Attitude × Subjective Ambivalence interaction, $b = -.13$, $t(493) = -4.69$, $p < .001$, 95% CI = [−.19, −.08], $r = -.21$. At low levels of ambivalence ($-1SD$), attitudes were more predictive of voting likelihood judgments, $b = .50$, $t(493) = 18.32$, $p < .001$, 95% CI = [.45, .55], $r = .64$, than at high levels of ambivalence ($+1SD$), $b = .23$, $t(493) = 4.74$, $p < .001$, 95% CI = [.14, .33], $r = .21$. Thus, these results once again provided evidence for the traditional Attitude × Ambivalence interaction *only* at relatively high levels of perceived knowledge.

Finally, we wanted to examine whether the perceived knowledge or subjective ambivalence effects were due to their

Figure 3. Judged likelihood of voting for a politician who favored same-sex marriage as a function of attitudes, perceived knowledge, and subjective ambivalence in Study 3.
Note. All predictors are graphed at $+1SD$ and $-1SD$ from the mean for each predictor. Error bars represent mean standard errors for each slope.

association with certainty. First, we tested whether knowledge was having its effects due to certainty by conducting the same three-way interaction analyses as above but also including certainty and its two- and three-way interactions with attitudes and subjective ambivalence in the model. Even when controlling for certainty, the Attitude × Perceived Knowledge × Subjective Ambivalence interaction remained significant, $b = -.10$, $t(480) = -3.57$, $p < .001$, 95% CI = $[-.15, -.04]$, $r = -.16$. We next tested whether certainty could account for the ambivalence effects by conducting the three-way interaction analyses but controlling for certainty and its two- and three-way interactions with attitudes and knowledge. In this model, the Attitude × Perceived Knowledge × Subjective Ambivalence interaction remained significant, $b = -.09$, $t(480) = -3.01$, $p = .003$, 95% CI = $[-.15, -.03]$, $r = -.14$. These results do not support certainty as the mechanism for the effects of perceived knowledge or subjective ambivalence.[4] Thus, Study 3 replicated the Attitudes × Perceived Knowledge × Subjective Ambivalence interaction on judged behavioral likelihood. In addition, controlling for potential associations between knowledge and certainty or ambivalence and certainty did not change this pattern, suggesting that certainty does not account for either of these effects.
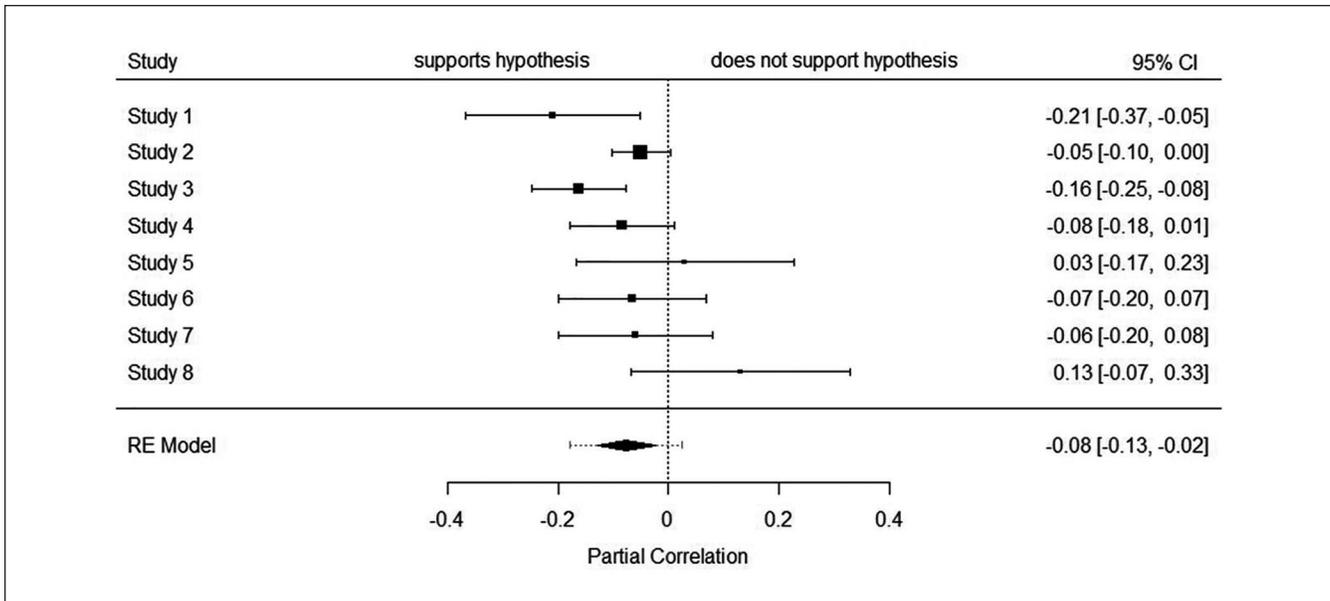
Meta-Analysis

When researchers seek to determine whether an effect exists at the population level, they are really looking for the results to align across studies in the direction of the hypothesized effect. Assuming a normal distribution of effects, for a single study with only 50% power, when the population effect falls in a particular direction, 97.5% of the time, the results will fall in the direction of the population effect, whereas 2.5% of

the time, the results will fall in the opposite direction. In contrast, if the population effect were zero, researchers would be equally likely to find positive and negative effects. Because significant results are more informative regarding the direction of effects than weaker, nonsignificant results (Tukey, 1991), we chose to focus on the studies that provided the clearest evidence for an interaction between attitudes, knowledge, and ambivalence (and these all fell in the same direction). However, the significant studies alone would represent a larger effect size than the entire set of relevant studies. Therefore, curious readers may wonder about an effect size estimate based on the more complete set of studies. To accomplish this goal, we combined all of the studies from graduate student projects of current (as of 2016) Attitudes and Persuasion Lab members during their time at Ohio State University that contained the measures of interest to conduct a mini-meta-analysis (e.g., Goh, Hall, & Rosenthal, 2016; Mcshane & Böckenholt, 2017).[5]

The meta-analyzed data set included eight studies with a total of 3,054 participants from graduate students supervised by Duane Wegener and/or Richard Petty from 2010 to 2016. The exact measures and results of the three-way interaction between attitudes, ambivalence, and knowledge for each of these studies are available in the Supplemental Material. Following recommendations by Aloe and Thompson (2013), we used the partial correlation of the three-way interaction as the effect size measure to conduct a random effects meta-analysis. We calculated the partial correlation using the following formula: $r = t / \sqrt{t^2 + df}$.

First, we meta-analyzed the three-way interaction between attitudes, perceived knowledge, and subjective ambivalence. Across all eight studies, we found strong support for the

Figure 4. Meta-analysis of the three-way interaction between attitudes, ambivalence, and knowledge on strength outcomes.
Note. CI = confidence interval; RE = random effects.

three-way interaction, $r = -.08$, $p = .004$ (Figure 4). There was marginally significant heterogeneity of effect sizes across studies, $Q(7) = 12.96$, $p = .07$, something to which we return later. We also conducted meta-analyses of the simple two-way interactions between ambivalence and attitudes at (within sample) high and low levels of knowledge. At high levels of knowledge ($+1SD$ in each sample), the interaction between knowledge and attitudes was significant across all studies, $r = -.10$, $p = .02$. In addition, there was significant heterogeneity of effect sizes, $Q(7) = 22.47$, $p = .002$. At lower levels of knowledge ($-1SD$ in each sample), the interaction between attitudes and ambivalence was not significant, $r = .00$, $p = .91$, and there was significant heterogeneity of effect sizes, $Q(7) = 18.22$, $p = .01$. For figures to accompany each of these meta-analytic simple two-way analyses, see the Supplemental Material.

In sum, a meta-analysis of our studies provided support for the findings presented in the three studies in the text.[6] Although we observed significant heterogeneity of effect sizes for each of these tests, there is nothing particularly striking about the variability in our effects (i.e., these data are not "messier" than what one might expect for a complete set of studies of this sort). As Stanley and Spence (2014) demonstrated through simulation, even when a nonzero effect size exists in the population and all samples are drawn from the same population, the mere existence of sampling error and modest measurement error will introduce substantial variability in the effects such that one would expect to see some nonsignificant studies. Moreover, sets of studies (ours included) rarely sample from the same population as changes to materials (e.g., different attitude objects), context (e.g., lab vs. online data collection), and participant groups (e.g.,

university samples vs. nonuniversity samples) introduce changes in the population effect sizes. Given the significant amount of variability that comes from sampling error and that our studies vary in additional ways, the variability observed in our studies is if anything a bit more modest than what one might reasonably expect given the wide range of conditions under which we tested our effects (Kenny & Judd, 2019). Furthermore, we expect that there are additional moderators of the three-way interaction. Predictably, this heterogeneity of effect sizes occurs within effects largely in the same direction (six of the eight effects fell in the same direction), suggesting that the pattern of effects is stronger for some studies than others. For example, the three-way interaction may be affected by whether the overall levels of attitudes, perceived knowledge, and subjective ambivalence are relatively high or low in a given study. In addition, people might expect to feel ambivalent about some topics more than others, in which case the ambivalence may not be so troublesome (Durso et al., 2019). In such instances, subjective ambivalence might be less likely to undermine the impact of high-knowledge attitudes. Nevertheless, across the studies in our meta-analysis, there was support for our key hypotheses.

General Discussion

Three highlighted studies on different topics with a variety of attitude-relevant dependent measures demonstrated that the amount of perceived knowledge people had about the attitude object moderated effects of subjective ambivalence on attitude impact. These findings were also supported by a meta-analytic examination of a broader set of studies that

included an even wider range of outcomes, including self-reported behavior, behavioral willingness, behavioral intentions, and attraction toward an advocate. Previous research would have led researchers to conclude that ambivalence consistently undermines attitude impact (Armitage & Conner, 2000). However, the current work only found support for the typical Attitude × Subjective Ambivalence interaction when participants felt that they were relatively knowledgeable about the attitude object. Conversely, the current work did not find evidence of an Attitude × Subjective Ambivalence interaction when participants felt that they were relatively unknowledgeable about the attitude object. This pattern supports a multiplicative rather than additive model of attitude impact as a function of the influences of ambivalence and knowledge—a key class of indicators of attitude strength. Although this article focused on moderation of the Attitude × Ambivalence interaction by knowledge, it is also true that the Attitude × Knowledge interaction is moderated by ambivalence (see analyses in Supplemental Material). That is, we only find meta-analytic support for the typical Attitude × Knowledge interaction when participants were relatively high in ambivalence. Conversely, we did not find meta-analytic support for the Attitude × Knowledge interaction at low levels of ambivalence. This multiplicative approach illustrates the broader need to consider strength determinants in conjunction with one another to more accurately predict strength-related outcomes. Furthermore, these multiplicative findings might help explain variability in the knowledge or ambivalence effects obtained in past (and future) studies. Given current concerns about replicability, identifying the conditions under which effects are most likely to occur is particularly important (Luttrell, Petty, & Xu, 2017).

The current findings have implications across many domains, including consumer behavior, politics, health, and the environment. Although previous work has suggested that ambivalence undermines attitude impact, the current work suggests that may not be such an issue if the target audience is relatively low in perceived knowledge. However, if targeting an audience higher in perceived knowledge or wanting to increase an audience's (perceived) knowledge, the current findings suggest the importance of developing products and picking candidates that are relatively univalent so that when advertisers and political parties increase consumer and citizen knowledge, it will result in a boost to attitude impact. In other words, adding perceived knowledge will not help (and might hurt) if it is accompanied by ambivalence.

In addition, this research has implications for work on interpersonal attraction. A wealth of research has demonstrated that people are attracted to others who share their attitudes (e.g., Byrne, 1997). Study 1 demonstrated that ambivalence toward the relevant topic undermined the influence of attitudes on attraction to a junk food tax advocate when the participants believed they were knowledgeable. However, when the participants were relatively low in perceived knowledge, ambivalent attitudes were not less predictive (and trended toward being more predictive) than univalent attitudes (Patton, Wegener, & Sawicki, 2016).

Although the standardized effect sizes of our three-way interactions are relatively small according to conventional standards (Cohen, 1992), the relevance of such patterns to a wide variety of domains and outcomes makes them have potentially important societal implications (cf. Greenwald, Banaji, & Nosek, 2015). Simply lacking perceived knowledge completely wipes out the effect of subjective ambivalence on attitude impact. The interaction effect size may seem small because historically researchers have primarily reported their significant but not nonsignificant studies. Thus, an average reported effect size in the literature is likely to be inflated. We chose to avoid any bias in the effect size estimate here by including all available studies in the meta-analysis, although we know this made our effect size seem comparatively smaller to effects in the literature. Finally, it is important to note that even effect sizes of interactions that include reversals of effects across a moderator (that are crucial both theoretically and practically) will often be substantially smaller than those of comparable main effects simply because of nature of the residual variances of the product terms involved in the interactions (McClelland & Judd, 1993).

Future Directions

The current work examined subjective ambivalence by perceived knowledge interactions on attitude impact, but future work could profitably examine the joint effects of ambivalence and knowledge on attitude durability, such as resistance to change and stability over time. Previous work has suggested that people who are more ambivalent are more easily persuaded (Armitage & Conner, 2000) and are more influenced by social norms (Hohman, Crano, & Niedbala, 2016). To the extent that attitude impact and attitude durability show similar patterns, the current work suggests that ambivalence effects on durability might primarily occur for those whose attitudes are associated with relatively high levels of perceived knowledge. In addition, ambivalent attitudes are thought to be relatively unstable over time, at least under some circumstances (Luttrell et al., 2016). However, reducing stability with ambivalence requires a high enough baseline of stability to show such decreases, and relatively high levels of knowledge (so that univalent attitudes can remain stable), might be necessary to show such effects.

Mechanisms. We have described the possible mechanisms at work as reflecting general meta-cognitive perceptions of the attitude. For example, when people feel knowledgeable, but subjectively ambivalent, they might perceive that this conflict undermines the utility or reliability of the attitude (just as perceptions of low knowledge might undermine perceptions of utility or reliability of the attitude). Alongside these

perceptions, people relatively low in perceived knowledge but high in subjective ambivalence might view a thought, judgment, or behavior as capable of helping them reduce the subjective ambivalence. When they do, ambivalent attitudes might be relatively predictive due to the motivational strength of ambivalence (cf. Sawicki et al., 2013).

But there could also be mechanisms that rely less on such perceptions per se. For instance, the current Studies 3 and 4 also included a measure of structural ambivalence. Meta-analytically, these studies provided evidence of an Attitude × Structural Ambivalence × Perceived Knowledge interaction (analyses in the Supplemental Material). An alternative mechanism that could occur for either the structural or the subjective antecedents is that when people are deciding what judgment or behavior to undertake, they may be looking for a clear guide (Harmon-Jones, Harmon-Jones, & Levy, 2015; van Harreveld et al., 2009). When attitudes seem to be based on a lot of knowledge with little ambivalence, they may provide a clear and fluent guide to judgments and behavior. However, when people are ambivalent, the guide may not possess that same fluency. For people with attitudes that are low in perceived knowledge and unconflicted, there may be times when the univalence is sufficient to guide judgments and behavior, but a lack of accessibility, may reduce attitude use much of the time. If low levels of perceived knowledge are associated with low levels of accessibility, regardless of the level of ambivalence, it could be that more directly cognitive mechanisms create the same overall pattern that a perspective based more on meta-cognitive perceptions of the attitude would predict.

Finally, there may be times when the structural antecedent or the meta-cognitive antecedent may be more or less important. For example, if people are consciously considering the qualities of their attitude when deciding how to think, judge, or behave, the perception of knowledge and ambivalence may be especially important. Previous work has suggested that this would be the case when a person is trying to resolve ambivalence (Sawicki et al., 2013). However, when people are engaged in relatively low levels of processing, the structural antecedents may be sufficient to affect attitude–behavior relations (cf. See, Petty, & Fabrigar, 2013). In the durability effects of attitudes, for example, it could also be that actual levels of knowledge or of ambivalence might be key to some resistance or stability effects (e.g., those that depend on logical argumentation or the presence of retrieval cues), whereas perceptions of amount of knowledge or subjective ambivalence might be key to others (e.g., those that depend on motivation to keep one's attitude or to reduce discomfort associated with one's attitude). This would be consistent with Luttrell et al.'s (2016) findings that structural, but not subjective, ambivalence interacts with certainty to predict stability.

There is still much to learn about the interactions of various strength-related properties of attitudes, but the current findings further develop our understanding. Alongside recent work examining moderation of ambivalence effects by certainty (e.g., Clarkson et al., 2008; Luttrell et al., 2016), the current research suggests that previous examinations of each attitude property in isolation provides an incomplete view of how strength-related properties influence consequences of attitudes for related thinking, judgments, and behavior. We look forward to future research exploring additional dynamics of knowledge, ambivalence, and other antecedents of attitude strength.

ORCID iDs

Laura E. Wallace https://orcid.org/0000-0002-2298-7569

Vanessa Sawicki https://orcid.org/0000-0002-5459-0339

Supplemental Material

Supplemental material is available online with this article.

Notes

1. Because we replicate our findings across several studies with a variety of sample sizes and find meta-analytic support for our effect, individual study power should be of less concern than the evidence across studies (cf. Mcshane & Böckenholt, 2017).
2. In Study 2, participants were also asked about their likelihood of purchasing a flexible fuel vehicle. However, because the attitude measure was about the use of biofuels rather than the purchase of flexible fuel vehicles, the purchase of a vehicle should be relatively less related to the attitude measures than the use of biofuels (Ajzen & Fishbein, 1977). As such, we chose to focus our analyses on the item about purchasing biofuels. See the Supplemental Material for analyses including both potential

outcome measures when meta-analyzing the set of relevant studies.

3. Analyses examining the role of structural rather than subjective ambivalence for Studies 3 and 4 (the only studies that contained measures of structural ambivalence) are available in the Supplemental Material.

4. Analyses reporting the results of an Attitude $\times$ Subjective Ambivalence $\times$ Certainty interaction and an Attitude $\times$ Perceived Knowledge $\times$ Certainty interaction, without controlling for knowledge or subjective ambivalence, respectively, are available in the Supplemental Material.

5. The study numbering reflects that we present Studies 1 to 3 in depth because they provided the clearest evidence for our effect. Studies 4 and 5 have the next smallest numerical labels because like Studies 1 to 3, they only contained measured variables. Finally, Studies 6 to 8 have the largest numerical labels because they contained attempts at manipulating ambivalence and knowledge and used topics that we *a priori* considered to be relatively novel.

6. Studies 6 to 8 employed relatively novel topics and attempts at manipulating ambivalence and knowledge. If overall levels of perceived knowledge are too low, we would not expect knowledge to moderate ambivalence effects. Therefore, we also conducted a meta-analysis with only Studies 1 to 5, which found a slightly larger effect size for the three-way interaction, $r = -.10$, $p = .003$.

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