

Ambivalence X Knowledge Supplemental Materials

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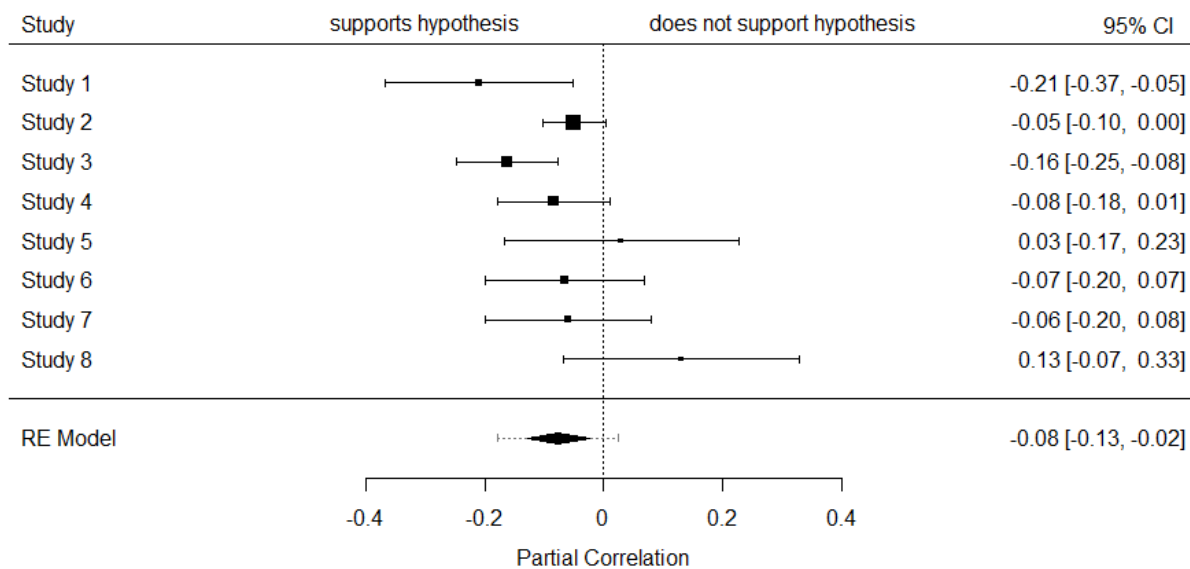
Summary Table for Meta-analysis: Study topics and whether the study included manipulations of knowledge and ambivalence

Study	Topic	Included Manipulations of Ambivalence and Knowledge
Study 1	Junk Food Tax	No
Study 2	Biofuels	No
Study 3	Same Sex Marriage	No
Study 4	Alcohol	No
Study 5	Organic Food	No
Study 6	Plastic Bag Tax	Yes
Study 7	Novel Person	Yes
Study 8	Novel Person	Yes

Note. Even when attempts at manipulating knowledge and ambivalence were included, in the meta-analysis, we included the results based on the measures. This was done to be consistent across all studies and because some of the manipulations did not successfully manipulate the variable of interest or included a confound (e.g. attitude extremity)

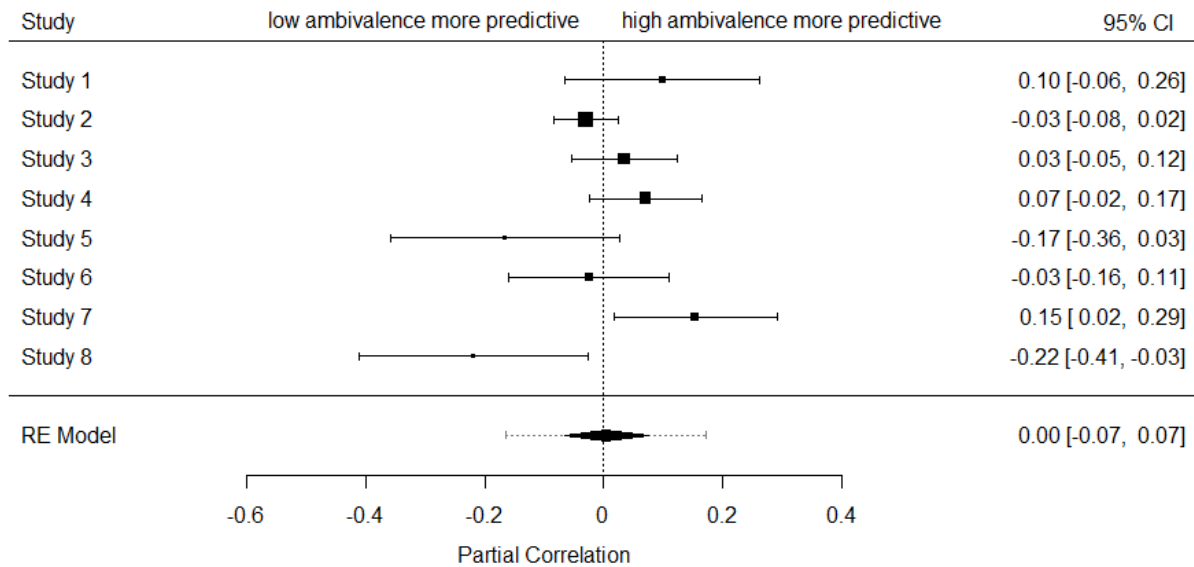
Graphs for Meta-analytic overview of all studies conducted in the authors' lab related to current line of work

Meta-analysis of the three-way interaction between attitudes, ambivalence, and knowledge on strength outcomes

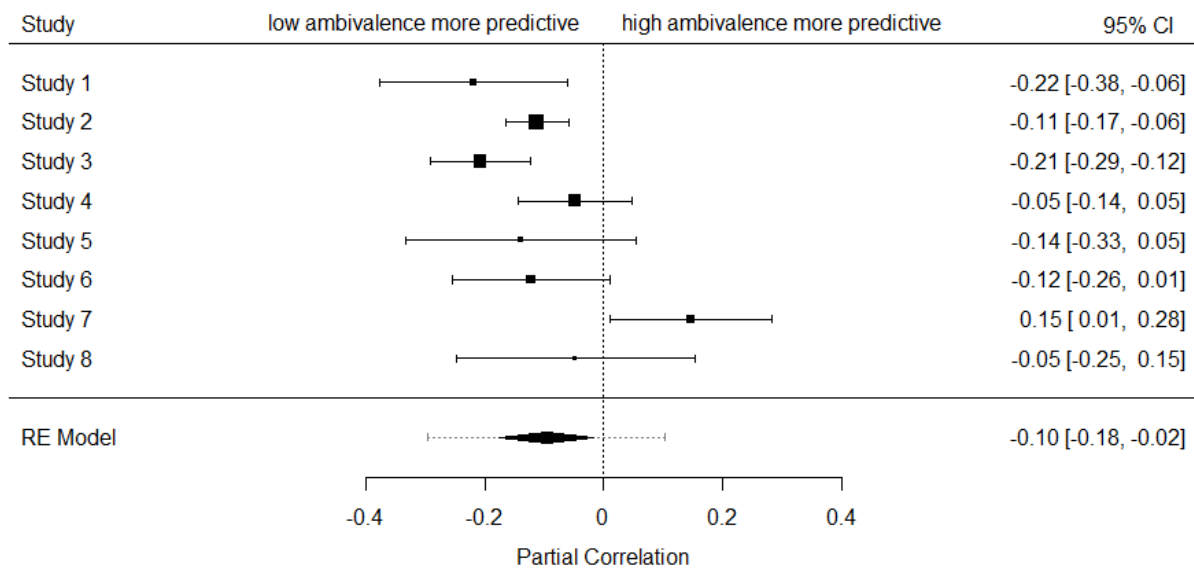


Meta-analysis of Ambivalence by Attitudes Simple Two-Way at Low and High Levels of Knowledge

Meta-analysis of the two-way interaction between attitudes and ambivalence on strength outcomes at low levels of knowledge



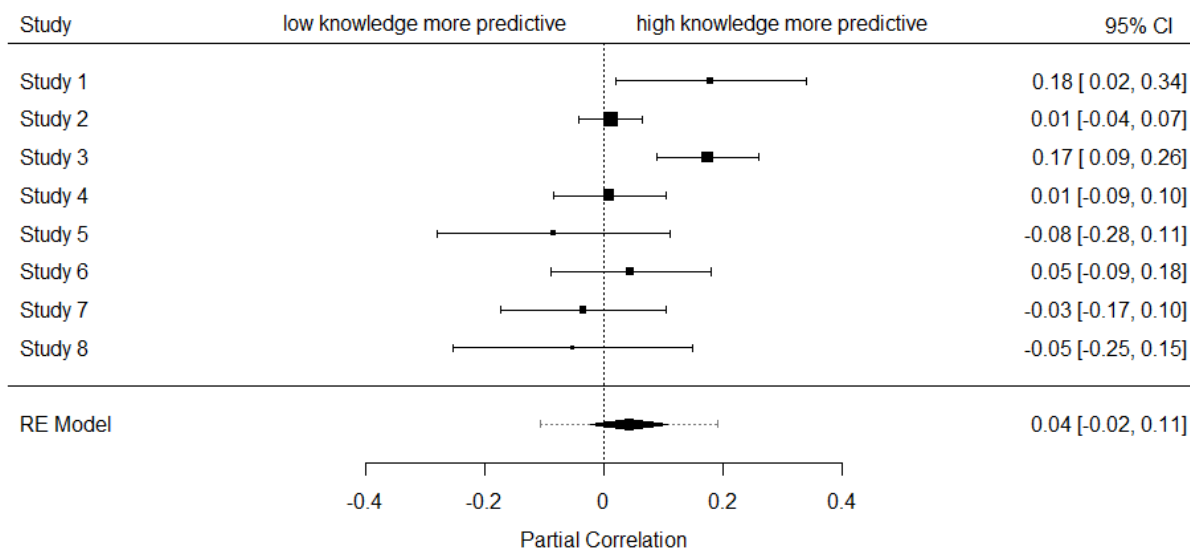
Meta-analysis of the two-way interaction between attitudes and ambivalence on strength outcomes at high levels of knowledge



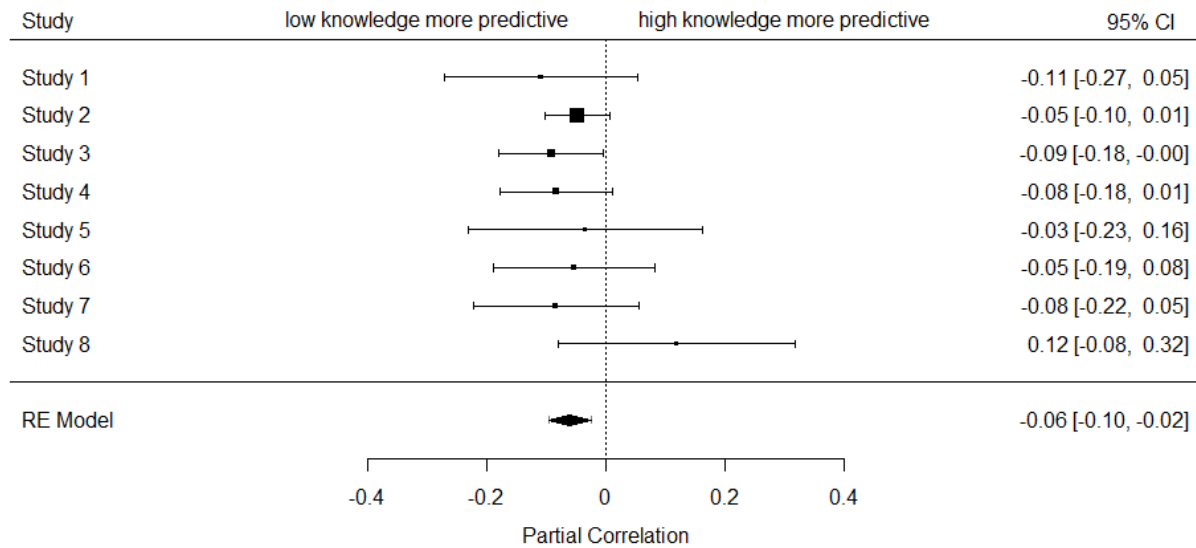
Meta-analysis of Attitude x Knowledge Interaction at high and low levels of ambivalence

As mentioned in the Discussion section of the manuscript, this data also allowed us to examine whether ambivalence moderated the effects of knowledge on attitude impact. The omnibus test of this interaction is the same three-way interaction as reported in the text. However, to test this hypothesis, we broke down the interaction by examining the Attitude x Knowledge interaction at different levels of ambivalence. When we examined the Attitude x Knowledge interaction at low levels of ambivalence, we did not find meta-analytic support for the Attitude x Knowledge interaction, $r = .04$, $p = .21$. However, when we examined the Attitude x Knowledge interaction at high levels of ambivalence, it was significant, $r = -.06$, $p = .001$. These results suggest that in addition to knowledge moderating the effects of ambivalence, ambivalence also moderates the effect of knowledge on attitude impact.

Meta-analysis of the two-way interaction between attitudes and knowledge on attitude impact at low levels of ambivalence



Meta-analysis of the two-way interaction between attitudes and ambivalence on attitude impact at high levels of ambivalence

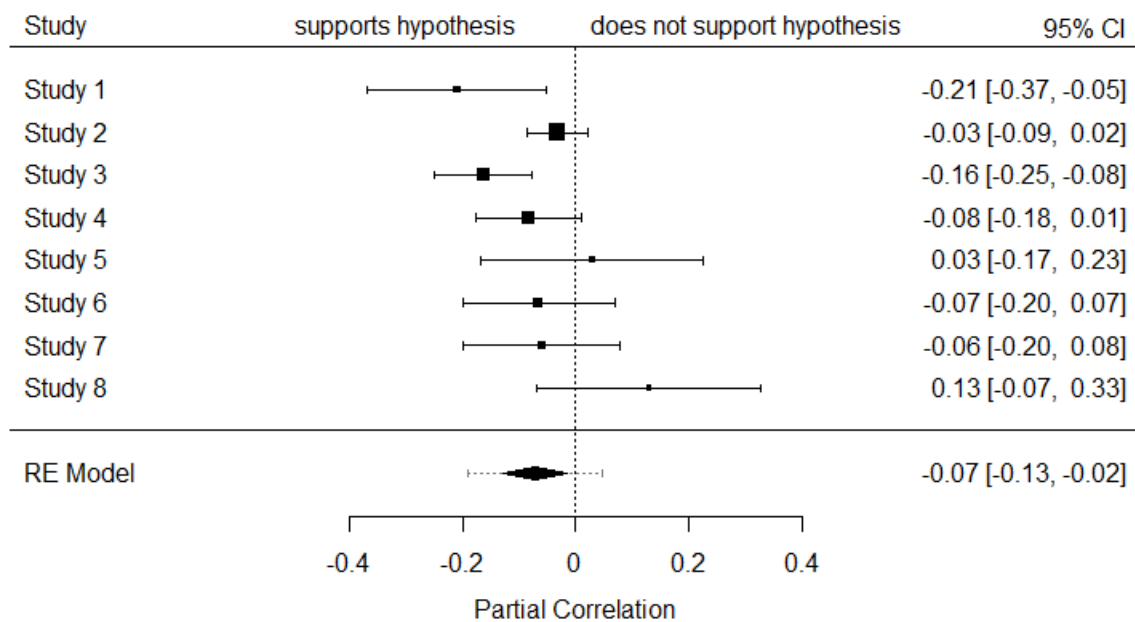


Meta-analytic overview of all studies conducted in the authors' lab related to current line of work with alternative biofuels measures

As mentioned in the text, Study 2 contained an additional “behavioral likelihood” measure. In addition to the “likelihood of purchasing biofuels if owned a car capable” measure, participants also reported their “likelihood of purchasing a flexible fuel vehicle.” Because the attitudes, ambivalence, and knowledge measures were specifically about biofuels, we expected that the behavioral likelihood measure about fuel would be more directly related to the other measures than the behavioral likelihood measure about the car. As such, we chose to focus our analyses on the “likelihood of purchasing fuel” dependent measure.

However, we wanted to conduct a meta-analysis with the fuel and car measures averaged into one dependent measure for Study 2. When we do this, the random effects meta-analytic review continues to provide evidence for the hypothesized three-way interaction, $r = -.07$, $p = .01$. There was also significant heterogeneity of effect size in this model, $Q = 14.40$, $df = 7$, $p = .04$.

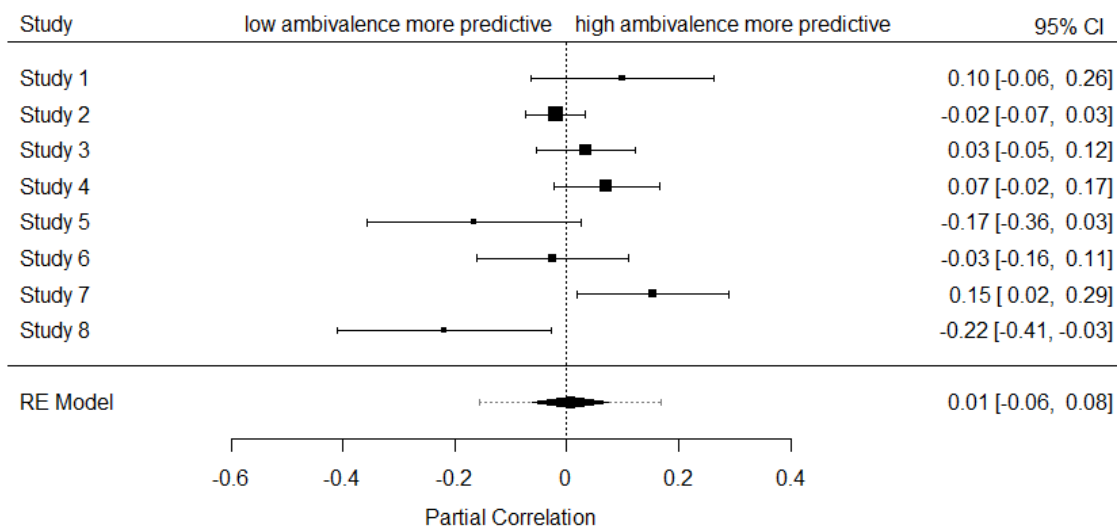
Meta-analysis of the three-way interaction between attitudes, ambivalence, and knowledge on strength outcomes



In addition to conducting the meta-analysis of the three-way interaction above, we also conducted meta-analyses of the two ambivalence by attitudes two-way interactions at high and low levels of knowledge.

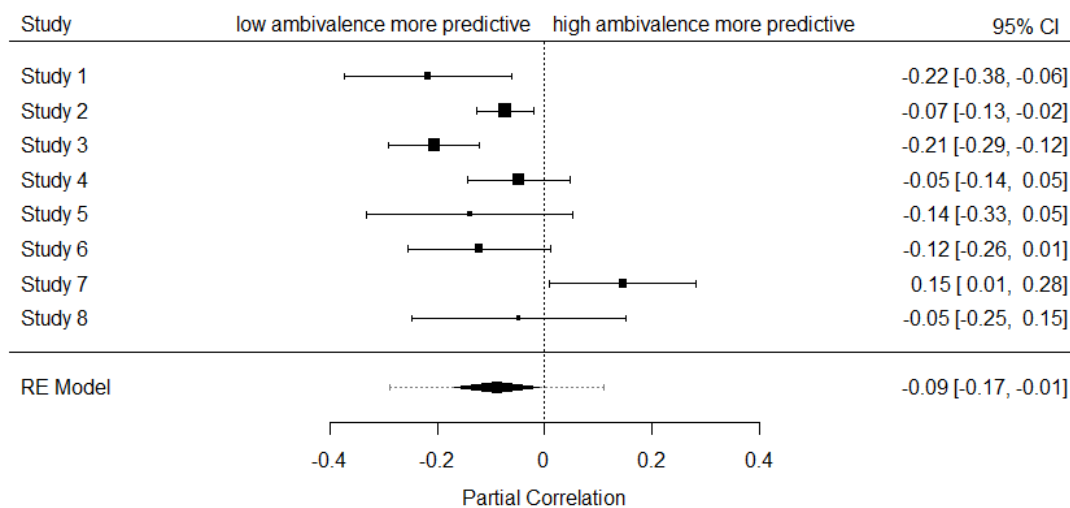
At low levels of knowledge, the simple two-way interaction between ambivalence and attitudes was not significant, meta-analytically, $r = .01$, $p = .86$. Additionally, there was significant heterogeneity of effect sizes, $Q(7) = 17.46$, $p = .01$.

Meta-analysis of the two-way interaction between attitudes and ambivalence on strength outcomes at low levels of knowledge



At high levels of knowledge, the meta-analysis provided support for a significant interaction between ambivalence and attitudes, $r = -.09$, $p = .03$. Additionally, there was significant heterogeneity of effect sizes, $Q(7) = 23.08$, $p = .002$.

Meta-analysis of the two-way interaction between attitudes and ambivalence on strength outcomes at high levels of knowledge



Study 1 Complete Attitudes X Ambivalence X Knowledge on Outcome Model

	<i>b</i>	<i>t</i>	<i>p</i>	95% CI
Attitude	.15	3.18	.002	[.06, .24]
Ambivalence	.02	.57	.57	[-.05, .08]
Knowledge	-.06	-.99	.32	[-.17, .06]
Attitude X Ambivalence	-.01	-1.00	.32	[-.04, .01]
Ambivalence X Knowledge	.01	.50	.62	[-.03, .05]
Attitude X Knowledge	-.01	-.29	.77	[-.09, .07]
Attitude x Ambivalence x Knowledge	-.03	-2.55	.01	[-.05, -.01]

Study 1 Means, Standard Deviations and Covariances

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	
1. Attitudes	5.67	1.95	3.79							
2. Subjective Ambivalence	5.37	2.43	-0.70	5.89						
3. Knowledge	2.70	1.39	-0.04	-0.22	1.94					
4. Attitude X Ambivalence			-6.17	-0.34	0.20	39.18				
5. Ambivalence X Knowledge			0.20	1.00	-0.68	1.26	13.73			
6. Attitude X Knowledge			0.49	0.20	-0.20	-0.88	-2.25	8.48		
7. Attitude x Ambivalence x Knowledge			-0.86	1.41	-2.24	2.94	3.01	-20.67	101.61	
8. Attraction	4.36	.99	0.65	-0.01	-0.06	-1.52	0.16	0.56	-2.62	0.98

Study 2 Complete Attitudes X Ambivalence X Knowledge on Outcome Model

	<i>b</i>	<i>t</i>	<i>p</i>	95% CI
Attitude	.67	19.90	<.001	[.61, .74]
Ambivalence	-.04	-.93	.35	[-.11, .04]
Knowledge	-.07	-1.62	.11	[-.15, .01]
Attitude X Ambivalence	-.12	-3.23	.001	[-.19, -.05]
Ambivalence X Knowledge	-.03	-.77	.44	[-.12, .05]
Attitude X Knowledge	-.05	-1.21	.23	[-.13, .03]
Attitude x Ambivalence x Knowledge	-.07	-1.82	.07	[-.15, .01]

Study 2 Means, Standard Deviations, and Covariances

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8
1. Attitudes	3.28	1.10	1.20							
2. Subjective Ambivalence	2.02	.87	-0.08	0.76						
3. Knowledge	2.47	.80	-0.06	-0.02	0.64					
4. Attitude X Ambivalence			-0.44	-0.10	0.07	1.05				
5. Ambivalence X Knowledge			0.07	0.04	-0.04	-0.02	0.56			
6. Attitude X Knowledge			0.24	0.07	-0.05	-0.15	-0.02	0.92		
7. Attitude x Ambivalence x Knowledge			-0.15	-0.02	-0.02	0.26	-0.12	-0.42	0.90	
8. Biofuel purchase likelihood	3.36	1.44	0.86	-0.07	-0.08	-0.43	0.04	0.17	-0.17	2.06

Study 3 Complete Attitudes X Ambivalence X Knowledge on Outcome Model

	<i>b</i>	<i>t</i>	<i>p</i>	95% CI
Attitude	.36	17.59	<.001	[.32, .40]
Ambivalence	-.01	-.21	.83	[-.09, .07]
Knowledge	.07	1.49	.14	[.14, -.02]
Attitude X Ambivalence	-.05	-2.36	.02	[-.10, -.01]
Ambivalence X Knowledge	.01	.14	.89	[-.08, .09]
Attitude X Knowledge	.01	.36	.72	[-.04, .06]
Attitude x Ambivalence x Knowledge	-.09	-3.67	.0003	[-.15, -.04]

Study 3 Means, Standard Deviations, and Covariances

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8
1. Attitudes	5.03	1.96	3.86							
2. Subjective Ambivalence	2.03	1.01	-0.68	1.01						
3. Knowledge	3.09	.83	0.18	-0.21	0.70					
4. Attitude X Ambivalence			-1.04	-0.24	-0.04	2.95				
5. Ambivalence X Knowledge			-0.04	0.04	-0.08	0.22	0.74			
6. Attitude X Knowledge			0.71	-0.04	0.05	-0.76	-0.45	2.91		
7. Attitude x Ambivalence x Knowledge			-0.88	0.36	-0.49	0.71	0.01	-1.23	2.76	
8. Voting Intentions	3.21	1.12	1.55	-0.29	0.16	-0.60	-0.03	0.44	-0.67	1.24

Study 4 Complete Attitudes X Ambivalence X Knowledge on Outcome Model

	<i>b</i>	<i>t</i>	<i>p</i>	95% CI
Attitude	.33	15.28	<.001	[.29, .38]
Ambivalence	.01	.46	.65	[-.03, .04]
Knowledge	.07	3.53	<.001	[.03, .10]
Attitude X Ambivalence	.01	.36	.72	[-.02, .04]
Ambivalence X Knowledge	-.004	-.30	.77	[-.03, .02]
Attitude X Knowledge	-.02	-1.41	.16	[-.06, .01]
Attitude x Ambivalence x Knowledge	-.02	-1.74	.08	[-.04, .002]

Study 4 Means, Standard Deviations, and Covariances

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8
1. Attitudes	3.85	1.46	2.12							
2. Subjective Ambivalence	3.14	1.44	0.32	2.08						
3. Knowledge	4.86	1.42	-0.03	-0.27	2.03					
4. Attitude X Ambivalence			-1.72	-0.34	0.31	4.33				
5. Ambivalence X Knowledge			0.31	0.08	-0.18	-0.33	4.42			
6. Attitude X Knowledge			0.74	0.31	-0.04	-1.03	0.84	4.45		
7. Attitude x Ambivalence x Knowledge			-1.04	-0.42	0.85	1.52	-1.23	-4.88	11.46	
8. Self-report of alcohol consumption	1.96	.72	0.70	0.10	0.11	-0.54	0.08	0.22	-0.38	0.52

Study 5 Complete Attitudes X Ambivalence X Knowledge on Outcome Model

	<i>b</i>	<i>t</i>	<i>p</i>	95% CI
Attitude	.29	4.39	<.001	[.16, .42]
Ambivalence	-.04	-.48	.63	[-.19, .11]
Knowledge	.06	1.26	.21	[-.04, .17]
Attitude X Ambivalence	-.14	-2.18	.03	[-.27, -.01]
Ambivalence X Knowledge	-.02	-.32	.75	[-.11, .08]
Attitude X Knowledge	-.03	-.92	.36	[-.11, .04]
Attitude x Ambivalence x Knowledge	.01	.29	.77	[-.06, .09]

Study 5 Means, Standard Deviations, and Covariances

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8
1. Attitudes	5.35	1.33	1.78							
2. Subjective Ambivalence	2.88	1.21	-0.46	1.46						
3. Knowledge	3.57	1.66	0.71	-0.61	2.76					
4. Attitude X Ambivalence			-0.03	0.22	-0.24	2.15				
5. Ambivalence X Knowledge			-0.24	0.29	-0.76	1.39	3.88			
6. Attitude X Knowledge			0.29	-0.24	-0.11	-1.28	-0.76	4.95		
7. Attitude x Ambivalence x Knowledge			-1.61	1.67	-1.19	1.19	2.19	-1.33	7.45	
8. Self-report of organic food purchase	2.17	.90	0.56	-0.24	0.44	-0.29	-0.33	0.09	-0.68	0.80

Study 6 Complete Attitudes X Ambivalence X Knowledge on Outcome Model

	<i>b</i>	<i>t</i>	<i>p</i>	95% CI
Attitude	.61	9.77	<.001	[.49, .74]
Ambivalence	-.04	-.62	.54	[-.15, .08]
Knowledge	.08	1.20	.23	[-.05, .22]
Attitude X Ambivalence	-.04	-1.48	.14	[-.10, .01]
Ambivalence X Knowledge	.03	1.02	.31	[-.03, .09]
Attitude X Knowledge	-.01	-.46	.65	[-.08, .05]
Attitude x Ambivalence x Knowledge	-.01	-.96	.34	[-.04, .01]

Study 6 Means, Standard Deviations, and Covariances

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8
1. Attitudes	6.06	2.54	6.43							
2. Subjective Ambivalence	3.53	2.31	-1.14	5.33						
3. Knowledge	5.99	1.97	1.27	-0.87	3.90					
4. Attitude X Ambivalence			-7.62	0.26	-1.97	30.44				
5. Ambivalence X Knowledge			-1.97	0.17	-1.39	6.37	21.89			
6. Attitude X Knowledge			1.09	-1.97	-0.22	-1.13	0.63	31.41		
7. Attitude x Ambivalence x Knowledge			-2.57	7.36	-0.47	5.29	2.69	-51.15	169.06	
8. Plastic Bag Ban Advocacy Willingness	4.35	2.57	4.39	-1.05	1.19	-6.01	-1.01	1.02	-3.59	6.59

Study 7 Complete Attitudes X Ambivalence X Knowledge on Outcome Model

	<i>b</i>	<i>t</i>	<i>p</i>	95% CI
Attitude	.99	17.00	<.001	[.88, 1.11]
Ambivalence	-.00	-.06	.95	[-.11, .11]
Knowledge	.01	.18	.86	[-.10, .12]
Attitude X Ambivalence	.07	2.56	.01	[.02, .13]
Ambivalence X Knowledge	-.01	-.45	.65	[-.05, .03]
Attitude X Knowledge	-.03	-1.15	.25	[-.07, .02]
Attitude x Ambivalence x Knowledge	-.01	-.84	.40	[-.02, .01]

Study 7 Means, Standard Deviations, and Covariances

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8
1. Attitudes	4.83	2.40	5.75							
2. Subjective Ambivalence	3.95	2.16	1.22	4.67						
3. Knowledge	4.76	2.26	-0.07	-1.55	5.11					
4. Attitude X Ambivalence			-7.56	-0.32	3.13	32.95				
5. Ambivalence X Knowledge			3.13	2.64	-0.84	3.30	31.31			
6. Attitude X Knowledge			6.61	3.13	-0.48	-13.47	12.96	38.47		
7. Attitude x Ambivalence x Knowledge			-13.56	1.42	13.07	66.74	6.34	-53.07	325.11	
8. Will to work with Bob	4.82	2.59	5.06	1.04	0.13	-5.28	2.63	4.83	-9.60	6.65

Study 8 Complete Attitudes X Ambivalence X Knowledge on Outcome Model

	<i>b</i>	<i>t</i>	<i>p</i>	95% CI
Attitude	.61	5.35	<.001	[.39, .84]
Ambivalence	.03	.39	.70	[-.14, .20]
Knowledge	-.05	-.54	.59	[-.25, .14]
Attitude X Ambivalence	-.11	-1.92	.06	[-.23, .00]
Ambivalence X Knowledge	.05	.93	.36	[-.05, .14]
Attitude X Knowledge	.05	.64	.52	[-.09, .18]
Attitude x Ambivalence x Knowledge	.04	1.28	.21	[-.02, .11]

Study 8 Means, Standard Deviations, and Covariances

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8
1. Attitudes	6.45	1.52	2.30							
2. Subjective Ambivalence	4.37	1.98	-1.65	3.90						
3. Knowledge	4.58	1.70	0.34	-0.78	2.87					
4. Attitude X Ambivalence			-1.07	1.19	-0.10	7.12				
5. Ambivalence X Knowledge			-0.11	0.08	-0.08	1.58	10.88			
6. Attitude X Knowledge			0.29	-0.11	0.20	-2.48	-4.41	6.61		
7. Attitude x Ambivalence x Knowledge			-3.02	2.84	-4.67	3.64	3.65	-5.30	29.98	
8. Will to work with Bob	6.59	1.65	1.34	-0.85	-0.16	-1.27	0.23	0.30	-0.69	2.73

Perceived Knowledge x Structural Ambivalence on Attitude-Outcome Relations in Studies 3 and 4

We also examined whether perceived knowledge might interact with structural ambivalence to predict attitude-outcome consistency in Studies 3 and 4, the two studies that contained a measure of structural ambivalence. As such, we conducted the exact analyses reported in the text for each study, but replaced subjective ambivalence with the index of structural ambivalence. First, to replicate previous research, we regressed the outcome in each study on centered attitudes, structural ambivalence, and their interaction. Replicating previous research, in Study 3, there was a significant interaction, $b = -.03$, $t(499) = -2.36$, $p = .02$, 95% CI $[-.05, -.004]$, $r = -.11$. However, in Study 4, this interaction was not significant, $b = -.00$, $t(436) = -.10$, $p = .92$, 95% CI $[-.02, .02]$, $r = .00$.

Using the measure of structural ambivalence, the Attitude x Knowledge x Ambivalence interaction was directionally consistent but weaker in Study 3, $b = -.02$, $t(495) = -1.61$, $p = .11$, 95% CI $[-.05, .005]$, $r = -.07$, and Study 4, $b = -.01$, $t(430) = -1.87$, $p = .06$, 95% CI $[-.03, .0006]$, $r = -.09$. We again broke down the three-way pattern by examining the Attitude x Ambivalence interaction at relatively high and low levels of perceived knowledge. At low levels of knowledge (-1SD), there was not a significant Attitude x Ambivalence interaction in Study 3, $b = -.005$, $t(495) = -.30$, $p = .76$, 95% CI $[-.04, .03]$, $r = -.01$, or Study 4, $b = .01$, $t(430) = 1.01$, $p = .31$, 95% CI $[-.01, .04]$, $r = .05$. Attitudes were about equally predictive of behavior at high (+1SD), $b = .32$, $t(495) = 6.91$, $p < .001$, 95% CI $[.23, .41]$, $r = .30$ (Study 3); $b = .39$, $t(490) = 7.18$, $p < .001$, 95% CI $[.28, .49]$, $r = .33$ (Study 4), and low levels of ambivalence (-1SD), $b = .34$, $t(495) = 8.92$, $p < .001$, 95% CI $[.26, .41]$, $r = .37$ (Study 3); $b = .33$, $t(490) = 11.33$, $p < .001$, 95% CI $[.28, .39]$, $r = .48$ (Study 4).

At higher levels of knowledge (+1SD), however, there was a significant Attitude x Ambivalence interaction in Study 3, $b = -.04$, $t(495) = -2.32$, $p = .02$, 95% CI $[-.08, -.01]$, $r = -.10$, and a marginal interaction in Study 4, $b = -.02$, $t(430) = -1.66$, $p = .10$, 95% CI $[-.05, .00]$, $r = -.08$. Ambivalent attitudes (+1SD), $b = .34$, $t(495) = 6.16$, $p < .001$, 95% CI $[.23, .45]$, $r = .27$ (Study 3); $b = .24$, $t(430) = 4.92$, $p < .001$, 95% CI $[.14, .34]$, $r = .23$ (Study 4), were less predictive of behavior than relatively univalent attitudes (-1SD), $b = .50$, $t(495) = 16.32$, $p < .001$, 95% CI $[.44, .56]$, $r = .59$ (Study 3); $b = .32$, $t(430) = 13.00$, $p < .001$, 95% CI $[.27, .36]$, $r = .53$ (Study 4).

Finally, we conducted a meta-analysis of these two studies to examine the Attitude X Structural Ambivalence X Perceived Knowledge interaction across all of the data available to us. This analysis provided meta-analytic support for the three-way interaction, $r = -.08$, $z = -2.46$, $p = .01$, 95% CI $[-.14, -.02]$, with no heterogeneity of effect sizes, $Q(1) = .07$, $p = .79$. Meta-analytically, there was not support for an Attitude X Structural Ambivalence interaction at low levels of perceived knowledge, $r = .02$, $z = .47$, $p = .64$, 95% CI $[-.05, .08]$, with no heterogeneity of effect sizes, $Q(1) = .89$, $p = .35$. Conversely, there was support for an Attitude X Structural Ambivalence interaction at high levels of perceived knowledge, $r = -.09$, $z = -2.84$, $p = .005$, 95% CI $[-.16, -.03]$, with no heterogeneity of effect sizes, $Q(1) = .13$, $p = .72$.

Interactive effects of Certainty and Knowledge, as well as Certainty and Subjective Ambivalence in Study 3

In an analysis in which we did not control for perceived knowledge, there was a marginal Attitudes \times Subjective Ambivalence \times Certainty interaction, $b = -.05$, $t(495) = -1.73$, $p = .08$, $r = -.08$. At lower levels of certainty (-1 SD), there was no Attitude \times Subjective Ambivalence interaction, $b = -.01$, $t(495) = -.32$, $p = .75$, $r = -.01$. At higher levels of certainty (+1 SD), there was a significant Attitude \times Subjective Ambivalence interaction: $b = -.09$, $t(495) = -2.84$, $p = .005$, $r = -.13$.

Similarly, in an analysis in which we did not control for subjective ambivalence, there was a significant Attitude \times Knowledge \times Certainty interaction without controlling for subjective ambivalence or its interactions, $b = .09$, $t(484) = 3.11$, $p = .002$, $r = .14$. This reflected that at low levels of certainty, $b = -.08$, $t(484) = -1.81$, $p = .07$, $r = .08$, there was a marginal interaction reflecting increased attitude impact under low levels of perceived knowledge, consistent with a bolstering pattern. Conversely, at high levels of certainty, the traditional strength Attitude \times Knowledge interaction emerged, $b = .08$, $t(484) = 2.82$, $p = .005$, $r = .13$.