Truth or Truthiness? How Desires Influence Truth Associations

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Abstract

What people want to happen and what actually happens often differs. How do people resolve this discrepancy between desires and reality within memory? One possibility is that they don't. I argue that truth evaluations arise from automatic processes that produce associations with truth and controlled processes that compare the validity of different beliefs. Further, I contend that desires shape associations with the truth. In Studies 1-3 I use real-world events to demonstrate that desires are related to truth associations, even when those desires do not reflect reality. Study 4 examines how desires causally impact truth associations and Study 5 examines how desires and knowledge about an outcome interact in influencing truth associations. Studies 2, 3, and 5 also explore how truth associations mediate the effects of desires on expectations and beliefs about events. I find that desires influence associations with the truth and that truth associations mediate the impact of desires on beliefs about events.

Keywords: implicit social cognition, implicit measures, Implicit Association Test, attitudes, truth associations, aIAT, desires

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When I was eight years old, I almost drowned in a wave pool. It was a wet hot Canadian summer afternoon, and I had been fighting with my brother for all day. This feuding culminated with him pushing me into the deep end of the pool. My right leg immediately seized into a cramp and rendered me unable to swim to the surface. I blacked out soon after and woke up to a lifeguard resuscitating me. This experience served as a justification and a rallying cry for why my brother was a horrible person for many years after.

I told this story to my brother two years ago, and he disagreed. He said it never happened! I went to my mother, my father, my aunt and my cousins. None of them had any recollection of the event. I resigned myself to being the victim of bad memory, but yet, the memory felt as familiar and vivid as it had ever been. I *wanted* this memory to be true, even though I *knew* it wasn't.

This discrepancy between what we *feel* to be true and what we explicitly *know* to be true is the subject of this dissertation. I propose that truth associations[1] arise from automatic processes that create feelings of truth in response to activated knowledge and controlled processes that compare the validity of competing units of knowledge. In particular, I hypothesize that desires automatically influence truth associations. In five studies, I investigated how people respond to false information as if it were true, how automatic and controlled processes influence truth associations, and how desires shape truth associations.

People Respond to False Information as if it were True

[1] In this manuscript, 'associations' refer to a theory-uncommitted conception of association, which refers to the contiguity or similarity of two or more concepts without a pre-specified theory of the underlying mental processes at play (Greenwald, Nosek, Banaji, & Klauer, 2005).

There is ample evidence demonstrating that people respond to false information as if it were true. In some cases, people will even remember false memories as if they were true ones. This phenomenon has been best demonstrated by work on false memories by Loftus and colleagues (e.g., Bernstein, Laney, Morris, & Loftus, 2005; Loftus, 2003). In one of the most provocative studies of this research program, Loftus and Pickrell (1995) instructed participants to read about childhood memories they had experienced and write about each of them. All of the childhood memories were true except for one: a story where the participant gets lost in the shopping mall, starts crying, and is found by an elderly woman who reunites them with their family. Weeks later, 25% of participants falsely remember this fabricated memory to be a true memory.

What are the factors that increase the likelihood of false memories? One mechanism is the similarity of the false memory to true memories (Lyle & Johnson, 2006). Another mechanism is imagination inflation – imagining or mentally simulating an event increases the chance that people will falsely remember it as a true event later (e.g., Garry, Manning, Loftus, & Sherman, 1996; Thomas, Bulevich, & Loftus, 2003). For example, thinking about a nurse removing a skin sample from your finger as a child increases the likelihood that you will falsely remember that as a true event later.

Even if people explicitly regard information as false, that may still respond to information as if it were true (e.g., Anderson, 1983; Carroll, 1978; Holmes & Mathews, 2005; Radford & Weston, 1975). Merely considering false information can change how people behave. For example, imagining consuming cheese cubes decreases actual consumption of cheese cubes shortly afterward (Morewedge et al., 2010) and imagining touching a product increases perceived ownership and valuation of a product (Peck & Shu, 2009).

In the intergroup domain, people may disbelieve stereotypes about other groups but still express those stereotypes automatically in judgment and behavior (Devine, 1989). These automatic stereotypes are pervasive and widespread (Nosek et al., 2007) and predict behavior above and beyond self-reported beliefs (Greenwald, Banaji, & Nosek, in press; Greenwald, Poehlman, Uhlmann, & Banaji, 2009; Oswald, Mitchell, Blanton, Jaccard, & Tetlock, 2013). Stereotypes that counter conscious beliefs and values have been linked to police officers' tendency to accidentally shoot innocent Black people (Correll, Park, Judd, & Wittenbrink, 2002), science professors' judgments of male and female applicants in hiring (Moss-Racusin, Dovidio, Brescoll, Graham, & Handelsman, 2012), and even judgments about whether Black defendants are worthy of the death penalty (Eberhardt, Davies, Purdie-Vaughns, & Johnson, 2006). Even if conscious values and beliefs say otherwise, knowledge of cultural stereotypes that one believes to be false can be expressed automatically and unconsciously.

Dual Process Perspectives on Evaluations of Truth

A distinction between implicit and explicit evaluations of truth is source monitoring: processes that produce attributions about the origin of memories, knowledge, or beliefs (Johnson, 1988a; 1988b). Source monitoring is important for verifying the validity of thoughts. For instance, a memory may be believed to be false if a memory is attributed to daydreaming or desires rather than the actual event. Whereas direct memory tests (e.g., recall, recognition) produce robust evidence of source monitoring, indirect memory tests (e.g., priming) provide weak evidence that source monitoring occurs. The direct retrieval of memories requires some consideration of the source of memories, whereas indirect evaluations of memories only require that an association be active in thought (Johnson, Hashtroudi, & Lindsay, 1993). This dissociation also points to the existence of heuristic and systematic processes for source

monitoring. Heuristic cues like familiarity, fluency, and perceptual vividness are incorporated into implicit evaluations of truth, but systematic processes such as the determination of how plausible a memory is are not (Johnson, 2006).

According to recent models of evaluation, evaluations of a memory's validity arise from controlled cognitive processes. In the Associative-Propositional Evaluation (APE) Model (Gawronski & Bodenhausen, 2006; 2011), the central distinction between associative (implicit) and propositional (explicit) processes is cognitive consistency. Propositional processes create evaluations by resolving inconsistencies between activated associations, whereas associative processes do not. From the perspective of the APE model, resolution of inconsistency is a primary driver for verifying the veracity of a thought. This point is made strongly in a study of cognitive dissonance by Gawronski and Strack (2004), in which participants write a counter-attitudinal essay. As predicted by dissonance theory (Festinger & Carlsmith, 1959), writing a counter-attitudinal essay produced explicit attitude change in a direction counter to the pre-existing attitude. However, implicit attitudes that remained unchanged. From this perspective, resolving cognitive dissonance is an explicit phenomenon, not an implicit one (cf. Greenwald, Banaji, et al., 2002 for an alternate view of cognitive consistency in implicit cognition).

Similar to the APE Model, the Meta-Cognitive Model (MCM; Petty, Briñol, & DeMarree, 2007), distinguishes between implicit and explicit evaluations through validity tags that represent the degree of confidence that an individual has in an activated association. Unlike the APE Model, the MCM suggests that the validity of an association can be directly inferred from factors other than cognitive consistency. These factors include fluency and ease of retrieval, the content of the evaluation, thought confidence, and evaluation strength. The MCM implies that automatic feelings of "fit" can influence the perceived validity of an association.

Most recently, Huntsinger, Isbell, and Clore (in press) described the role of affective reactions of truth associations. From this view, positive affect confers confidence and negative affect fosters doubt in accessible mental content. This theory implies that the verification of thoughts can be automatic. In one study, Huntsinger and colleagues (2010) found that mood can moderate the impact of counter-stereotypic thoughts on automatic stereotyping. Typically, considering counter-stereotypic thoughts reduces automatic stereotyping. However, counter-stereotypic thoughts effects change when combined with mood. People with positive mood show *decreases* in automatic stereotyping as expected, but people with negative mood show *increases* in automatic stereotyping. Conceptually, positive mood is validating counter-stereotypic thoughts active in memory, and negative mood is invalidating those thoughts. These effects suggest that evaluations of truth can occur automatically without the input of consistency processes.

Are evaluations of the truth automatic or controlled? The literature from social and cognitive psychology suggests that the answer is both. Johnson's (2006) source-monitoring framework, the MCM, and Huntsinger and colleagues (in press) describe evidence for heuristic cues like familiarity, fluency, and mood for the validation of thoughts. The source-monitoring framework, MCM, and APE model also describe deliberative processes that examine the validity of thoughts in the context of other information (e.g., by resolving cognitive inconsistencies).

Desires and Truth Associations

What we associated with the truth may not be a direct reflection of what we know to be true. In this section, I explore three plausible accounts for how could desires influence associations with the truth: positive illusions, familiarity, and mental rehearsal.

In the 2005 premiere episode of the *Colbert Report*, Stephen Colbert coined a phenomenon called truthiness - "a truth that comes from the gut, not books" (Colbert, 2005). This term gained widespread appeal and became Merriam-Webster Dictionary's 2006 Word of the Year where it was defined as "the quality of preferring concepts or facts one wishes to be true, rather than concepts of facts known to be true". In a similar vein, desires and truth associations could be intrinsically linked. People are motivated to hold positive illusions for the self and related others (Taylor & Brown, 1988), and relationships between desires and truth associations may reflect a general tendency to see the world as one wishes it to be rather than how it actually is. The extent to which an attitude object is liked could inform feelings of the truth for desired outcomes and that could lead to increased truth associations of desired outcomes in turn.

Familiarity may also explain a relationship between desires and truth associations. What is liked is more familiar. In one study (Garcia-Marques, Mackie, Claypool, & Garcia-Marques, 2000), participants were exposed to 12 smiling faces and 12 neutral faces. After a filler task, participants were asked to judge whether 48 faces were "old" or "new". 24 of the faces were seen in the first phase, and 12 faces were novel and smiling, and 12 faces were novel and neutral. There was no difference in recognition rates between smiling and neutral faces that were originally seen in the first phase.[2] However, novel smiling faces were erroneously more likely to be judged as "old" than novel neutral faces. This study suggests that positivity breeds familiarity. Relatedly, what is familiar is also more true. In a study by Arkes and colleagues (1989), participants rated the truth/falsity of 108 statements (e.g., "More presidents of the U. S. were

[2] This suggests that the relationship between desires and truth associations may be eliminated when participants learn the outcome of an event. I explore this possibility later in the dissertation.

born in Virginia than any other state.", "The planet Venus is larger than the planet Earth."). Then, they came back a week later to evaluate a second list of 108 statements, one-third of which were statements from the first session. Statements from the first session were rated as truer than statements from the second session, suggesting that familiarity bred feelings of truth. Taken together, desires for an outcome may breed familiarity with that outcome, and that familiarity may breed associations with the truth in turn.

Finally, people may mentally rehearse desired outcomes before finding out what happens. They could develop positive expectations for obtaining the desired outcome, imagine how great obtaining it may be, and consider the benefits of obtaining it (Loewenstein, 1987).[3] As automatic associations may not discriminate between internally generated thoughts and externally experienced events (Johnson & Raye, 1981), mental rehearsal could influence truth associations before an event occurs, and maintain influence of truth associations even after the outcome is explicitly known. In other words, practicing a desire could create truth associations before an event happens.

After an event, what is mentally rehearsed depends on whether the desired outcome was obtained. For people who had their desires confirmed, further rehearsal will tend to be positive reflections of the outcome. In contrast, people who have their desires dashed may dwell on actual outcomes and counterfactuals about how things could have happened differently (Roese, 1997). Considering counterfactuals may simultaneously reinforce truth associations of actual and unobserved outcomes through mental rehearsal. Reflections of the actual outcome may influence

[3] Although people may also consider undesired outcomes, confirmation bias suggests that they are less likely to do so (Wason, 1960).

self-reported memories and truth associations alike, but reflections of unobserved outcomes may only impact truth associations.

Measures of Truth Associations

To assess explicit evaluations of the truth, I asked participants about their beliefs of what outcome of an event was, along with their confidence in that knowledge. To assess truth associations, I primarily used a variant of the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998) known as the autobiographical Implicit Association Test (aIAT; Sartori, Agosta, Zogmaister, Ferrara, & Castiello, 2008). The aIAT was proposed as a tool to detect which of two possible events is true for a person's past experiences. Specifically, it was developed with the intent of detecting knowledge that is concealed; knowledge that people may know but are motivated to respond as if they did not. Initial studies with this tool have examined its validity as a lie-detector in predicting whether individuals have engaged in mock crimes, illegal drug use, and even murder (Sartori et al., 2008). A review of the literature on the aIAT finds it is over 90% accurate in detecting what an individual believes to be true (Agosta & Sartori, 2013).

Overview of Studies

In Study 1, I found initial evidence demonstrating that truth associations are related to but distinct from attitudes and knowledge about events. Studies 2 and 3 established the reliability of this effect across different samples and topics and examined potential moderators for the attitude-truth association relationship. Study 4 examines the causal impact of knowledge about an event on truth associations, and Study 5 experimentally investigates the relative contribution of attitudes and knowledge on truth associations.

Study 1 – The Super Bowl

The purpose of Study 1 was to assess whether that truth associations are related to but distinct from attitudes and beliefs. To examine this, I conducted a study in the days surrounding the 2014 Super Bowl between the Denver Broncos and the Seattle Seahawks. I hypothesized that Broncos and Seahawks fans alike would show truth associations that are reflective of their desires before the Super Bowl. After the Super Bowl where the Seattle Seahawks beat the Denver Broncos 43 to 8, I hypothesized that truth associations would be related to both desires and beliefs about what happened. Specifically, I predicted that Seahawks and Broncos fans alike would exhibit truth associations aligned with reality, but that that Seahawks fans's truth associations would show greater alignment with reality than Broncos fans' truth associations.

Method

Participants

The Super Bowl was on February 2, 2014, and I collected participants from January 31, 2014 to February 11, 2014. 360 participants from the Project Implicit (http://implicit.harvard.edu) participant pool and volunteers from online forums and social media started the study and completed through the aIAT. Of these, 12 (3.3%) participants met the IAT exclusion criteria and were excluded from analyses for a final sample of 348 participants.

Procedure

Volunteers registered for the Project Implicit participant pool and were randomly assigned to this study from a pool of a dozen or more studies. Once assigned, participants could

not be assigned to the same study again. Following informed consent, participants completed an autobiographical Implicit Association Test (aIAT) assessing truth associations with "Denver Broncos won the Super Bowl" relative to "Seattle Seahawks won the Super Bowl". Then, participants completed questionnaires assessing football team attitudes, interest in football, and football knowledge. Participants who took the study before the Super Bowl were asked about their expectations for who would win the Super Bowl, and participants who took the study after the Super Bowl were asked about who they thought won the Super Bowl. Finally, participants were debriefed.[4]

Measures

Truth associations. The aIAT assesses the relative strength of associations between two events (i.e., Seahawks won the Super Bowl, Broncos won the Super Bowl) and true/false. Participants were instructed to categorize word phrases and images as quickly as possible while also being accurate. The aIAT was composed of seven blocks, with three practice blocks (omitted for analyses) and four critical blocks. The design followed the procedural recommendations from Nosek, Greenwald, and Banaji (2005).

- In the first practice block (20 trials), participants categorize sentences referring to 'Seahawks won the Super Bowl' or 'Broncos won the Super Bowl' to categories labeled on the upper left and upper right of the screen using the "e" key for the category on the left and the "i" key for the category on the right.

[4] Immediately before the debriefing, participants were given the option to consent to being contacted for a follow-up session where they would take the aIAT again along with questions assessing knowledge of who won the Super Bowl. Due to implementation issues, only 9 participants came back for a follow-up session. Data from the follow-up session were not analyzed.

- In the second practice block (20 trials), participants categorize true and false sentences using the same two keys and corresponding labels on the top left and right.
- In the third (20 trials) and fourth (40 trials) critical blocks, participants categorize sentences of the two events and true/false sentences on alternating trials. Specifically, participants categorize ‘Seahawks won the Super Bowl’ sentences and true sentences with one key and ‘Broncos won the Super Bowl’ sentences and false sentences with the other key.
- In the fifth practice block (40 trials), participants categorize sentences of ‘Seahawks won the Super Bowl’ and ‘Broncos won the Super Bowl’ again, except the two event categories have switched sides. The event category originally on the left is now categorized with the right key, and the event category originally on the right is now categorized with the left key.
- In the sixth (20 trials) and seventh (40 trials) critical blocks, participants categorize pairings opposite to the ones in the third and fourth blocks. Consequently, participants categorize ‘Seahawks won the Super Bowl’ sentences and false sentences with one key and ‘Broncos won the Super Bowl’ and false sentences with the other key. The sixth and seventh blocks were counterbalanced with the third and fourth blocks between participants to control for potential order effects (Greenwald et al., 1998).

The IAT was scored with the *D* algorithm recommended by Greenwald et al. (2003), with higher scores indicating faster responses when ‘Seahawks won the Super Bowl’ was paired with true sentences and the ‘Broncos won the Super Bowl’ was paired with false sentences compared to the reverse. *D* was calculated after removing response latencies under 400 ms or over 10000 ms. Participants were excluded from all analyses if more than 10% of the critical response trials were

faster than 300 ms, the error rate on any critical block was higher than 40%, or the overall error rate across all combined response blocks was over 30% (Nosek et al., 2007). See Appendix A for a description of how truth associations were measured in each study.

Attitudes. Participants completed two self-report items measuring attitudes for the Seahawks compared to the Broncos that were averaged together for analysis. One item assessed relative preference for the Seahawks compared to the Broncos on a seven-point scale from "I strongly prefer the Seattle Seahawks to the Denver Broncos" to "I strongly prefer the Denver Broncos to the Seattle Seahawks." The other item asked "In a game between the Seattle Seahawks and the Denver Broncos, which of the following best reflects your feelings?" with response options on a seven-point scale from "I would be much happier if the Seattle Seahawks won" to "I would be much happier if the Denver Broncos won".

Self-reported identification. I assessed fan identification with a team with three items. One item asked "What is your favorite football team?" with a list of all teams in the NFL. The other two questions asked "How strong of a fan are you of the [Seattle Seahawks/Denver Broncos]?" with a five-point scale from "I am a strong fan of the [Seattle Seahawks/Denver Broncos]" to "I would not call myself a fan of the [Seattle Seahawks/Denver Broncos]". As relatively few participants identified with being a fan of either team (8.9%), I did not use this measure in the reported analyses.

Expectations about who will win the Super Bowl. Before the Super Bowl, participants were asked "Who do you think will win this year's Super Bowl?" with response options on a seven-point scale from "Definitely the Denver Broncos" to "Definitely the Seattle Seahawks". This question was supposed to be removed immediately after the Super Bowl on February 2, but this

was administered until February 5 due to a technical error. Data from this question after February 2 was not used for analyses.

Beliefs about who won the Super Bowl. After the Super Bowl, participants were asked "Who do you think won this year's Super Bowl?" with response options on a seven-point scale from "Definitely the Denver Broncos" to "Definitely the Seattle Seahawks". Less than 40% of the post-Super Bowl participants received this question, as the question was not presented until February 5 due to a technical error.

Self-perceived and actual NFL knowledge. Participants were asked two items assessing self-perceived NFL knowledge and six items assessing actual knowledge of the Super Bowl teams (i.e., Seahawks and Broncos). The two items were "How closely do you follow the National Football League (NFL)?" and "How knowledgeable are you about the National Football League (NFL)?" Responses were given on a six-point scale from "Extremely [closely/knowledgeable]" to "Not at all [closely/knowledgeable]." These two items were averaged together for analysis. The questionnaire assessing actual knowledge were six multiple choice questions asking who the coaches, starting running backs, and starting quarterbacks of the two Super Bowl teams were.

Results and Discussion

To examine how truth associations are related to attitudes, beliefs, and expectations, I conducted bivariate and partial correlations (See Tables 1a and 1b for bivariate correlations). Before the Super Bowl, attitudes were uniquely related to truth associations after controlling for expectations, $r(44) = .31$, $p = .032$, but expectations did not uniquely predict truth associations after controlling for attitudes, $r(44) = .14$, $p = .32$. After the Super Bowl, attitudes were also uniquely related to truth associations controlling for beliefs about who won the Super Bowl,

$r_s(95) = .30$, $p = .002$.[5] However, beliefs did not uniquely predict truth associations after controlling for attitudes, $r_s(95) = .09$, $p = .35$.[6]

Table 1a

Correlation Matrix of Pre-Super Bowl Outcomes

		1	2	3	4	5
1	Truth associations					
2	Attitude	.47**				
3	Perceived NFL knowledge	.22	.05			
4	Actual NFL knowledge	.21	.10	.79***		
5	Expectations for outcome	.36**	.64***	-.20	-.21	

Table 1b

Correlation Matrix of Post-Super Bowl Outcomes

		1	2	3	4	5
1	Truth associations					
2	Attitude	.23**				
3	Perceived NFL knowledge	.01	-.09			
4	Actual NFL knowledge	.14*	-.02	.75***		
5	Belief about outcome	.19	.08	.38***	.40***	

An alternative approach to operationalizing beliefs about the outcome when the majority of participants know who won the Super Bowl is to compare participants before and after the Super Bowl happened (Table 2). Descriptively, pre-Super Bowl participants did not differ from post-Super Bowl participants on attitudes, $t(285) = 1.52$, $p = .13$, $d = .18$, 95% CI [-.05, .41],

[5] Only 15 out of 107 (17.8%) participants reported they didn't know who won or thought the Broncos won the Super Bowl. Due to the non-normality of the distribution, I conducted Spearman's rank-order correlations instead of Pearson correlations.

[6] In Study 2, I included perceived and actual knowledge as covariates in all partial correlation analyses. For consistency, I conducted partial correlations with these additional covariates in this study as well. Expectations and beliefs about the outcome were still not uniquely related to truth associations, *p*s = .16, .16. Attitudes were no longer uniquely related to truth associations before the Super Bowl after controlling for expectations, perceived knowledge, and actual knowledge, $r(40) = .25$, $p = .092$, but attitudes were still uniquely related to truth associations after the Super Bowl when controlling for beliefs about the outcome, perceived knowledge, and actual knowledge, $r(90) = .22$, $p = .027$.

perceived knowledge, $t(303) = -.14$, $p = .89$, $d = -.02$, 95% CI [-.24, .21], or actual knowledge, $t(303) = .81$, $p = .45$, $d = .09$, 95% CI [-.13, .32]. However, pre-Super Bowl participants differed from post-Super Bowl participants on truth associations, $t(346) = 5.61$, $p < .001$, $d = .60$, 95% CI [.39, .82], (*M*s = -.05, .35, *SD*s = .52, .48), suggesting that learning the outcome of the Super Bowl could have influenced participants' truth associations.

Table 2

Descriptive Statistics for Study 1

	Before Super Bowl			After Super Bowl		
Measure	*N*	*M*	*SD*	*N*	*M*	*SD*
Truth associations	56	-.05	.52	292	.35	.48
Attitude	50	-.22	1.77	237	.15	1.54
Perceived NFL knowledge	53	2.55	1.56	252	2.51	1.56
Actual NFL knowledge	53	2.08	2.33	252	2.33	2.20
Expectations for outcome	53	-.43	1.38			
Belief about outcome				107	2.49	1.15

Note. Higher scores represent truth evaluations reflecting the Seahawks winning the Super Bowl, more positive attitudes toward the Seahawks, and greater expectations for a Seahawks win. Possible scores ranged from – 3 to + 3 for attitudes, expectations, and belief, 1-6 for perceived knowledge, and 0-6 for actual knowledge.

I next examined truth associations before and after the Super Bowl (Table 3). Before the Super Bowl, truth associations largely reflected attitudes. Broncos fans'[7] truth associations reflected a Broncos win, Seahawks fans' truth associations reflected a Seahawks win, and non-fans' truth associations did not reflect either outcome. After the Super Bowl, participants' truth associations reflected a Seahawks win regardless of prior desires. However, the magnitude of truth associations suggest that desires still played a role: Seahawks fans' truth associations were double the magnitude of Broncos fans, $t(141) = 4.08$, $p < .001$, $d = .69$, 95% CI [.35, 1.03], and

[7] I define 'fan' as people who reported preferences for one team over another here, not by whether they identify as fans of a team.

non-fans, $t(170) = 4.02$, $p < .001$, $d = .62$, 95% CI [.31, .93]. Treating any score above zero as accurate truth associations, 91% of Seahawks fans, 75% of non-fans, and 69% of Broncos fans correctly associated the Seahawks with winning the Super Bowl.

Table 3

Truth Associations by Attitude and Study Date

Measure	*N*	*M*	*SD*
Before Super Bowl			
Prefer Broncos	23	-.27	.40
Neutral	15	.02	.52
Prefer Seahawks	11	.38	.50
After Super Bowl			
Prefer Broncos	65	.25	.49
Neutral	94	.28	.47
Prefer Seahawks	78	.54	.38

Note. Higher scores mean higher truth associations reflecting that the Seahawks won the Super Bowl. Prefer Broncos = participants who reported a Broncos preference, Neutral = participants who reported no preference, Prefer Seahawks = participants who reported a Seahawks preference.

Is the relationship between attitudes and the truth associations reduced after the outcome of the Super Bowl is known? To examine this formally, I entered attitudes and study date as the first step of a regression and an interaction term as the second step. There were main effects of attitudes, $F(1, 284) = 24.21$, $p < .001$, $\eta^2_p = .08$, and study date, $F(1, 284) = 23.46$, $p < .001$, $\eta^2_p = .08$, on aIAT scores. Introducing the interaction term did not lead to a significant increase in variance explained in the aIAT, $\Delta R^2 = .01$, $F(1, 283) = 2.71$, $p = .10$, suggesting that the relationship does not change after the outcome is known.

Overall, Study 1's results suggest truth associations are related to attitudes and distinct from knowledge about outcome of an event. The relationship between truth associations and attitudes was not attenuated by knowledge or expectations about the outcome. This is particularly notable considering that the Seahawks beat the Broncos by 35 points, the largest point

differential in the Super Bowl in over 20 years. However, these effects lack statistical precision as the sample included less than 60 participants from before the Super Bowl. Further, some aIAT stimuli confounded valence and truth/falsity (e.g., "I am breathing", "I am dead"). I address these issues in the next study.

Study 2 – 2014 Florida Governor's Race (Cross-Sectional)

Study 1 demonstrated a relationship between attitudes and truth associations, but the mechanisms underlying that relationship are unclear. To address this concern, Study 2 assessed potential moderators and mediators for the relationship between attitudes and truth associations. Study 2 took place in the weeks surrounding the 2014 Florida gubernatorial election between Rick Scott (R) and Charlie Crist (D). This election was one of the most competitive races in the 2014 midterm elections: Rick Scott won the governorship with 48.2% of the vote compared to Charlie Crist's 47.1%.

Method

Participants

Participants were 1007 American citizens from the Project Implicit (http://implicit.harvard.edu) participant pool. Sample size was based on the success of participant recruitment and resource constraints on the participant pool. I collected participants from October 20 until November 11. Unlike in Study 1, many of these participants were unaware of the outcome (who won the election) after it occurred. As there were many plausible models, I split the dataset into two halves: one half (N = 505) to conduct exploratory analyses, and one half (N = 502) to cross-validate with confirmatory analyses based on what was discovered in exploration. In text, I discuss only the analysis plan and results for the confirmatory sample. For

information about the exploratory sample's analyses and results, see (https://osf.io/frd2n/?view_only=d975bd4c4d80436cb597e65b73325eef). The confirmatory sample begin with 533 participants and 31 (5.7%) were excluded for failing to meet the IAT exclusion criteria for a final sample of 502 participants. 384 participants took the study before election day and 118 participants took the study after election day.

Procedure

Participants saw a page with a picture, name, and party affiliation for each of the major candidates: a Democrat (Charlie Crist), a Republican (Rick Scott), and a Libertarian (Adrian Wyllie). Then, they rehearsed their memory for the candidates by taking a brief quiz about the candidates' political parties. After, they took an aIAT and measures of attitude, perceived and actual political knowledge, expectations, mental rehearsal, political affiliation, and demographics. Participants who took the study after election day (November 4) also received questions about their beliefs about the election outcome.

Measures

Truth associations. The aIAT followed the same procedure as the aIAT in Study 1, except the categories and stimuli were 'In 2014, Crist is elected' and 'In 2014, Scott is elected'. The true/false stimuli were updated to be easier to categorize and less confounded with valence (e.g., "I'm awake", "I'm asleep" instead of "I am breathing", "I am dead").

Attitudes. Participants completed self-report items measuring attitudes toward the candidates. One item assessed relative preference for candidates on a seven-point scale ranging from "I strongly prefer Charlie Crist to Rick Scott" to "I strongly prefer the Rick Scott to Charlie Crist." Before the election, participants were also asked "If the election was held today, who would you

vote for governor in the 2014 Florida governor's race?". After the election, participants reported who they voted for governor or who they would have voted for if they did not vote. The response options for these questions were "Charlie Crist", "Rick Scott", "Adrian Wyllie", or "None of the above".

Expectations about who will win the election. Participants were asked "Who do you think will win in the 2014 Florida governor's race?" before election day. The response options were "Charlie Crist", "Rick Scott", "Adrian Wyllie", or "None of the above". No participant selected Adrian Wyllie, so this item was scored as -1 = Charlie Crist, 0 = None of the Above, and 1 = Rick Scott.

Belief about who won the election. Participants were asked " Who do you think won in the 2014 Florida governor's race?" with response options on a seven-point scale ranging from "Definitely Charlie Crist" to "Definitely Rick Scott".

Mental rehearsal. To assess mental rehearsal, I asked three questions following the same format before and after the election: "How much have you [thought/read, watched or listened to media/talked to others] about the outcome of the election [since it happened]?". The response options were on a five-point scale ranging from "Not at all" to "An extreme amount". To assess interest, I asked, "How closely did you follow the news on election day?" on a six-point scale ranging from "Extremely closely" to "Not at all closely". To assess counterfactual use, I asked "How much have you thought about how the election could have happened differently?" on a five-point scale ranging from "Not at all" to "An extreme amount".

Features of the memory. Participants were asked about features of their memory for the election outcome. For every question in this category, participants were given the option to

answer “I didn’t learn of the election outcome”. To assess emotional intensity, I asked “How intense was your emotional reaction when you heard the news of the election outcome?” on a six-point scale ranging from “Extremely intense” to “Not at all intense.” To assess the extent to which the memory was a flashbulb memory rather than an everyday memory, I adapted six 7-point scale items from Talarico and Rubin (2003). To assess recollection, participants answered “As I remember learning of the election outcome, I feel that as though I am reliving it.”(from “Not at all” to “As clearly as if it was happening now”) and “As I remember learning of the election outcome, I feel that I travel back to the time it happened” (from “Not at all” to “Completely”). To assess beliefs, participants were asked “I believe that my memory of learning the election outcome *really* occurred in the way I remember it.” (from “100% imaginary” to “100% real”) and “I could be persuaded to believe that my memory of how I learned the election outcome was wrong.” (reverse-scored; from “Not at all” to “Completely”). Finally, to assess vividness, participants answered two items asking “As I remember learning of the election outcome, I can [see / hear] it in my mind.” (from “Not at all to Completely”.

Perceived and actual election knowledge. Participants were asked two items assessing perceived election knowledge and six items assessing actual election knowledge. The two items were “How closely do you follow the 2014 Florida governor’s race?” and “How knowledgeable are you about the 2014 Florida governor’s race?” Responses were on a six-point scale ranging from “Extremely [closely/knowledgeable]” to “Not at all [closely/knowledgeable].” These two items were averaged together for analysis. The questionnaire assessing actual knowledge were six multiple choice questions asking who the current governor is (Rick Scott), what Floridian political figure recently changed their party affiliation (Charlie Crist), what issues are voted on in

the November 4 election, the capital of Florida (Tallahassee), and the length of a governor's term in Florida (4 years).

Political affiliations and demographics. Participants were asked about whether they registered to vote and their political and partisan identification. They were also asked about their gender, age, and religiosity.

Results and Discussion

I first conducted bivariate and partial correlations to examine the relationships between the outcomes of interest (See Tables 4a and 4b for bivariate correlations). Pre-election day, attitudes were uniquely related to truth associations after controlling for expectations, perceived knowledge, and actual knowledge, $r(343) = .39$, $p < .001$, but expectations did not uniquely predict truth associations after controlling for attitudes, perceived knowledge, and actual knowledge, $r(343) = .02$, $p = .68$. Post-election day, attitudes were uniquely related to truth associations after controlling for belief about the outcome, perceived knowledge, and actual knowledge, $r(111) = .26$, $p = .007$. Unlike Study 1, beliefs about the outcome uniquely predicted truth associations after controlling for attitudes, perceived knowledge, and actual knowledge, $r(111) = .23$, $p = .030$. This discrepancy in findings may be attributable to differences in the distribution of belief about the outcome. Analysis of beliefs was constrained by a ceiling effect in Study 1 but not Study 2. Whereas 82.2% "definitely" knew the Seahawks won the Super Bowl in Study 1, only 18.8% "definitely" knew that Rick Scott won the 2014 Florida gubernatorial election in Study 2.

Table 4a

Correlation Matrix of Pre-Election Day Outcomes

		1	2	3	4	5
1	Truth associations					
2	Attitude	.40**				
3	Perceived election knowledge	-.10	-.28***			
4	Actual election knowledge	-.07	-.22***	.48***		
5	Expectations for outcome	.17**	.36***	-.03	-.01	

Table 4b

Correlation Matrix of Post-Election Day Outcomes

		1	2	3	4	5
1	Truth associations					
2	Attitude	.21*				
3	Perceived election knowledge	.10	-.01			
4	Actual election knowledge	.08	-.13	.51***		
5	Belief about outcome	.18*	-.20*	.40***	.45***	

As many post-election day participants did not know who won the election, post-election participants may look more similar to pre-election participants on the aIAT than in Study 1. The results support this account; pre- and post-election day participants were not significantly different on truth associations, $t(492) = -1.05$, $p = .30$, $d = -.09$, 95% CI [-.27, .08] (*M*s = -.10, -.05, *SD*s = .42, .42). Pre- and post-election day participants also did not differ in attitudes, $t(209.11) = -1.94$, $p = .054$, $d = -.27$, 95% CI [-.54, .00], perceived knowledge, $t(233.82) = 1.45$, $p = .15$, $d = .19$, 95% CI [-.07, .45], or actual knowledge, $t(495) = -.49$, $p = .63$, $d = -.04$, 95% CI [-.22, .13] (Table 5).

Table 5

Descriptive Statistics for Study 2

	Before Election Day			After Election Day		
Measure	*N*	*M*	*SD*	*N*	*M*	*SD*
Truth associations	376	-.10	.42	118	-.05	.42
Attitude	374	-.74	1.64	116	-.42	1.48

Perceived election knowledge	381	1.59	.99	117	1.46	.80
Actual election knowledge	380	.30	.21	117	.31	.24
Expectations for outcome	359	-.05	.92			
Belief about outcome				117	.77	1.71

Note. Higher scores represent truth associations and memories reflecting that Rick Scott won the election, more positive attitudes toward Rick Scott, and greater expectations for a Rick Scott win. Possible scores ranged from -3 to + 3 for attitudes and belief, -1 to +1 for expectations, 1-6 for perceived knowledge, and 0-6 for actual knowledge.

I next investigated the relationship between attitudes and aIAT scores before and after election day (Table 6). Before and after the election, supporters of Charlie Crist and Rick Scott's truth associations reflected who they wanted to win. Treating any score above zero as accurate truth associations, 63% of Scott supporters, 39% of non-supporters, and 38% of Crist supporters correctly associated Scott with winning the election post-election day. Supporting the other results, the relationship between attitudes and the aIAT did not change after election day: there was a main effect of attitudes, $F(1, 481) = 69.50$, $p < .001$, $\eta^2_p = .13$, no main effect of study date, $F(1, 481) = .25$, $p = .61$, $\eta^2_p = .00$, and no interaction between attitudes and study date, $\Delta R^2 = .00$, $F(1, 480) = 2.47$, $p = .12$.

Table 6

Truth Associations by Attitude and Study Date

Measure	*N*	*M*	*SD*
Before Election Day			
Prefer Crist	171	-.28	.41
Independent	148	-.01	.34
Prefer Scott	49	.22	.41
After Election Day			
Prefer Crist	45	-.10	.40
Independent	52	-.08	.43
Prefer Scott	19	.16	.39

Note. Higher scores represent truth associations reflecting that Rick Scott won the election. Prefer Crist = participants who reported a preference for Charlie Crist, Independent = participants who reported no preference, Prefer Scott = participants who reported a preference for Rick Scott.

Study 2's sample's lack of knowledge gave opportunity to examine the possibility of mistaken memory effects. Political ideologues form false memories consistent with their ideologies (Frenda, Knowles, Saletan, & Loftus, 2013), and these false beliefs are caused partly by indirect feelings of truth such as recognition and familiarity. In a similar fashion, truth associations may be related to ideology-consistent false beliefs. Examination of the relationship between attitudes and beliefs about the outcome finds that it was mediated by truth associations. As Figure 2 illustrates, the standardized regression coefficient attitudes and beliefs was statistically significant, as was the standardized regression coefficient between beliefs and aIAT scores. Unstandardized indirect effects were computed for each of 5,000 bootstrapped samples, and the 95% confidence interval was computed by determining the indirect effects at the 2.5th and 97.5th percentiles. The bootstrapped unstandardized indirect effect was significant, bootstrapped B = .06, 95% CI [.01, .14]. There was a negative overall relationship between attitudes and beliefs about the outcome (counter to predictions and the exploratory sample's results), meaning that Crist supporters were more likely to know that Scott won the election than Scott supporters. In support of predictions, truth associations acted as a suppressor variable that made the relationship between attitudes and beliefs more positive. This supports a causal model wherein desires for an outcome leads to desire-consistent beliefs about what happened through truth associations. Finally, I conducted a test of the reverse mediation model (Beliefs -> Truth associations -> Attitudes) and found it was also significant, bootstrapped B = .04, 95% CI [.003, .11]. This suggests that follow-up experiments are needed to distinguish cause from effect.

I also planned to assess whether the relationship between attitudes and expectations were mediated by truth associations as it did with knowledge. In the confirmatory sample, expectations was not related to truth associations and so the mediation model could not be tested.

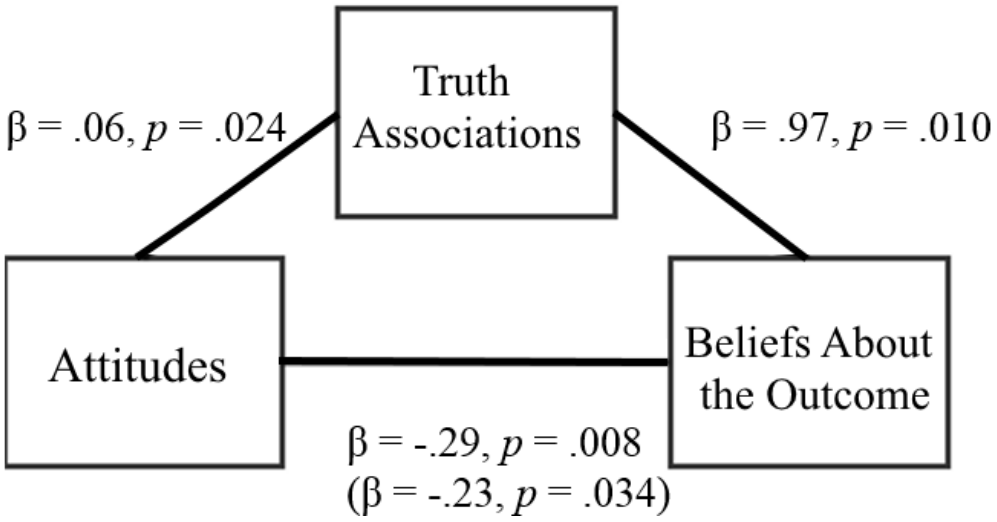

Figure 2. Truth associations mediate the relationship between attitudes and knowledge of the outcome

None of the potential explanatory variables for the relationship between attitudes and truth associations (i.e., mental rehearsal, emotional intensity, flashbulb memory) moderated or mediated the attitude-truth association relationship in the exploratory sample. As robustness checks, I tested these moderation and mediation models (for a list, see https://osf.io/frd2n/?view_only=d975bd4c4d80436cb597e65b73325eef). Of the 44 mediation and moderation models tested in the exploratory sample that were originally not significant, one was significant in the confirmatory sample. These findings show that the relationship between desires and truth associations are not explained by how emotionally impactful the outcome was, how detailed and vivid the memory the outcome was, or how much a person had thought about the outcome.

As with Study 1, Study 2 suggests truth associations are related to but distinct from attitudes and beliefs. The relationship between truth associations and attitudes are not attenuated by beliefs or expectations about the outcome. A core difference between these first two studies is the distribution of beliefs about who won. Whereas 82.2% of people in Study 1 knew the

outcome of the Super Bowl, only 50.4% knew the outcome of the election in the current study. This allowed for analyses exploring the role of truth associations in false beliefs. I found that truth associations suppressed an overall negative relationship between attitudes and knowledge. In other words, truth associations may increase correspondence between what people desire and what people remember. The reverse mediation model was also significant however. These mediation models suggest the possibility of a causal path between attitudes, truth associations, and knowledge, and future experiments will be needed to determine cause and effect.

Study 3 - 2014 Florida Governor's Race (Longitudinal)

In a third study, I sought to investigate the trajectory of truth associations over time by examining participants in the days and weeks surrounding the 2014 Florida governor's race. In contrast to Study 2, participants in this sample were students at the University of Florida and tended to be moderately or highly informed about the election. I assessed truth associations 6-12 days before, 2 days before, 1 day after, and 2 weeks after the election. I hypothesized that expectations and knowledge about the outcome would most be most influential in the days surrounding the election and less influential when the election is more distant in memory.

Method

Participants

76 participants were recruited from psychology courses at the University of Florida. 4 (5.2%) participants were excluded for meeting the IAT exclusion criteria, for a final sample of 72 participants. They were paid a $10 Amazon gift card each and were entered into a raffle for the opportunity to receive an additional $100 Amazon gift card. I planned to collect as many

participants as possible with $1000. 56% of the sample were registered to vote, and 46% of those registered voters voted in the election.

Procedure

The study took place over four sessions in the weeks before and after the November 4 election. The Time 1 session took place in a lab 6-12 days before the election (October 23 – October 27). This session was identical to the pre-election day Study 2 procedure. Time 2 took place online 2 days before the election (November 2) and was identical to Time 1, except with a measure of voting intentions and without an introduction to the candidates and re-assessments of political knowledge, political affiliation, and demographics.

Time 3 and Time 4 took place online 1 day (November 5) and 2 weeks (November 18) after the election, respectively. These sessions were identical to the post-election Study 2 procedure, except without an introduction to the candidates and with a measure of voting behavior. At the end of Time 4, participants reported their contact information for payment and be debriefed.

Results

I first assessed the trajectory of truth associations over time (Figure 3). Contrary to expectations, truth associations remained stable throughout the span of the study. Between Time 2 and Time 3, the election occurred and a winner was named. Nonetheless, there was no main effect of time on truth associations, $F(3, 159) = 1.44$, $p = .24$, and follow-up contrasts between each of the time points did not provide evidence for change over time, ps $> .05$.

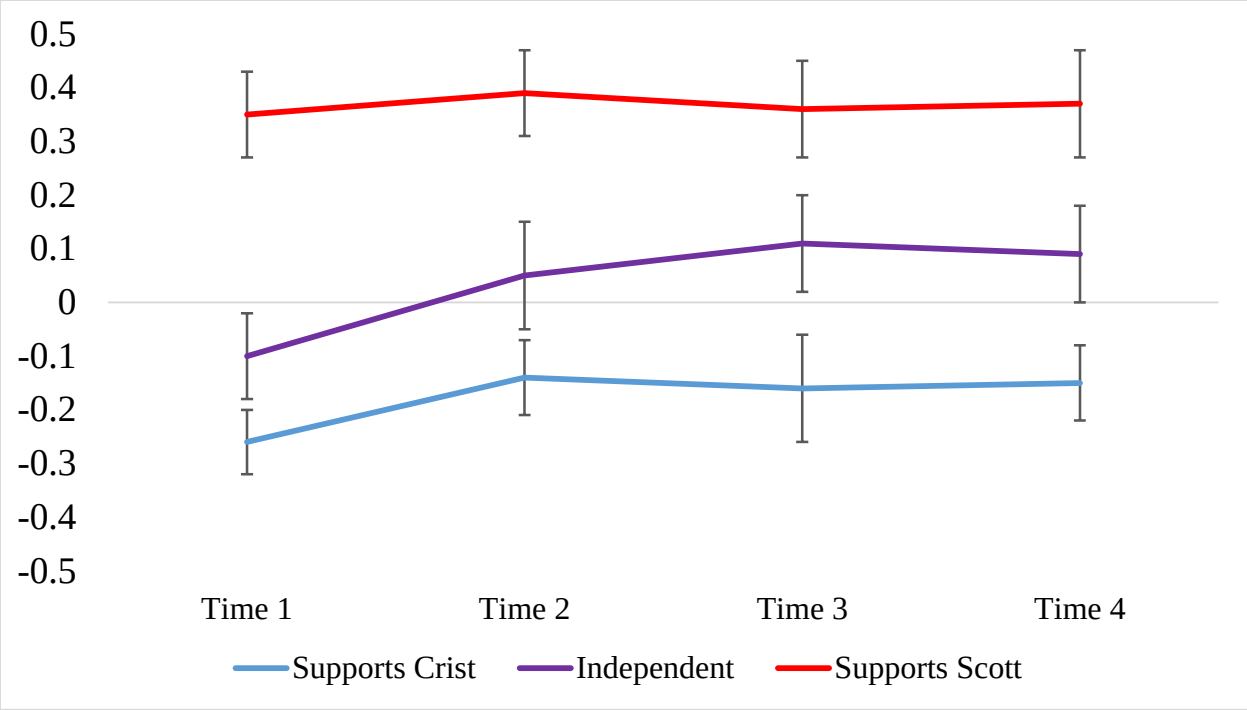

Figure 3. Truth associations as a function of attitudes and time.

Next, I examined the relationship between truth associations and attitudes over time. It could be that attitudes and truth associations are more related pre-election day than post-election day. Knowledge about who won could reduce the relationship between desires and truth associations. If that's the case, the relationship between T1 attitudes[8] and truth associations will be stronger at T1 and T2 and weaker at T3 and T4. Alternatively, it could be that attitudes and truth associations are more related when election day is more distant. When the events of election day are highly salient, knowledge and expectations may play a larger role. If that's the case, the relationship between T1 attitudes and truth associations will be stronger at T1 and T4 and weaker at T2 and T3.

[8] I conducted six repeated-measure *t*-tests and found no evidence of attitude change over the course of the study (*ps* > .50), so all other analyses were conducted with T1 baseline attitudes to maximize comparability between analyses.

To examine these possibilities, I first compared the correlation between T1 attitudes and the average of T1 and T2 truth associations, $r(68) = .61$, $p < .001$, and the average of T3 and T4 truth associations, $r(61) = .53$, $p < .001$, and found that the two correlations did not significantly differ, $Z = .94$, $p = .35$.[9] I next compared correlations between T1 attitudes and the average of T1 and T4 truth associations, $r(68) = .59$, $p < .001$, and the average of T2 and T3 truth associations, $r(61) = .57$, $p < .001$, and found that the correlations did not differ either, $Z = .23$, $p = .82$. I also examined interaction effects between T1 attitudes and expectations/beliefs about the outcome, and found no evidence for interactions at any of the four time points, ps > .20. Overall, these results suggest that the relationship between attitudes and truth associations did not change over time.

I next examined the extent to which attitudes, expectations, and belief of the outcomes were uniquely related to truth associations (See Table 7 for simple correlations). At T1 and T2, T1 attitudes were uniquely related to truth associations after controlling for expectations, $r(60) = .44$, $p < .001$, $r(54) = .42$, $p = .001$, but T1 and T2 expectations were not uniquely related to truth associations after controlling for T1 attitudes, $r(60) = .18$, $p = .15$, $r(54) = .121$ $p = .12$. T3 and T4 attitudes were uniquely related to truth associations after controlling for beliefs about the outcome, $r_s(57) = .50$, $p < .001$, $r_s(56) = .51$, $p < .001$.[10] T3 beliefs were related to truth associations after controlling for T1 attitudes, $r_s(57) = .28$, $p = .033$, but T4 beliefs were not, $r_s(56) = .19$, $p = .16$.

Table 7

[9] As a proportion of participants completed some sessions but not others, degrees of freedom varied between sessions.

[10] As with Study 1, there was a strong skew in the beliefs about outcome; 77.4% and 82.0% of participants reported that they "definitely" knew that Rick Scott won the election in T3 and T4, respectively. For analyses involving beliefs about the outcome, I conducted analyses with Spearman's *rho* instead of Pearson's *r* to correct for this issue

Correlation Matrix of Study 3 Outcomes

		1	2	3	4	5	6	7	8	9
1	T1 Truth Associations									
2	T2 Truth Associations	.52***								
3	T3 Truth Associations	.43***	.62***							
4	T4 Truth Associations	.60***	.55***	.61***						
5	T1 Attitudes	.55***	.55***	.50***	.51***					
6	T1 Expectations for Outcome	.41**	.31*	.51***	.27	.50***				
7	T2 Expectations for Outcome	.45***	.43**	.49***	.38*	.56***	.67***			
8	T3 Beliefs about Outcome	-.12	.16	.25	.03	-.05	-.11	-.11		
9	T4 Beliefs about Outcome	.00	.07	.25	.11	.02	-.02	.06	.63***	

*** $p < .001$ ** $p < .01$ * $p < .05$

As in Study 2, I planned to examine whether the relationship between attitudes and expectations and beliefs about the outcome were mediated by truth associations. Unlike Study 2, beliefs about the outcome were not correlated with truth associations but expectations were. Consequently, I could not test mediation models involving beliefs about outcomes. Employing the same approach as in Study 2, I found that truth associations did not mediate the relationship between attitudes and expectations in T1, bootstrapped $B = .17$, 95% CI [-.07, .050], or in T2, bootstrapped $B = .15$, 95% CI [-.11, .51].[11] Follow-up experiments will be needed to separate cause from effect.

Discussion

In Study 3, truth associations did not change over time despite the fact that knowledge did. Truth associations were stable from up to 12 days before the election to over 2 weeks after the election. The relationship between attitudes and truth associations was robust and did not change over time either. Attitudes and truth associations were moderately correlated (*r*s = .50 -

[11] I also tested alternative mediation models that may explain the relationship between expectations, attitudes, and truth associations. From these models, I found that attitudes mediated the relationship between expectations and truth associations in T1, bootstrapped $B = .20$, 95% CI [.10, .36], and T2, bootstrapped $B = .19$ 95% CI [.08, .36], and that expectations mediated the relationship between truth associations and attitudes in T1, bootstrapped $B = .50$, 95% CI [.16, 1.12], and T2, bootstrapped $B = .59$, 95% CI [.19, 1.26].

.55) across all four time points. I also found that expectations and knowledge about the outcome were not uniquely related or unreliably related to truth associations. Lastly, I conducted mediation analyses examining the relationships between attitudes, expectations, and truth associations and found inconsistent results.

A notable discrepancy in these findings is a lack of updating in truth associations after the election. These findings are at odds with Study 1, which found that participants after the Super Bowl exhibited truth associations in line with reality, and with the wider literature on the aIAT, which finds robust evidence for updating after learning an outcome (Sartori et al., 2008; Agosta & Sartori, 2013). Lack of knowledge about the outcome is not a plausible explanation, as most participants knew the outcome of the election.

A unique procedural element of the current study is repeated measurement across the four sessions. The multiple-session format may have led participants to rehearse their opinions about the election. Early mental rehearsal, in turn, may have crystallized their truth associations and reduced updating after the event occurred. Research suggests that attitudinal associations are rooted more in early experiences than recent ones (Rudman & Goodwin, 2003; Rudman & Heppen, 2003), and perhaps the same is true for truth associations. Automatic associations about an object are also often constrained to the context in which they are encountered (Barden, Maddux, Petty, & Brewer, 2004; Gawronski, Rydell, Vervliet, & De Houwer, 2010; Wittenbrink, Judd, & Park, 2001). The initial session may have produced a contextualized truth association that is based on one's attitudes and was activated whenever participants logged onto their computer to take the study. Truth associations assessed in other contexts may have produced greater evidence of updating than what was observed in the current study.

Due to its correlational design, it is difficult to understand what may be happening with this dataset. I have provided speculative accounts about why truth associations did not update after the truth was learned. It's also possible that a strong null is true; learning an outcome has relatively little effect on truth associations compared to one's attitudes about the outcome. In the remaining studies of this dissertation, I conduct experiments to examine the relative contributions of attitudes and knowledge to truth associations.

Study 4 - 2014 Florida Governor's Race (Experimental)

The first three studies were correlational. In Study 4, I predicted that knowledge about the outcome would have a causal impact on truth associations in an experiment about the 2014 Florida governor's race. As with Study 2, I employed a mostly uninformed sample and tested whether learning about the outcome influenced truth associations.

Method

Participants

Participants were 409 Non-Black[12] participants from the University of Virginia psychology participant pool after the 2014 midterm elections. 12 participants were excluded for meeting the IAT exclusion criteria, for a final sample of 397 participants. Sample size was determined by the number of participants I could collect by the end of the Fall 2014 semester through the participant pool. I planned to stop data collection at the end of Fall 2014 if the study collected more than 124 participants. I reached that goal, but decided to continue collecting in

[12] This study was run with non-Black participants because it was paired with a study examining implicit racial biases for which that exclusion criterion was important.

Spring 2015 because the study was run alongside another study that had not yet reached its pre-planned sample size. The decision to collect additional data was not contingent on study outcomes.

Procedure

Study 4 was similar to Study 2's post-election procedure, except for three changes. First, participants were asked who they thought won the election directly after learning about the governor's race. Second, , participants were randomly assigned tolearn the outcome (i.e., …Rick Scott won the 2014 Florida governor's race) or to not learn the outcome (i.e., "…either Rick Scott or Charlie Crist won the 2014 Florida governor's race.") Finally, as the outcome-related stimuli involving general statements of fact (e.g., "Crist wins in 2014"), I changed the True/False stimuli from autobiographical statements (e.g., "I am taking a study") to general statements of fact as well (e.g., "Dogs are mammals").

Results and Discussion

Experimentally provided knowledge about who won the election influenced truth associations, $t(390) = 2.55$, $p = .011$, $d = .26$, 95% CI [.06, .46]. Participants who learned the outcome held truth associations more reflective of the outcome (M = .10, SD = .41) than participants who did not (M = .00, SD = .38). I also investigated the relationship between attitudes and truth associations as a function of condition (Table 8). There was a main effect of attitudes, $F(1, 388) = 18.15$, $p < .001$, $\eta^2_p = .09$, a main effect of condition, $F(1, 388) = 6.49$, $p = .011$, $\eta^2_p = .02$, and no interaction between attitudes and condition, $\Delta R^2 = .00$, $F(1, 388) = .26$, $p = .61$. Knowledge of the outcome did not moderate the relationship between attitudes and truth associations.

Table 8

Truth Associations by Attitude and Condition

Measure	*N*	*M*	*SD*
Didn't Learn the Outcome			
Prefer Crist	69	-.12	.37
Independent	91	-.03	.36
Prefer Scott	58	.16	.37
Learn the Outcome			
Prefer Crist	53	-.05	.38
Independent	76	.10	.39
Prefer Scott	45	.26	.40

Note. Higher scores represent truth associations reflecting that Rick Scott won the election. Prefer Crist = participants who reported a preference for Charlie Crist, Independent = participants who reported no preference, Prefer Scott = participants who reported a preference for Rick Scott.

As with prior research on the influence of autobiographical memories on truth associations (Sartori et al., 2008), I found that learning about an event had an impact on truth associations. Knowledge about the outcome did not reduce the relationship between attitudes and truth associations, and attitudes had a stronger overall effect on truth associations than knowledge itself. As this study measured attitudes but did not manipulate them, the relationship between attitudes and truth associations may be due to unassessed variables. To address uncertainties about the causal impacts of attitudes and desires, I ran a fifth study that manipulated both attitudes and knowledge to examine the causal impact of both on truth associations.

Study 5 – California State Controller Election

At face, truth associations about an event are highly correspondent to evaluating what one remembers about the outcome of an event. And yet, the prior studies find that knowledge about an event has only a small impact on truth associations. Desires are equally or more related to truth associations than knowledge.

It is possible that attitudes directly influence truth associations. Alternatively, it's possible that an effect of attitudes is explainable through knowledge of facts related to one's desired candidate. For example in Studies 3 and 4, attitudes toward Charlie Crist may be related to knowledge that Crist was the governor of Florida from 2007-2011 and attitudes toward Rick Scott may be related to knowledge that he was the incumbent governor, and that external knowledge drives truth associations.

To isolate the impact of desires, I employed an experimental design that manipulates desires and knowledge in a hypothetical election. Participants learned about a desirable candidate and undesirable candidate running for California State Controller, then find out that the desirable candidate wins, the undesirable candidate wins, or that it is not known who won. I hypothesized that knowledge and desires would have independent effects on truth associations.

Method

Participants

Participants were volunteers who visited the research website Project Implicit (https://implicit.harvard.edu) that are U.S. citizens who do not live in California. In Study 4, I found the effect of learning the outcome on truth associations was d = .26, 95% CI [.06, .46]. 80% power to detect d = .26 is 234 / cell, or N = 1404. Consequently, I planned to collect a minimum of 1404 participants and to stop data collection after that number has been exceeded. I planned to exclude participants who meet the IAT exclusion criteria and participants who report using the Internet to search for information about the study.

Due to a low retention rate (44%), this study was taken down before it reached 1404 participants. The results reported in this manuscript reflect the 517 participants who completed

the study. 28 (5.4%) participants met the IAT exclusion criteria and 4 (0.1%) participants reported using the Internet to search for information about the study and were excluded from all analyses, leaving a final sample of 485 participants.[13]

Procedure

The study was a 2 (Desire: Klepper win, Gelman win) X 3 (Knowledge: Klepper wins, No knowledge, Gelman wins) between-subjects design. At the beginning of the study, participants were told "In this study, we will show you three articles that will track a voter's experience in the months, weeks, and days surrounding the election campaign. As you read these articles, please imagine that you are voter in California trying to decide who you would vote for." Participants first read a short article about two candidates for California State Controller, Nathan Klepper and Martin Gelman. Participants were randomly assigned to learn that Nathan Klepper held desirable qualities and Martin Gelman held undesirable qualities to induce a desire for a Klepper win, or that Gelman had positive qualities and Klepper had undesirable qualities to induce a desire for a Gelman win. After, participants read a second article reinforcing the candidates' desirability/undesirability and were told the State Controller race was close. After answering questions about their attitudes and expectations, participants were randomly assigned to learn the desirable candidate won, the undesirable candidate won, or that it was still up in the air (See Appendix B for a step-by-step walkthrough of the procedure). In the final section of the study, participants completed an Implicit Association Test (IAT) assessing truth associations and

[13] It was possible to modify the study to increase retention rates and run it on the Project Implicit pool again. Before I made a decision to do so, I investigated the data collected so far. First, I conducted a sequential analysis (Lakens, 2014) to determine that a critical effect would need to surpass $p = .0167$ to justifiably ending data collection early with 517 participants. Diligent use of sequential analyses requires that researchers pre-register the sequential analyses and stopping rules. I did not pre-register a sequential analysis or stopping rule, but decided against running the study more after observing the descriptive results for the 517 participants already collected. To partially correct for the early stopping, I set a critical alpha level of $p = .0167$ for all analyses in the current study.

questions about who they thought won the election, political interest, knowledge, ideology, and partisan identification, and whether they searched up the election on the internet during the study.

We included several method-related variables in addition to IAT order that were randomized between-participants. Participants in this study were randomly assigned to take either an aIAT assessing associations between 'Klepper won the election/Gelman won the election' and 'True/False' or an IAT assessing associations between 'Nathan Klepper/Martin Gelman' and 'Won Election/Lost Election'. The candidates' faces were also randomized between-participants to control for stimulus-driven effects.

Measures

Truth associations. To examine the generalizability of truth association effects beyond the aIAT participants were randomly assigned to one of two IAT versions. One version was the aIAT, which assessed associations between the two possible outcomes (Klepper won the Election, Gelman won the election) and True/False. Another version assessed associations between the two candidates (Nathan Klepper, Martin Gelman) and Won Election/Lost Election. Examples of stimuli in the Won Election/Lost Election categories included 'Elected to Office', "Lost the Vote', and 'State Controller Win'. Higher IAT scores indicated faster responses in in the blocks with 'Klepper won the election/True – 'Gelman won the election/False' and 'Nathan Klepper/Won Election – Martin Gelman/Lost Election'.

Attitudes. Participants completed self-report items measuring attitudes toward the candidates. One item assessed relative preference for candidates on a seven-point scale ranging from "I strongly prefer Martin Gelman to Nathan Klepper" to "I strongly prefer the Nathan Klepper to

Martin Gelman." Participants were also asked "Who would you vote for in the election for California State Controller?", but this question was not used for analysis.

Expectations about who will win the election. Participants were asked "Who do you expect will win the election?" before being assigned to find out the outcome or not. The response options were on a seven-point scale ranging from "Definitely Martin Gelman" to "Definitely Nathan Klepper".

Belief about the outcome of the election. After the IAT, participants were asked " Who do you think won the election?" with response options on a seven-point scale ranging from "Definitely Martin Gelman" to "Definitely Nathan Klepper".

Perceived political knowledge. Participants were asked two items assessing perceived political knowledge. The two items were "In general, how closely do you follow U.S. politics?" and "In general, how knowledgeable are you about U.S. politics?" Responses were on a six-point scale ranging from "Extremely [closely/knowledgeable]" to "Not at all [closely/knowledgeable]." These variables were not used for analyses.

Political affiliations. Participants were asked about their political and partisan identification.

Results

To investigate the impacts of desire and knowledge on truth associations, I conducted a hierarchical linear model organized in four steps (See Table 9). In Step 1, I regressed method-related variables (i.e., IAT order, IAT variant, stimulus face) on truth associations. The results indicated that truth associations were more pro-Klepper when participants categorized Klepper with winning the election first, $F(1, 429) = 14.78$, $p < .001$, $\eta 2_p = .033$, and that IAT variant and

stimulus face did not predict truth associations. In Step 2, I conducted a regression with method-related variables, knowledge condition, and desire condition predicting truth associations. Inclusion of these variables improved the model fit greatly from 3.5% to 41.8% of variance in truth associations, $\Delta R^2 = .38$, $F(3, 426) = 93.45$, $p < .001$. Considered simultaneously, both knowledge, $F(2, 412) = 71.10$, $p < .001$, $\eta 2_p = .26$, and desire, $F(1, 412) = 129.74$, $p < .001$, $\eta 2_p = .24$, influenced truth associations.[14]

In Step 3, I added the interaction between knowledge condition and desire condition to the model and found that the interaction did not increase model fit, $\Delta R^2 = .007$, $F(2, 424) = 2.58$, $p = .077$. The effect of desires on truth associations was not qualified by knowledge, and the effect of knowledge on truth associations was not qualified by desires. Finally in Step 4, I examined whether knowledge and desire conditions interacted with each of the three method-related variables. Adding the six interaction terms increased model fit, $\Delta R^2 = .036$, $F(9, 415) = 3.07$, $p = .001$, suggesting that one or more of the methodological factors qualified the effects. Specifically, I found that truth associations reflected knowledge to a greater degree when assessed with the Won/Lost Election IAT instead of the aIAT, $F(2, 415) = 10.99$, $p < .001$, $\eta 2_p = .050$. Participants who learned that Klepper or Gelman won expressed truth associations more reflective of this knowledge on the Won/Lost Election IAT ($M s_{adj} = .29, -.56$, $SE s_{adj} = .05, .05$) than the aIAT ($M s_{adj} = .08, -.29$, $SE s_{adj} = .06, .05$). The aIAT did not substantially differ from the

[14] An alternative approach to operationalizing desires is with self-reported attitudes. Results with self-reported attitudes were consistent with experimentally induced desires. Self-reported attitudes predicted truth associations by about the same degree, $F(1, 412) = 129.74$, $p < .001$, $\eta 2_p = .24$, did not interact with knowledge condition in predicting truth associations, $F(2, 410) = 2.03$, $p = .13$, $\eta 2_p = .01$, and did not interact with method-related variables, ps > .05. The relationship between self-reported attitudes and expectations was not mediated by truth associations, bootstrapped $B = -.01$, 95% CI [-.07, .05], but the relationship between self-reported attitudes and beliefs about the outcome was, bootstrapped $B = .11$, 95% CI [.03, .19].

Won/Lost Election IAT in the 'no knowledge' condition (Ms_{adj} = .03, -.06, SEs_{adj} = .05, .05). No other methodological condition interactions were significant.

Lastly, I tested mediation models on participants in the 'No knowledge' condition to examine whether truth associations mediated the effect of desires on expectations/beliefs about the outcome after controlling for method-related variables. I found that truth associations did not mediate effects of desires on expectations, bootstrapped B = .17, 95% CI [-.17, .52], but did mediate the effect of desires on beliefs about the outcome, bootstrapped B = .59, 95% CI [.24, 1.00]. These findings support the results of Studies 2 and 3, finding that truth associations accounts for the relationship between desires and beliefs (but not expectations) about outcomes.

Discussion

In Study 5, I manipulated participant's desires and knowledge about the outcome of a hypothetical election to discover their contribution in changing truth associations. I found that desires and knowledge changed truth associations independently but not interactively. Knowledge did not change the impact of desires on truth associations, nor did desires change the impact of knowledge on truth associations. I also tested several mediation models examining a potential role for truth associations in expectations and mistaken memories. Consistent with prior studies, I found that truth associations mediated the impact of desires on beliefs about the outcome, but not expectations. This study demonstrates that desires and knowledge independently influence truth associations and that truth associations account for the effect of desires on beliefs about outcomes.

Table 9

Hierarchical linear regression predicting truth associations by method-related variables (Step 1), knowledge and desires (added in Step 2), the interaction between knowledge and desires (added in Step 3), and two-way interactions between method-related variables, knowledge, and desires (added in Step 4)

Predictor	*df*	$\eta 2_p$	*F*	*p*	R^2
Step 1					.035
IAT order	1	0.033	14.78	< .001	
IAT variant	1	0.001	0.215	.64	
Stimulus face	1	0.001	0.254	.62	
Step 2					.418
IAT order	1	0.073	31.98	< .001	
IAT variant	1	0.004	1.73	.19	
Stimulus face	1	0.002	0.89	.35	
Knowledge condition	2	0.255	72.87	< .001	
Desire condition	1	0.226	124.23	< .001	
Step 3					.425
IAT order	1	0.073	33.50	< .001	
IAT variant	1	0.005	1.94	0.16	
Stimulus face	1	0.003	1.07	0.30	
Knowledge condition	2	0.258	73.67	< .001	
Desire condition	1	0.224	122.61	< .001	
Knowledge condition x desire condition	2	0.012	2.58	0.08	
Step 4					.461
IAT order	1	0.076	33.95	< .001	
IAT variant	1	0.004	1.67	0.29	
Stimulus face	1	0.002	0.84	0.36	
Knowledge condition	2	0.257	71.80	< .001	
Desire condition	1	0.228	122.55	< .001	
Knowledge condition x desire condition	2	0.014	2.84	0.06	
Knowledge condition x IAT order	2	0.001	0.283	0.75	

Knowledge condition x IAT variant	2	0.05	10.99	< .001
Knowledge condition x Stimulus face	2	0.005	0.97	0.38
Desire condition x IAT order	1	0.002	0.67	0.41
Desire condition x IAT variant	1	0.003	1.35	0.25
Desire condition x Stimulus face	1	0.001	0.26	0.61

General Discussion

In this dissertation, I investigated the relationships between desires, knowledge, and truth associations. I found that truth associations were related to but distinct from desires and knowledge about events in Studies 1-3. Studies 4 and 5 examined these relationships experimentally, and found that truth associations are independently influenced by what is known and what is desired. Further, Studies 2, 3, and 5 examined the potential role of truth associations in attitude-consistent expectations and beliefs. I found that truth associations mediated the relationship between desires and beliefs about outcomes, but not desires and expectations. Taken together, this dissertation finds that desires and knowledge influence truth associations, and that truth associations mediate the effect of desires on beliefs about outcomes.

Truth and Truthiness

The mind responds to false information as if it were true. People develop mistaken memories that are almost non-distinguishable from real memories (Loftus, 2003), unwittingly act on information they know to be false (e.g., Morewedge et al., 2010), and even employ stereotypes that are counter to ones' beliefs and values (Devine, 1989). This dissertation finds another area in which the truth value of information is not diagnostic of how people think and have. What people automatically associate with the truth can be at odds with what people know and report as true. Why might false or invalid information sway associations, but leave conscious beliefs largely untouched? In this section, I review three accounts of the relationship between desires and truth associations.

Social-cognitive models suggest that heuristic and systematic processes produce different outcomes for truth associations and conscious beliefs (e.g., Gawronski & Bodenhausen, 2011; Strack & Deutsch, 2004). For example, associations are more likely to be based on a thought's familiarity, fluency, and vividness as indicators of truth (e.g., "That sounds like it happened…") than deliberate beliefs. Meanwhile, conscious beliefs are more likely to employ processes that compare the validity of competing thoughts (e.g., "This sounds like it happened…but I just read a news article stating the opposite actually happened."). Desires tend to be more familiar, fluent, and vivid (Alter & Balcetis, 2010; Winkielman, Schwarz, Fazendeiro, & Reber, 2003), and in the current research, they may serve as a heuristic cue for truth associations. What's known about an outcome is the most valid indicator of what is true, and serves as the primary source of information for explicit reports. To examine the social-cognitive account, I assessed the availability of heuristic cues in Studies 2 and 3 by asking participants how rehearsed, vivid, and emotional the desired and actual outcomes of an event was. Speaking against the cognitive account, I did not find evidence that these heuristic cues affected the relationship between attitude and truth associations. In Studies 4 and 5 I found that the attitude-truth association relationship persisted in minimal experimental paradigms where participants had little opportunity to rehearse one possible outcome over another. These results suggest that desires are not related to truth associations only because they are more familiar, practiced, or fluent.

A second account for the discrepancy is a motivational one: what people *want* to be true influences what people *perceive* to be true. People are motivated to see themselves and the world as more positive than it actually is, and these positive illusions are beneficial for mental health (Taylor & Brown, 1988). The motivation to see the world as one wishes it to be true may be uncritically incorporated into automatic evaluations of the truth, but discounted as invalid in

deliberate reports of truth. In this dissertation, the relationship between attitudes and truth associations was weakly to moderately positive across all studies (*r*s = .23 - .55) and that relationship was not moderated by other factors. These results do not provide strong evidence for a motivational account, but also do not provide evidence against it. According to this self-enhancement account, the relationship between desires and truth associations should only hold if people are motivated to see themselves and the world positively. A rigorous test of this account could investigate depressed individuals or individuals with low self-esteem, who are less motivated to have positive illusions and may consequently not hold desires that are consistent with truth associations (Alloy & Abramson, 1979; Taylor & Brown, 1988).

Truth is highly valued. Individuals base their decisions on ideas that they believe to be true and perceive others who state falsehoods or lie to be immoral. The pursuit of truth is the foundation of science and philosophy, and much of the judicial system within the United States is predicated on the pursuit of credible evidence and truth. Even Superman fights for "Truth, Justice, and the American Way." This connection between truth and positive value may also be expressed in mental associations. What's true is what's liked, and what's liked may also be what's true. This conflation between truth and positivity could explain relationships between desires and truth associations. If this account holds, then changes to measurement that reduce the connection between truth and positivity ought to reduce the desire-truth association relationship as well. I investigated this possibility in Studies 3-5. In the first two studies, the true/false stimuli were obviously confounded with positivity/negativity (e.g., "I am dead" as a false stimulus). I reduced this confounding in Study 3 with personal statements that were evaluatively neutral (e.g., "I'm asleep"), and reduced it further in Study 4 by changing the statements to be non-personal as well ("e.g., Dogs are mammals"). Study 5 randomly assigned participants to IATs

that assesses associations with winning vs. losing an election instead of true and false. The relationship between desires and truth associations were robust and about the same size across all these studies despite efforts to reduce the salience of associations between truth and positivity. These results suggest the association between truth and positivity is not sufficient to explain the effects of desires on truth associations reported in the present studies.

This dissertation provides evidence addressing these three accounts of the attitude-truth association relationship, but does not rule out any account conclusively. The correlational evidence argues against the social-cognitive and truth-positivity accounts and is mostly silent about the motivational account. None of this evidence addresses this issue experimentally. Future research should experimentally manipulate the concepts at the core of each of these accounts (e.g., familiarity, positive illusions, true = good association) to arbitrate between these possibilities. It may be that one, some, or all of these accounts are at the root of the relationship between desires and truth associations.

The aIAT as Lie-Detector

Early research on the aIAT described it as an "accurate method of detecting concealed knowledge that outperforms currently available lie-detection techniques" (p. 780, Sartori et al., 2008). In this research program, participants take an IAT variant where participants categorize two possible events with true and false. Accuracy is defined as IAT *D* scores than higher than zero (i.e., faster responses when a true event is paired with true compared to when the false event is paired with true). A review by Agosta and Sartori (2013) examined eight validation experiments and found that accuracy was over 90%. The current research, however, suggests that the aIAT (and truth associations in general) are not exclusive indicators of knowledge. I

employed the same metric as Agosta and Sartori (2013) across the five studies, looking only at participants who definitely knew the outcome of the event (i.e., participants reported "Definitely the Seattle Seahawks/Rick Scott" from Studies 1-3 and participants in the knowledge conditions of Studies 4 and 5) and found that accuracy rates were 76%, 64%, 43%, 62%, and 65% for Studies 1-5, respectively. These accuracy rates were lower for people with desires for the opposite outcome: 59%, 50%, 66%, 53%, and 62% for Studies 1-5 respectively.[15] This is troublesome for the application of the aIAT as a lie detector, as the people who are most motivated to lie are often the people who are the most motivated to desire alternative outcomes.

There are many possible explanations for why the present findings diverge from prior studies on the aIAT. One difference is the type of populations assessed. The majority of the prior research was conducted in university laboratories using experimental designs. In the current research, three of five were conducted outside of the university laboratory and three of the five studies were correlational. These populations may have lower knowledge about the outcomes. I attempted to address variability in knowledge by analyzing only participants who reported "definitely" knowing the outcome, but still found effects lower than those estimated in prior studies. A second difference is the type of events examined. Whereas the majority of prior studies have targeted neutral events (e.g., Picking the 4 of diamonds vs. the 7 of clubs from a deck of cards), the current research intentionally targeted events that had a desired outcome. Some prior studies have also examined situations where participants were motivated toward a particular result (e.g., studies involving mock crimes, cocaine users, people who have had their licenses revoked for drunk driving), but those studies had higher accuracy rates than the current

[15] Interestingly, a variant of the IAT in Study 5 that assessed associations between two political candidates (Nathan Klepper/Martin Gelman) and two possible outcomes (Won Election/Lost Election) was more sensitive to knowledge than the aIAT was.

studies. A third difference is the reliability of effect sizes estimates. Combining across all the validation experiments reviewed in Agosta and Sartori (2013), the total sample was 204 participants. In contrast, the total sample of this dissertation was 2,365 participants – over a tenfold difference. Finally, the majority of aIAT research has been conducted within one research group (Agosta & Sartori, 2013), and independent replications from other research groups have found smaller effect sizes (Hu & Rosenfeld, 2012; Hu, Rosenfeld, & Bodenhausen, 2012). Differences in lab practices may explain why the current studies' results are discrepant, but I cannot yet identify what those differences in practices might be.

Truth Associations in Judgment and Behavior

A useful approach for understanding how truth associations relate to judgments and behavior is by examining related phenomena. This dissertation suggests that truth associations occur despite conscious awareness of the truth, which is at odds with research on false memories. A more suitable guide is research on the relationship between implicit social cognition and behavior. Truth associations are measured with the same types of measures used in the broader literature on implicit social cognition, and may display many of the same properties.

Relative to explicit beliefs, implicit associations tend to be more related to behavior when it is in a socially sensitive domain (e.g., racism and sexism; Greenwald et al., 2009). Truth associations may play a proximal account for how prejudices connect to behavior. Imagine that a group of managers are deciding between interviewing one of two equally qualified candidates from Harvard University: Andrew and Jeffrey. The only difference is that Andrew is Black and Jeffrey is White. One strategy to detecting bias in this situation is assessing the managers' implicit prejudices. Research using this strategy finds that the correlation is typically weak –

ranging from $r = .06$ to $r = .24$ depending on the estimate (Rooth, 2010; Greenwald et al., 2009; Oswald et al., 2013). One explanation for these low correlations is a lack of correspondence. Questionnaires predicting behavior tend to be more predictive when those questionnaires are closely related to the behavior (Ajzen & Fishben, 1980), and the same be true for implicit measures. Thus, a superior approach could be examining truth associations that are more correspondent with the behavior at hand. For instance, a researcher could examine associations between Andrew went to Harvard/Jeffrey went to Harvard + True/False. An individual who holds no racial bias would not have truth associations in either direction. But an individual who is more likely to invite the White candidate to an interview may respond faster to Jeffrey went to Harvard + True.

Implicit associations tend to be more influential is when people lack motivation or opportunity to think things through (e.g., when one is tired or depleted; Olson & Fazio, 2009). In the context of truth-telling, people are more likely to lie when they are tired (Gunia, Barnes, & Sah, 2014). Night owls are more likely to lie the morning, and early birds are more likely to lie at night. This effect may not be intentional; instead, it may reflect increased reliance on truth associations that are at odds with what people know to be true. One anecdotal inspiration for this dissertation was the observation that people tend to exaggerate their anecdotes at cocktail parties and other group gatherings. In the heat of the moment, it is easy to overlook what actually happened and to instead tell others about what one wished had happened.

Implicit associations also tend to have more influence when decisions are ambiguous (e.g., Uhlmann & Cohen, 2005). In a similar fashion, contexts where the truth is contestable may lead to truth judgments aligned with ones' desires. That is, truth associations may serve as precursors to the development of false or mistaken beliefs. All of the studies in this dissertation

found that truth associations for the outcome of an event were reflective of desires when the outcome is not explicitly known. In Studies 2 and 5, truth associations also mediated the relationship between desires and beliefs about the outcome of an election for samples that had little or no direct knowledge about the actual outcome. A causal story from this correlational data suggests that truth associations play a role in the formation of attitude-congruent false memories. For instance, disliking President George W. Bush is related to increased susceptibility to forming a false memory that Bush was vacationing with a baseball celebrity during Hurricane Katrina (Frenda et al., 2013), and this relationship may be due to changes in truth associations.

Conclusion

What is associated with truth in memory? An obvious source is objective experience. What we associate to be true is based off what we experience to be true. Another possibility is truth associations are not just based on facts that we know. Truth associations may arise from phenomena that are unrelated to the actual truth, or are even contrary to it. In this dissertation I found that desires influence associations with truth. Understanding how and why this happens and what it means for behavior will be important next steps.

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Appendix A – Measures of Truth Associations

In this appendix, I describe the categories and stimuli used for each measure of truth associations in the five studies.

Study 1 – Broncos/Seahawks Super Bowl aIAT

This aIAT assessed associations between Broncos won the Super Bowl/Seahawks won the Super Bowl and True/False.

Broncos won the Super Bowl

- Broncos won the Super Bowl
- Broncos beat the Seahawks
- I know the Broncos won

Seahawks won the Super Bowl

- Seahawks won the Super Bowl
- Seahawks beat the Broncos
- I know the Seahawks won

True

- I am using a computer
- I am breathing
- I am a human
- I live in the U.S.

False

- I am driving a car
- I am dead
- I am a dog
- I live in Canada

Studies 2-4 – Crist/Scott Election aIAT

Studies 2 and 3 employed identical aIATs and Study 4 employed an alternative aIAT with non-self-relevant true/false stimuli. The aIATs assessed associations between In 2014, Crist is elected/In 2014, Scott is elected and True/False.

In 2014, Crist is elected

- Crist elected in 2014
- Crist wins in 2014
- In 2014, Crist is elected

- 

In 2014, Scott is elected

- Scott elected in 2014
- Scott wins in 2014
- In 2014, Scott is elected
- 

True (Studies 2 & 3)

- I'm using a computer
- I'm awake
- I'm taking a study
- I live in America

False (Studies 2 & 3)

- I'm driving a car
- I'm asleep
- I'm climbing a hill
- I live in Canada

True (Study 4)

- Dogs are mammals
- Berlin is in Germany
- Ice is cold
- Cars are vehicles

False (Studies 4)

- Dogs are reptiles
- Boston is in Germany
- Ice is hot
- Cars are furniture

<u>Study 5 – State Controller aIAT or Won Election/Lost Election IAT</u>

In this study, participants were randomly assigned to an aIAT or a Won Election/Lost Election IAT. The aIAT assessed associations between Gelman won the election/Klepper won the election

and True/False. The Won Election/Lost Election IAT assessed associations between Martin Gelman/Nathan Klepper and Won Election/Lost Election.

State Controller aIAT ---

Gelman won the election

- Gelman was elected
- Gelman won |
- [A picture of Klepper's face with an icon indicating that he is the winner]

Klepper won the election

- Klepper was elected
- Klepper won
- [A picture of Klepper's face with an icon indicating that he is the winner]

True

- Dogs are mammals
- Berlin is in Germany
- Ice is cold
- Cars are vehicles

False

- Dogs are reptiles
- Boston is in Germany
- Ice is hot
- Cars are furniture

Won Election/Lost Election IAT ----

Martin Gelman

- Martin Gelman
- Gelman
- [A picture of Martin Gelman's face]

Nathan Klepper

- Nathan Klepper
- Klepper
- [A picture of Nathan Klepper's face]

Won Election

- Won Election
- Elected to Office

- Winner
- State Controller Win

Lost Election

- Lost Election
- Lost the Vote
- Loser
- State Controller Loss

Appendix B – Step-By-Step Procedure for Study 5

In this study, we are interested in your opinions about American politics. You will read about hypothetical events, answer questions, and complete a task categorizing words and pictures into groups as fast as possible. Please adopt the mindset of a prospective voter as you take this study. This study will take 10 - 15 minutes.

While taking your study, please refrain from switching to other activities. It is important that you maintain focus on this study while you are taking it. Thanks!

[CONTINUE]

This past November, citizens across the United States voted in the 2014 midterm elections. Many elections were landslides, but some were very close. One of the closest elections in the nation was in California. There, a vacated position of State Controller was up for grabs between two politicians: Nathan Klepper and Martin Gelman. The State Controller is the Chief Financial Officer (CFO) of California, and whoever won the election would have large influence over the finances of one of the biggest states in the country.

In this study, we will show you three articles that will track a voter's experience in the months, weeks, and days surrounding the election campaign. As you read these articles, please imagine that you are voter in California trying to decide who you would vote for.

[CONTINUE]

Politician Names and Faces are randomized in a 2 (Name: Klepper / Gelman, Gelman / Klepper) X 2 (Face: Blond Guy / Brown Guy, Brown Guy / Blond Guy) design.

August 14, 2014

Profiles in Politics: Your Candidates for State Controller

Nathan Klepper

Nathan Klepper is a state assemblyman who has 12 years of experience as a former investor. In his 7 years as a state representative, he has championed a bill reforming campaign finance in the State of California and acted as a major force in creating the 2013-2014 Fiscal Year state budget. His colleagues see Klepper as principled, financially savvy, and charismatic.

Martin Gelman is a state assemblyman who has had 10 years of experience in the state legislature. Gelman has a reputation for being stubborn and self-interested. His tenure as a state representative has been marked by allegations of corruption and "pork barrel" spending - securing funds to benefit his interests at the expense of others. His colleagues see him as scheming, devious, and untrustworthy.

Martin Gelman

[CONTINUE]

November 1, 2014

In California, Election for State Controller in Dead Heat

Nathan Klepper

The election for a new California State Controller is incredibly close.

At the heart of the race are two candidates, Nathan Klepper and Martin Gelman A recent Rasmussen poll of likely voters puts the two candidates at a tie – 48% Nathan Klepper, 48% Martin Gelman, and 4% for other candidates. This election is slated to be one of the most competitive races in the 2014 midterm elections.

Klepper and Gelman have very different perspectives on finance management

Nathan Klepper has proposed an initiative to reduce corruption within the state government if elected. California was ranked No. 1 last year for number of public officials convicted of corruption with 2,522 convictions. He argues that a substantial part of the budget could be balanced by auditing public officials for embezzlement and wasteful spending.

Klepper believes his plan will restore public trust in government and be cost-effective. Klepper remarked, "This initiative is evidence-based and practical. It will make state government more efficient and will save us a lot of money in the long-term."

In contrast, Martin Gelman argues that Nathan Klepper's initiative to be misguided. Gelman commented, "This initiative is simply bad politics. Why target public servants when there's so much else going on? I don't want to have to look over my shoulder."

In interviews with the press and public debates, Gelman has not made specific campaign promises for a term in office. Instead, Gelman has argued, "Look, I'm not going to fix what ain't broke. We'll do things as California has always done."

With just days to go before the election on November 2nd, both candidates are rallying their supporters and traveling across the state to garner votes. In California, it's any one's game.

Martin Gelman

[Continue]

Who would you prefer to be California State Controller?

- I strongly prefer Nathan Klepper to Martin Gelman
- I moderately prefer Nathan Klepper to Martin Gelman
- I slightly prefer Nathan Klepper to Martin Gelman
- I do not prefer either candidate.
- I slightly prefer Martin Gelman to Nathan Klepper
- I moderately prefer Martin Gelman to Nathan Klepper
- I strongly prefer Martin Gelman to Nathan Klepper

Who would you vote for in the election for California State Controller?

- Definitely Nathan Klepper
- Probably Nathan Klepper
- Maybe Nathan Klepper
- I don't know
- Maybe Martin Gelman
- Probably Martin Gelman
- Definitely Martin Gelman

Who do you expect will win the election?

- Definitely Nathan Klepper
- Probably Nathan Klepper

- Maybe Nathan Klepper
- I don't know
- Maybe Martin Gelman
- Probably Martin Gelman
- Definitely Martin Gelman

In the box below, please list some reasons for why you would vote for the candidate you have chosen. *Participants receive a nudge prompt stating "It would be ideal if you were to spend more time writing out reasons before continuing." if their response is under 20 characters.*

[Continue]

Participants are randomly assigned to learn that the outcome was not known, that Klepper won, or that Gelman won.


Nathan Klepper

November 4, 2014, 11:23 PM

Klepper Wins Contest for California State Controller

The contest has come to a close, and Nathan Klepper has won the election for California State Controller. Almost 3 hours have passed since the polls have closed but districts across the state have just finished tallying votes. Klepper edged out Gelman to win the election, with 48% of the vote compared to Gelman's 47%.

The winner of the election is Nathan Klepper

At the respective candidates' headquarters, Klepper and Gelman are with their supporters. The atmosphere on Klepper's side is jubilant, while Gelman's side is melancholy. This is an election night that voters will not forget.


Martin Gelman

November 4, 2014, 11:23 PM

Who Wins the Contest for California State Controller?

The contest for California State Controller has come to a close, and one candidate has won. But which one? Almost 3 hours have passed since the polls have closed but districts across the state are still tallying votes. As of the latest exit polls the two leading candidates, Nathan Klepper and Martin Gelman, are tied – at 46.2% and 46.3% of the vote, respectively.

The winner of the election is not decided

At the respective candidates' headquarters, both Klepper and Gelman are with their supporters. The atmosphere on both sides are nervous but optimistic. This is an election night that voters will not forget.

November 4, 2014, 11:23 PM

Gelman Wins Contest for California State Controller

The contest has come to a close, and Martin Gelman has won the election for California State Controller. Almost 3 hours have passed since the polls have closed but districts across the state have just finished tallying votes. Gelman edged out Klepper to win the election, with 48% of the vote compared to Klepper's 47%.

The winner of the election is Martin Gelman

At the respective candidates' headquarters, Gelman and Klepper are with their supporters. The atmosphere on Gelman's side is jubilant, while Klepper's side is melancholy. This is an election night that voters will not forget.

[Continue]

Implicit Association Test

*Participants were randomly assigned to one of two IAT*s:

Martin Gelman: Martin Gelman, Gelman, a picture of Martin Gelman

Nathan Klepper: Nathan Klepper, Klepper, a picture of Nathan Klepper

Won Election: Won Election, Elected to Office, Winner, State Controller Win

Lost Election: Lost Election, Lost the Vote, Loser, State Controller Loss

--

Gelman won the election: Gelman was elected, Gelman wins, a picture of Martin Gelman with text indicating he won

Klepper won the election: Klepper was elected, Klepper wins, a picture of Martin Gelman with text indicating he won

True: Dogs are mammals, Berlin is in Germany, Ice is cold, Cars are vehicles

False: Dogs are reptiles, Boston is in Germany, Ice is hot, Cars are furniture

[Continue]

Who do you think won the election?

- Definitely Nathan Klepper
- Probably Nathan Klepper
- Maybe Nathan Klepper
- I don’t know
- Maybe Martin Gelman
- Probably Martin Gelman
- Definitely Martin Gelman

In general, how closely do you follow U.S. politics?

- Extremely closely
- Very closely
- Moderately closely
- Somewhat closely
- Not very closely
- Not at all closely

In general, how knowledgeable are you about U.S. politics?

- Extremely knowledgeable
- Very knowledgeable
- Moderately knowledgeable
- Somewhat knowledgeable
- Not very knowledgeable
- Not at all knowledgeable

In general, how liberal or conservative are you on <u>social</u> issues (e.g., abortion, gay marriage, gun control)?

- Strongly liberal
- Moderately liberal
- Slightly liberal
- Neutral (Moderate)
- Slightly conservative
- Moderately conservative
- Strongly conservative

In general, how liberal or conservative are you on <u>economic</u> issues (e.g., free market policies, taxation, welfare)?

- Strongly liberal
- Moderately liberal
- Slightly liberal
- Neutral (Moderate)
- Slightly conservative
- Moderately conservative
- Strongly conservative

What is your political identification?

- Democrat
- Republican
- Independent – I do not identify with either party
- Libertarian
- Green
- Other
- Don’t know

While taking the study, did you use the internet to search for information about the California State Controller?

- Yes
- No