

Summer 8-15-2018

The Truthiness Effect: The Influence of Nonprobative Photos on Truth Judgments

Laura N. Mangus
mangusla@shu.edu

Follow this and additional works at: <https://scholarship.shu.edu/dissertations>

 Part of the [Experimental Analysis of Behavior Commons](#)

Recommended Citation

Mangus, Laura N., "The Truthiness Effect: The Influence of Nonprobative Photos on Truth Judgments" (2018). *Seton Hall University Dissertations and Theses (ETDs)*. 2578.
<https://scholarship.shu.edu/dissertations/2578>

The Truthiness Effect: The Influence of Nonprobative Photos on Truth Judgments

by

Laura N. Mangus

A Thesis Submitted in Partial Fulfillment of the Requirements for the Master of Science in
Experimental Psychology with a Concentration in Cognitive Neuroscience

In

The Department of Psychology
Seton Hall University
August, 2018

© 2018 Laura N. Mangus

SETON HALL UNIVERSITY
College of Arts & Sciences

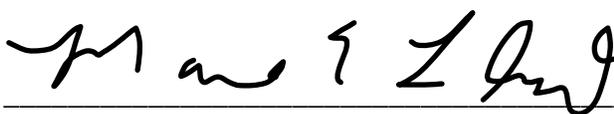
APPROVAL FOR SUCCESSFUL DEFENSE

Masters Candidate, Laura N. Mangus, has successfully defended and made the required modifications to the text of the master's thesis for the M.S. during this Summer 2018.

THESIS COMMITTEE

Mentor:

Marianne Lloyd, PhD:



Committee Member:

Andrew Simon, PhD:



Committee Member:

Jeremy Miller, PhD:



Acknowledgments

I would like to thank my thesis advisor, Dr. Marianne Lloyd, for helping me through every step of my journey. She has been an incredibly supportive mentor whose genuine nature and encouraging presence always brightened my mood and inspired confidence to persevere through every obstacle that came my way. My research and writing skills have greatly improved under her guidance and I am thankful for all she has done for me over the past two years.

I would also like to thank my committee members, Dr. Andrew Simon and Dr. Jeremy Miller. Both have given me valuable feedback and beneficial advice. I fully appreciate all their help.

I would also like to thank my fellow lab members who volunteered their time to help me collect data for my thesis. I am extremely grateful for their contributions.

Lastly, I would like to thank my fellow graduate students for all the support they have given me throughout this process. Every one of them has individually inspired and helped me through thick and thin. They truly made this experience an incredible adventure.

Table of Contents

Introduction.....	1
The Current Study.....	11
Cognitive Load.....	11
Fixed Time	12
Cognitive Reflection Task.....	13
Method	14
<i>Participants</i>	14
<i>Apparatus</i>	14
<i>Design and Procedure</i>	14
Results.....	16
Discussion	24
Conclusion	29
References.....	30

List of Figures

Figure 1.....	10
Figure 2.....	10
Figure 3.....	17
Figure 4.....	19
Figure 5.....	20
Figure 6.....	22

List of Tables

Table 1.	18
Table 2.	21
Table 3.	21

Abstract

Truthiness is used to describe a person's instinctive and rapid judgment about the truth of a claim, with no regard to logic or fact. Recent research has shown that a photo can influence a person to believe a claim is true, even if the photo used is non-probative. This effect is hypothesized to occur because photographs make claims easier to process while also enabling one to retrieve related thoughts and images to mind, which can then be mistaken for familiarity and truth (Newman, Garry, Bernstein, Kantner, & Lindsay, 2012). Cognitive load and response time manipulation were factors that had not been investigated in the truthiness literature. The present study examined the effect photos have on truth ratings in relation to high cognitive load, fixed-time response, and the inclination to be an intuitive thinker. Results demonstrated that high cognitive load and fixed-time conditions do not increase truth ratings. However, participants did display the truthiness effect when they were asked to judge true claims paired with photos in a condition that did not contain a high cognitive load or fixed-time task manipulation. This effect was also apparent in participants who showed a predisposition for intuitive thinking.

Keywords: truthiness, truth bias, truth judgments, fluency, cognitive load, response time

Introduction

When drawing conclusions about the credibility of information, individuals often employ a combination of strategies to form judgments. Two such strategies, rational thinking and intuition, often work in conjunction with one another to form an analysis of a particular concept (Evans & Stanovich, 2013). Some research has suggested that the latter of those two strategies can bring about a truthiness effect, which has been used to describe a person's instinctive and immediate judgment concerning the truth of a statement, with no regard to logic or fact (Newman, Garry, Bernstein, Kanter & Lindsey, 2012). Truthiness can be conceptualized as a "gut instinct" or a feeling-based judgment regarding the accuracy of the claim, as opposed to using analytical or critical thinking.

Recent research has shown that a photo can influence a person to believe a claim is true, even if the photo used is non-probative (Newman et al., 2012; Newman, Unkelbach, Lindsay, & Nash, 2015). A non-probative photo is a photo that is related to the claim yet brings no direct evidence to the truth of that claim. For example, participants are more likely to believe the claim: "The liquid inside a thermometer is magnesium" is true if it is paired with a photo of a thermometer than if the claim is shown by itself (Newman et al., 2012; Fenn, Newman, Pezdek, & Garry, 2013; Newman et al., 2015). The photo of a thermometer is non-probative because it provides no evidence as to the exact liquid used in the thermometer (Newman et al., 2015). Nonprobative photos impact perceptions of truth, a finding which has recently been used as a strategy to increase truth judgments towards claims.

In the first study that investigated truthiness, participants were shown a list of familiar and unfamiliar celebrities, half of whom were alive (Newman et al., 2012). Names were either

accompanied with a photo of the celebrity or were presented without a photo. Half the participants were asked to quickly respond “true” or “false” to the claim: “This person is dead” while the other half responded to the claim: “This person is alive.” Truth biases (*c*) were calculated with Signal Detection Theory (Stanislaw & Todorov, 1999), which is used to measure the way decisions are made when under conditions of uncertainty. In truthiness studies, the criterion (*c*) is the bias to say “true” to claims. The bias to say true to claims paired with photos is compared to bias to say true to claims absent of photos. Newman et al. (2012) results indicated that participants were more biased to say that the claim was true if a photo was presented with the name than if the photo was absent. Moreover, photos increased truth judgments for both “This person is alive” claims and “This person is dead” claims, illustrating that photos bring about a “truthiness effect” for both types of claims, and not just an “aliveness effect” or a “deadness effect”. This effect was larger for unfamiliar names than for familiar names, suggesting that photos may have a greater impact on truth judgments when faced with an unknown claim. In a second experiment, verbal descriptions (e.g. ethnicity, sex, hair color, career related nouns) of the celebrities were introduced. Verbal descriptions increased truth judgments towards claims, which indicates that the truthiness effect is not solely reliant on photographs (Newman et al., 2012).

The truthiness effect can be generalized amongst different types of claims and has also been found to have lasting effects on memory. (Newman et al., 2012, Fenn et al., 2013). In one experiment which investigated the generality of the truthiness effect, participants were asked to judge several trivia claims (e.g. turtles are deaf). Half of the claims presented were true, while the other half were false. Difficulty of claims was also manipulated. Half the claims presented were easy (answered accurately 80%-100% of the time), whereas the other half were difficult

(answered accurately 40%-60% of the time). All claims either appeared with a nonprobative photo (e.g. a turtle) or were presented without one. In alignment with the previous experiment, participants believed claims paired with photos to be true, more so than claims presented without photos. A follow up analysis revealed that the effect was larger for difficult claims than for easy claims. Both sets of findings suggest that the presence of nonprobative photos can affect people's judgments towards many different types of true and false claims and is most pronounced when claims are not well known. Furthermore, this truthiness effect has been found to "stick" over time (Fenn et al., 2013). Specifically, participants had a standard photo/no-photo truth judgment task involving 32 trivia claims and then came back 48 hours later to make judgments on the same trivia claims, however no photos were presented during the second session. Seeing claims a second-time increased overall truth rating, a result which corresponds with previous research that shows repeated statements can increase truth judgments (Bacon, 1979). Additionally, truth bias (bias to say "true" to claims) was higher for claims that were previously paired with photos than for claims that were previously absent photos, providing evidence that brief interactions with nonprobative pictures may have lasting effects on memory.

The truthiness effect is hypothesized to be driven by one of two heuristics; confirmation bias and fluency (Newman et al., 2012). Heuristics are mental shortcuts used to relieve cognitive load and speed up cognitive processing when making decisions or coming to satisfactory solutions. Heuristics are thought to be a quick and intuitive forms of reasoning, which are often utilized under conditions of uncertainty (Tversky & Kahneman, 2005). Borrowing from confirmation bias, one hypothesis suggests that people search the photo looking for evidence that confirms their belief that the claim is true. This heuristic has been theorized to occur in order to free up cognitive availability because falsifying a claim takes more energy than confirming a

claim (Nickerson, 1998). Confirmation bias, in general, decreases when individuals are asked to provide reasoning against their initial belief, indicating that individuals automatically search for consistent evidence over inconsistent evidence (Kunda, 1990).

The second hypothesis suggests that fluency might be the main contributor behind the truthiness effect. Fluency is the ease with which information is perceived, processed, and retrieved (Jacoby & Whitehouse, 1989). Photos may increase fluency since it provides semantically related context to the claim. This context can increase the ease of processing of the claim. Photos can also enable one to retrieve many related thoughts and images to mind. These related thoughts and images might be mistaken for familiarity, which could influence a participant to believe a claim is true, rather than false (Begg, Anas, & Farinacci, 1992; Whittlesea, Jacoby, & Girard, 1990). Photos are not the only stimuli that can increase fluency. In fact, a large body of research has focused on the manipulation of different stimuli in order to increase ease of processing and bring about a feeling of truth in participants. For example, repeated statements are presumed to be truer in comparison to statements that are only presented once (Hasher, Goldstein, & Toppino, 1977), and statements presented in high color contrast are rated true more than those presented in low color contrasts (Reber & Schwarz, 1999). Newman (2014) found that when claims were paired with names, truthiness increased for names that were easier to pronounce than for names that were harder to pronounce. Furthermore, nonprobative information that makes future events easier to picture can influence participants to believe that the event is more likely to occur (Newman et al., 2016). People are more likely to believe they will contract a disease when symptoms were easier to imagine (e.g. headaches, low energy) than when they were harder to imagine (e.g. inflamed liver, malfunctioning nervous system) (Sherman, Cialdini, Schwartzman, & Reynolds, 1985). These studies add to a growing body of

research which shows that accompanied information that increases the ease of processing can bias an individual towards believing a claim or statement is true.

Ease of processing has also been found to be associated with positive emotional affect. In a study conducted by Winkielman & Cacioppo (2001), participants viewed pictures of everyday objects while also being evaluated with facial electromyography (EMG) software. At the same time, participants were asked to self-report their emotions to each stimulus. The cognitive processing of pictures was manipulated by presenting a contour prime that either matched or mismatched the photo. Pictures that were easier to process elicited positive emotions, more so than pictures that were harder to process. However, pictures that were harder to process did not influence self-reports or EMG results of negative emotion.

Photos can also have an impact on claims involving positive outcomes. In one study, participants were asked to judge claims that either made a positive or negative future prediction concerning the price of an item. Half of the claims presented were paired with a nonprobative related photo. For example, a picture of thyme paired with the positive claim, "This commodity is likely to increase in price," or with the negative claim, "This commodity is likely to decrease in price." Photo presence was manipulated within-subjects and claim outcome was manipulated between-subjects. Truthiness effects were observed when pictures were presented with positive future outcomes. However, no effect was found when pictures were presented with negative future outcomes (Newman, Azad, Lindsay, & Garry, 2016). It is suggested that this effect occurred for the positive claims, more so than the negative claims, because feelings of ease are innately positive, thus claims that make people feel good will influence participants to predict the future through a positive lens. Findings imply that feelings of ease selectively increased truthiness towards positive claims (Cardwell, Henkel, Garry, Newman, & Foster, 2016).

Additionally, if the photo presented promotes the learning of a new concept, participants are likely to evaluate related information in a positive light. In a study where participants evaluated several fictitious wines, people gave more positive ratings of wines when a photo that depicted a noun in the wine name was also presented (Cardwell, Newman, Garry, Mantonakis, & Beckett, 2017). For example, the wine name “Yellow Rick” was paired with a photo of a haystack (hayrick is another word for haystack). The photo of the haystack helped facilitate learning of the noun “Rick”. The learning of new words and concepts is suggested to be inherently positive. This positive feeling can become misattributed to the wine itself, therefore increasing positive ratings towards the wine. These findings are consistent with the fluency account that photos increase the ease of processing and mislead people into believing relevant claims that accompany them.

Photos that help the ease of processing may prompt participants to believe a claim is true, especially when the facts are not available at the time of assessment (Newman et al., 2012). In contrast, photos that decrease the ease of processing may prompt participants into believing a claim is false, thus bringing about a “falsiness” effect (Newman et al., 2015). Taking this into account, disfluent photos may bias an individual into believing a claim is wrong. One way to disrupt the ease of processing by using photos is to pair a tangential photo with a claim. For example, the claim: “The liquid inside a thermometer is mercury” paired with a picture of a lizard should disrupt fluency, make the claim harder to process, and bring about a falsiness effect. However, the context in which photos appear has an important role in determining the ease in which information is processed. An item deemed “easy” or “hard” to process depends on the comparison between that item and the other items in the study.

Newman and colleagues (2015) took context into consideration and manipulated the set-up of the experimental design as a way to further understand truthiness and falsiness. In the first four studies, all participants saw three conditions of photos: related photo, unrelated photo, and no photo. As expected, related photos increased truthiness more so than no photos. However, unrelated photos did not produce falsiness. Instead, they displayed a similar effect as the non-photo trials. The researchers suggested that because participants saw related photos, they developed an expectation that all photos should be semantically related to the claim. Consequently, any photos that are not semantically related to the claim are ignored. Since viewing both related and unrelated photos in the same session discredited unrelated photos and did not produce falsiness, Newman et al. (2015) conducted a manipulation to see if falsiness would occur when participants only saw unrelated photos mixed with no photo in a session. A mixed-design was administered in which photo presence was displayed within-subjects and relatedness was displayed between-subjects. Related photos increased truthiness. However, unlike the first few experiments, unrelated photos *did* promote falsiness towards the claims. This finding fits with the disfluency account, showing that the unrelated photos disrupted cognitive processing and led participants into believing that the claim was false, but this effect only occurred when related photos were absent from the condition. That is, the effect of unrelated photos depended on the experimental context in which they appeared.

Lastly, Newman et al. (2015) conducted a single-factor (photo: related photo, unrelated photo, no photo) between-subject design, which eliminated the participant's ability to make comparisons between photo relatedness conditions. With no backdrop to judge whether a claim is more fluent or disfluent than other claims, it is not surprising that neither truthiness nor falsiness occurred. This further builds the concept that pictures increase truthiness (or falsiness)

felt towards a claim because they are being compared to claims that are not paired with pictures. It is only when participants evaluate their processing experiences with photos against a benchmark of their experiences without photos, that truthiness or falsiness can occur.

This finding may build an argument against the confirmation bias hypothesis, which should not necessarily require relative judgment. If confirmation bias was utilized, then there should have been a truthiness effect when comparing participants who saw only related photos to participants who didn't see any photos. The photos should have facilitated a truth bias, regardless of context. However, in the Newman et al. (2015) pilot study, a small number of participants provided think-aloud narratives while answering each claim. In one instance, while judging the claim "Macadamia nuts are in the same evolutionary family as peaches" one participant looked at the picture of macadamia nuts and said, "I'm going to go with yes because they kind of look like peaches, so that would make sense." This suggests that the participant trawled through the photo and looked for evidence to support the claim, which supports the confirmation bias argument. It could be the case that truthiness is based on a combination of cognitive mechanisms, but based on the literature, it seems that fluency and context are more influential factors.

The research consistently shows that increased ease of processing is related to higher ratings of truth, preference, and positive affect (Cardwell et al., 2017; Fenn et al., 2013; Newman et al., 2012; Newman et al., 2015; Newman et al., 2016; Winkielman & Cacioppo, 2001). Heuristics, which are cognitive shortcuts used to form judgments and make decisions, are also used as a means to make cognitive processing more fluent, especially under circumstances of high cognitive load and restricted response time. The aim of the current study is to examine if engaging participants in heuristic processing will also increase the effect photos have on truth

judgments. In other words, the aim is to test whether manipulations that increase the use of heuristics can boost the truthiness effect.

Pilot Study

A pilot study was first conducted to ensure that the truthiness effect could be replicated before investigating ways to boost the effect. 40 undergraduate psychology students from Seton Hall University participated in a study involving trivia claims. The experiment was designed as a 2 (photograph: yes, no) x 2 (trivia claim: true, false) within-subjects design. The photographs presented depicted the grammatical subject of each claim, yet provided no evidence regarding the truth of the claim. Proportions of times participants responded true to claims was calculated and then mean differences between photo and no photo conditions were calculated for both true and false claims (see Figure 1). Photos had a minor effect on truth judgments. Additionally, participants' bias (c) to say the claim is true was calculated (Stanislaw & Todorov, 1999). Truth bias was slightly more negative for photos ($c = -0.223$) than no photos ($c = -0.206$), indicating that pairing a claim with a photo may have marginally influenced participants to respond that the claim was true (see Figure 2). Previous research has found a similar truth bias for claims presented with photos (Newman et al., 2012). However, the effect size for the pilot study was not as robust as the effect size in Newman et al., (2012) study which was closer to $c = -0.05$.

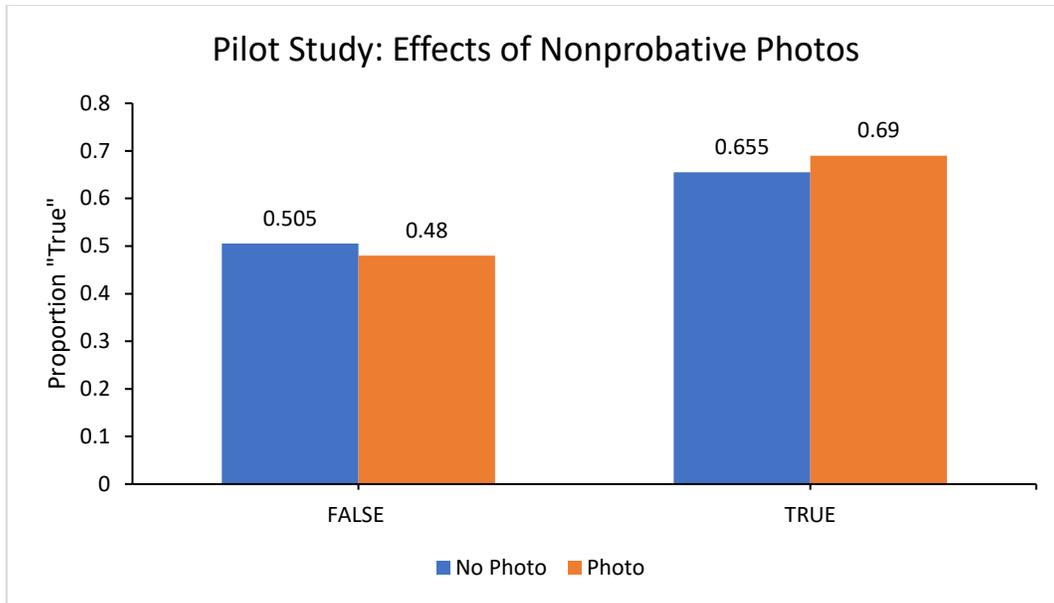


Figure 1. Proportion “True” as a Function of Claim Truth and Photo Presence or Absence

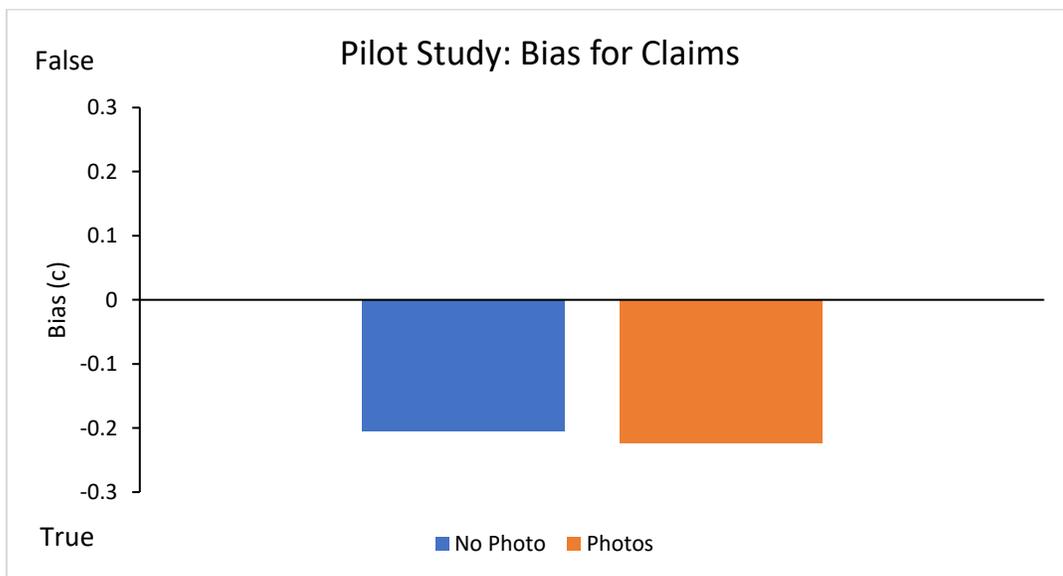


Figure 2. Truth Biases for Claims as a Function of Photo Presence or Absence

The Current Study

The current research focused on achieving two main outcomes. First, to replicate the finding that nonprobative photos promote a truthiness effect when judging trivia claims. Second, to discover if engaging in enhanced heuristic processing will boost this effect. Most truthiness studies have only looked for the presence or absence of the truthiness effect. Few have investigated specific factors that might increase this effect. The current research explored different ways to enhance the effect photos have on truth biases, therefore furthering our understanding and adding to the growing body of research involving the truthiness effect.

Investigating How Cognitive Load And A Fixed Time Influences Truthiness

In attempt to increase the truthiness effect, the current study investigated two factors that have been previously implemented to increase heuristic use. Two separate manipulations were conducted in which participants either engaged in a cognitive load task or a fixed response task.

Cognitive Load

Heuristics are used as a way to free up cognitive ability. When cognitive load is high, people tend to rely more heavily on heuristic processing (Evans & Stanovich, 2013). Moreover, the inhibition of intuitive reasoning takes cognitive capacity. When participants are in a high cognitive load condition, they are overloading their working memory capacities, thus making it less likely for them to engage in analytical thinking and impairing their ability to inhibit intuitive responses (Evans & Stanovich, 2013).

A widely-adopted way to manipulate cognitive load is to require participants to memorize a set of numbers throughout an experiment (Hinson, Jameson, & Whitney, 2003; Lee, Amir, & Ariely, 2009). A low cognitive load condition generally requires the memorization of a 3-digit

code, whereas a high cognitive load condition requires the memorization of a 6-10-digit code. Variations depend on the nature of the experimental task at hand and how taxing researchers want to be on participant's working memory. Prior research has suggested that a high cognitive load can increase participant's likelihood to rely on intuitive and emotional responses. In one study looking at participant's preferences of consumer products, participants tended to be more consistent in their choices if they were in a high cognitive load condition than in a low cognitive load condition, suggesting that people make quick, impulsive decisions when asked to retain external information (Lee et al., 2009). High cognitive loads have also been found to decrease the value of delayed monetary rewards, which suggests that a high cognitive load can be predictive of impulsive-decision making (Hinson et al., 2003).

Fixed Time

Analytical thinking takes time whereas, heuristic processing is a quick automatic response that is vulnerable to biases (Evans, 2013). Short response times have been correlated with faulty probability judgments and intuitive thinking. In contrast, long response times have been correlated with deliberation and consideration of alternative views (Alós-Ferrer, Garagnani, & Hügelschäfer, 2016). Previous research has suggested that under time pressure, participants tend to opt for heuristic strategies. Moreover, those who initially utilized analytical processing, abandoned it, and switched to using heuristic shortcuts (Reverberi, Rusconi, Paulesu, & Cherubini, 2009). Thus, enforcing a limit on participant's response time was predicted to interfere with analytical thinking, boost heuristic processing, and increase the truthiness effect. In the current study, participants in the fixed response time manipulation were given 4 seconds to respond to each claim. The claim disappeared and moved onto the next claim if participants did not answer within the given amount of time. Four seconds was chosen after analysis of reaction

times for cognitive load and control conditions. Average reaction time for cognitive load was approximately 5.5 seconds and average reaction time for control condition was approximately 5.3 seconds (See Table 3). Therefore, 4 seconds was chosen as a time frame, so participants could experience a pressure to respond quickly while also having enough time to read and respond to each claim before it disappeared.

Cognitive Reflection Task

The Cognitive Reflection Task (CRT) was administered before the experiment began in order to see if there was a truthiness effect in those who show a predisposition for heuristic thinking. The Cognitive Reflection Test is used to measure one's inclination to rely on intuitive or analytical thinking (Frederick, 2005). The test is composed of three problem-solving questions that each have an incorrect intuitive answer. For example, the first question states: A bat and a ball cost \$1.10. The bat costs \$1.00 more than the ball. How much does the ball cost? The automatic and intuitive answer maybe "10 cents" however, the correct response is "5 cents". The correct answer requires suppression of the impulsive answer that automatically springs to mind. Participants who score low on the CRT are thought to engage in intuitive thinking, whereas participants who score high on the CRT are thought to engage in analytical thinking. In application to the current study, it was hypothesized that the truthiness effect would be more likely to occur if a participant is actively engaging in intuitive cognitive processing, more so than analytical cognitive processing.

Method

Participants

Participants consisted of 337 Seton Hall University students who volunteered to take part in the study. Credit was assigned to those in undergraduate psychology courses. For the final analysis there were 100 participants in the cognitive load condition, 109 participants in the fixed response time condition, and 128 participants in the control group.

Apparatus

All stimuli were presented on Lenovo computers using E-Prime 2.0 software. Students were asked to interact with a keyboard connected to the computer.

Design and Procedure

The study was a 2 (photograph: yes, no) x 2 (trivia claim: true, false) x 3 (task group: cognitive load, time pressure, or control) mixed-subject design. Photograph and trivia claim were manipulated within-participants and task was manipulated between-participants.

Upon arrival, participants were placed at one of two computers and asked to fill out a consent form before they began the study. Participants first took the Cognitive Reflection Test which consisted of three questions. After completion, they were told that they will see a series of claims and that their task will be to decide the truth of each claim by using the yes/no keys on the keyboard. All photographs used in the experiment were non-probative photos corresponding to the grammatical subject of each claim and had been used in prior studies (Newman, 2012) or were collected from an open source image database. 60 trivia claims appeared individually, in large black font against a white background. Additionally, after every claim was judged,

participants were asked, on an additional slide, how confident they were in their answer. They used a scale from 1-4 to answer: 1= Not Confident, 2= A Little Confident, 3= Moderately Confident, 4= Very Confident.

In past studies involving trivia claims, half of the claims presented were true and the other half false. However, the trivia claims themselves were not counterbalanced to be true in some cases and false in others. In the current study, every trivia claim had two versions of itself, and were presented between-subjects. For example, the trivia claim: “Turtles are deaf” had a second version claiming, “Turtles can hear.” Counterbalancing the claims ensured that the claims themselves did not have an effect on truth judgments. Since pictures are predicted to influence the participant, truthiness should be evident regardless of the claim version being shown.

The counterbalance of trivia claims, trivia versions, and presence of photograph resulted in 12 conditions to which participants were randomly assigned during a session. However, due to differences in programming of the studies and the need to establish a baseline from which to assign the correct value for time pressure, the cognitive load and control conditions were run before the time pressure participants. Within a testing session, the order of trivia claims was randomized.

Participants engaging in the high cognitive load condition were asked to memorize a 6-digit number throughout the study and to report this number after every 10 claims. Those engaging in the fixed response time condition were asked to respond to each claim within 4 seconds. The control group were not asked to memorize any numbers and could proceed through the study in a self-paced manner.

Results

A 2 (photograph: yes, no) x 2 (trivia claim: true, false) x 3 (task group: cognitive load, fixed response time, control) ANOVA revealed a main effect of photos; nonprobative photos produced truthiness ($M = .567, SE = .006$), relative to no photos ($M = .545, SE = .007$), $F(1,334) = 8.875, (p = .003, \eta p^2 = .026)$. There was also a main effect of truth; true claims increased truth rating ($M = .627, SE = .007$), relative to false claims ($M = .485, SE = .007$), $F(1,334) = 256.19, (p = .000, \eta p^2 = .434)$. There was a main effect of task type, $F(2, 334) = 6.716, \eta p^2 = .039$. No interaction was found between photo and truth, $F(1,334) = .129, (p = .719, \eta p^2 = .000)$ or photo and task manipulation $F(2,334) = .401, (p = .670, \eta p^2 = .002)$. Furthermore, no interaction was found among photo, truth, and manipulation, $F(2,334) = 1.979, (p = .140, \eta p^2 = .012)$. However, a visual inspection of the data revealed that the main effect of photo was not consistent across groups (see Figure 3). Post-hoc paired sample t-test revealed that the control group displayed a truthiness effect for true photos, $t(127) = 3.180, p = .002, d = .28$, but not for false photos, $t(127) = .463, p = .644, d = .04$. There was no truthiness effect for high cognitive load group for either true $t(99) = .533, p = .595, d = .05$, or false photos $t(99) = 1.551, p = .124, d = .12$. Similarly, there was no truthiness effect for fixed response time for either true $t(108) = .451, p = .653, d = .04$, or false photos $t(108) = 1.332, p = .186, d = .13$. Furthermore, correlations were conducted between confidence scores and overall truthiness ratings for true claims and false claims. Only confidence scores where participants responded “true” to a claim was analyzed. There was a significant positive correlation between confidence scores for true claims paired with photos and the overall truthiness towards true claims (inclination to respond true towards true claims), $r(333) = .121, p = .027$. No significance was found when confidence ratings concerning true

claims that were absent photos was analyzed, $r(333) = -.045, p = .416$. Two data points were excluded from analysis due to recording error of confidence scores.

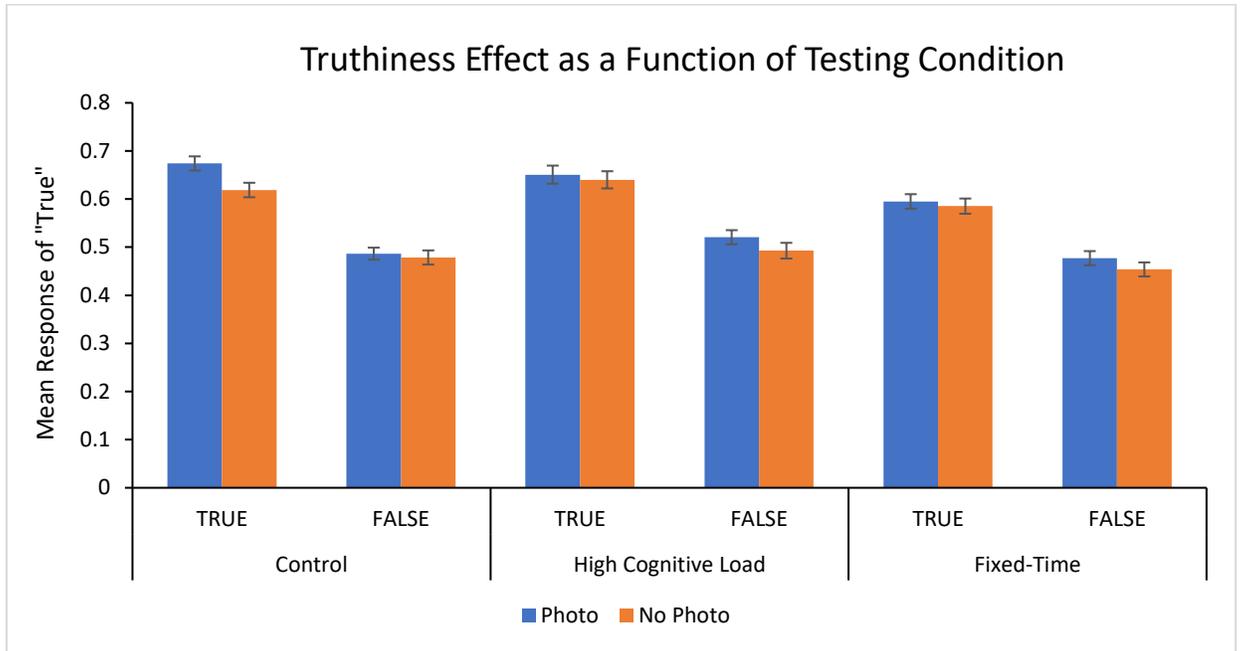


Figure 3. Truthiness Effect as a Function of Testing Condition.

Error bars represent standard error.

Table 1.

Means and Standard Error for “True” responses as a function of testing condition, claim truth, and photo presence or absence.

Control			
		<i>M</i>	<i>SE</i>
True	Photo	0.67	0.015
	No Photo	0.62	0.015
False	Photo	0.49	0.013
	No Photo	0.48	0.015
High Cognitive Load			
		<i>M</i>	<i>SE</i>
True	Photo	0.65	0.019
	No Photo	0.64	0.018
False	Photo	0.52	0.015
	No Photo	0.49	0.016
Fixed-Time			
		<i>M</i>	<i>SE</i>
True	Photo	0.6	0.015
	No Photo	0.59	0.016
False	Photo	0.48	0.015
	No Photo	0.45	0.015

Participants bias (c) to say the claim is true was also calculated (Stanislaw & Todorov, 1999). Visual inspection of groups suggests a truth bias that is more negative for photos than no photos, in control group, ($c^{\text{Photo}} = -0.207$, $c^{\text{No photo}} = 0.128$); cognitive load group, ($c^{\text{Photo}} = -0.218$, $c^{\text{No Photo}} = -0.167$); and fixed time group, ($c^{\text{Photo}} = -0.102$, $c^{\text{No Photo}} = -0.051$), (see Figure 4).

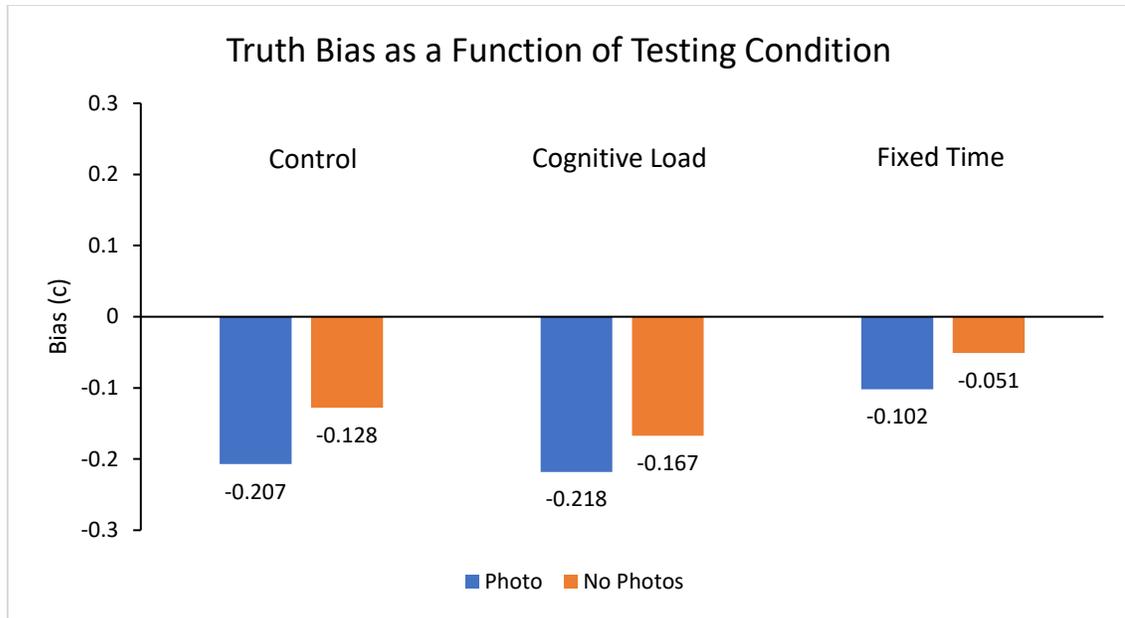


Figure 4. Truth Bias as a Function of Testing Condition

To further investigate how heuristic use affects truthiness ratings, data were split into participants who scored a 0 on the CRT and participants who scored 1 or above on the test. 196 participants who scored a 0 on the CRT were selected for analysis in order to determine if the truthiness effect was boosted by those prone to heuristic thinking. The result of this analysis was a significant 3-way interaction among photo, truth, and manipulation. $F(2,193) = 3.423$, ($p = .034$, $\eta p^2 = .034$), which reflected a data pattern consistent with that observed in the analysis of the full data set. Similar to the full data set, a paired sample t-test indicated a truthiness effect in the control condition for true claims, $t(75) = 2.620$, $p = .011$, $d = .3$, but not for false claims $t(75) = -.611$, $p = .543$, $d = -.07$ (see Figure 4, Table 2). There was no truthiness effect during the cognitive load manipulation for either true $t(53) = -.387$, $p = .700$, $d = -.05$, or false claims $t(53) = .708$, $p = .482$, $d = .10$. Furthermore, those who scored a 0 in the CRT task did not display any truthiness effect during the fixed response time manipulation for true $t(65) = -.716$, $p = .477$, $d = -.09$, or false claims $t(65) = .900$, $p = .372$, $d = .11$. A paired sample t-test was also conducted for

those who scored a 1 or higher on the CRT. Analysis indicated that there was no truthiness effect for true or false claims during cognitive load, fixed time, or control condition. Moreover, correlations were conducted between intuitive thinker's confidence scores and overall truthiness ratings for true claims and false claims. Only confidence scores where participants responded "true" to a claim was analyzed. There was no correlation between confidence scores for true claims paired with photos and the overall truthiness towards true claims, $r(193) = .080, p = .269$. Additionally, no significance was found when confidence ratings concerning true claims that were absent photos was analyzed, $r(193) = -.072, p = .314$. The correlation from the full data set remained significant for those participants who scored higher than a 0 on the CRT, $r(138) = .172, p = .042$.

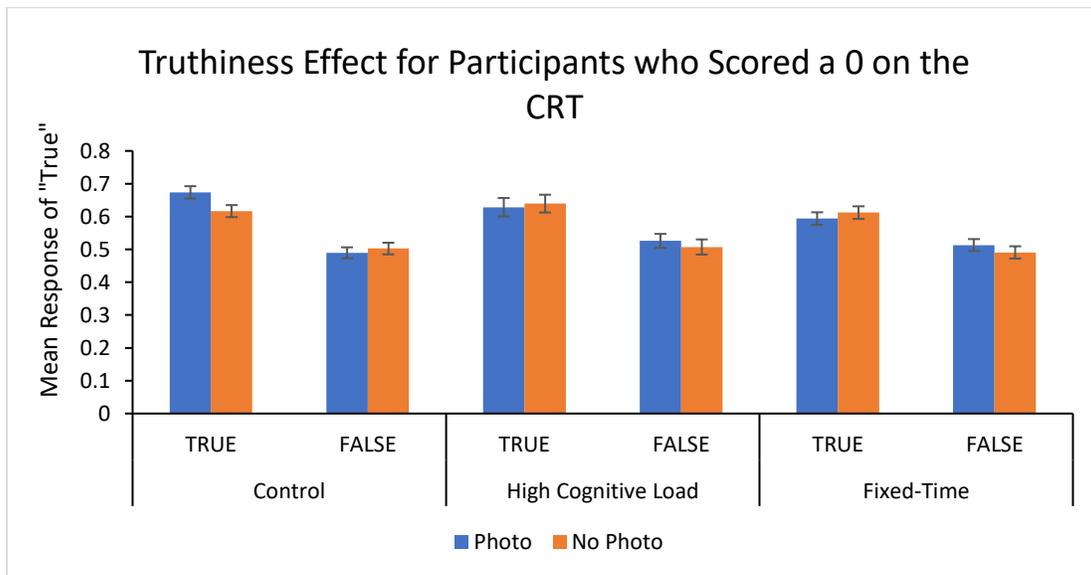


Figure 5. Truthiness Effect for Participants who Scored a 0 on the CRT

Error bars represent standard error

Table 2.

Means and Standard Error for “True” responses when participants scored a 0 on the CRT.

Control			
		<i>M</i>	<i>SE</i>
True	Photo	0.67	0.019
	No Photo	0.62	0.018
False	Photo	0.49	0.016
	No Photo	0.50	0.017
High Cognitive Load			
		<i>M</i>	<i>SE</i>
True	Photo	0.63	0.028
	No Photo	0.64	0.027
False	Photo	0.53	0.021
	No Photo	0.50	0.023
Fixed-Time			
		<i>M</i>	<i>SE</i>
True	Photo	0.59	0.019
	No Photo	0.61	0.019
False	Photo	0.51	0.018
	No Photo	0.49	0.019

Participants bias (c) to say the claim is true was also calculated (Stanislaw & Todorov, 1999). Visual inspection of groups suggests a truth bias that is more negative for photos than no photos in control group, ($c^{\text{Photo}} = -0.207$, $c^{\text{No Photo}} = 0.153$) and cognitive load group, ($c^{\text{Photo}} = -0.204$, $c^{\text{No Photo}} = -0.179$). Fixed-time group has similar true biases, ($c^{\text{Photo}} = -0.126$, $c^{\text{No Photo}} = -0.127$), (see Figure 6).

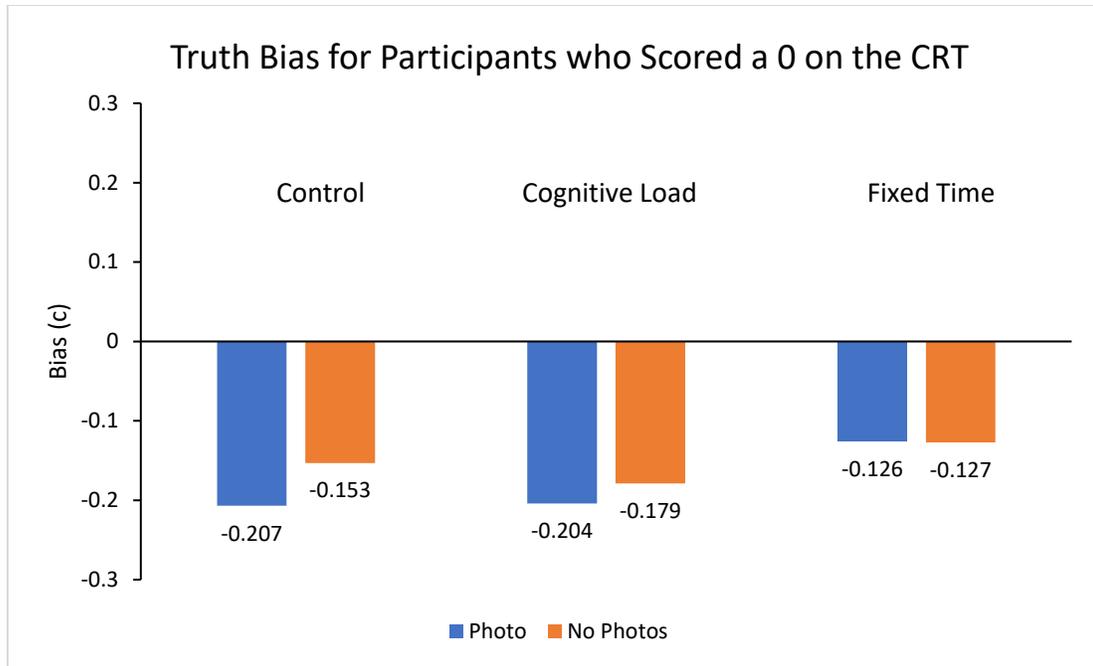


Figure 6. Truth Bias for Intuitive Thinkers

Average reaction times of truth judgments were calculated for each task manipulation. All reactions times less than 1 second were excluded from analysis. The control condition yielded a mean reaction time of approximately 5.3 seconds when photo was present or absent. Average reaction times in high cognitive load condition were approximately 5.5 seconds when photo was present and 5.6 seconds when photo was absent. Fixed-time condition resulted in an average reaction time of 2.8 seconds when photo was present or absent. Results display that a fixed-time condition resulted in faster reaction times than the high cognitive load or control condition (see Table 3).

Table 3

Mean reaction time in milliseconds as a function of testing condition and photo presence or absence

Average Reaction Time in Milliseconds		<i>M</i>	<i>SD</i>
Control	Photo	5269	3868
	No Photo	5300	4198
High Cognitive Load	Photo	5492	4188
	No Photo	5557	4759
Fixed-Time	Photo	2760	786
	No Photo	2769	775

Note. All reaction times less than 1000 milliseconds were excluded from analysis.

Discussion

Truthiness is a recent area of research that focuses on instinctive judgments of truth. One way of studying truthiness is to observe the influence of photographs. Past research has shown that simply displaying a related photo can impact our evaluation of what is true and what is not true (Newman et al., 2012; Fenn et al., 2013; Newman et al., 2015). It has been hypothesized that this effect occurs because photographs can make claims easier to process, while also enabling one to retrieve related thoughts and images to mind, which can then be mistaken for familiarity and truth (Cardwell et al., 2017; Newman et al., 2012; Fenn et al., 2013; Newman et al., 2015; Newman et al., 2016). These findings are important to be aware of when judging the accuracy of everyday claims, especially when making judgments towards claims found in news or social media outlets. In the current study, photos were found to increase the likelihood of participants saying yes towards claims but only during a standard test condition. This finding contributes more evidence towards the influence photos have on truth rating. However, photos only had an influence on truth judgments for true claims. In general, true claims increase the rate of true responses. Perhaps there was an additive effect of the claim being true and the claim being paired with a relevant photo that may have influenced the truthiness effect to occur for true claims more so than false claims.

Cognitive load and response time manipulation were two factors that had not been investigated in the truthiness literature. An increase in cognitive load and a limit on response time was predicted to influence participants to engage in heuristic processing (Alós-Ferrer et al., 2016; Evans & Stanovich, 2013; Hinson et al., 2003; Lee et al., 2009; Reverberi et al., 2009), thus increasing truth bias towards claims paired with photos more so than those in a control condition. Results revealed that only the control group displayed an increase in truth bias when

asked to judge true photos. It has been suggested that photos provide context towards the claim by enabling one to retrieve related thoughts and images to mind, thus increasing familiarity and subsequently a feeling of truth (Cardwell et al., 2017; Newman et al., 2012; Fenn et al., 2013; Newman et al., 2015; Newman et al., 2016). Perhaps an increase of cognitive load did not allow participants to bring related concepts to mind due to limited cognitive availability. In other words, participants who were using up their working memory may have not had the cognitive capacity to allow for photos to influence their truth ratings. It is possible that participants may have paid less attention to the photos in order to keep the 6-digit number in their head during the cognitive load condition. Furthermore, those in the fixed response time condition may have ignored the photos due to the heightened pressure to respond to the claim before time ran out. These findings suggest that both cognitive load and fixed response time diminished the truthiness effect for trivia claims. Only in the control condition were photos found to have an effect on truth ratings. Participants prone to heuristic thinking did show a truthiness effect in comparison to those who were prone to be analytical thinkers, but only for true claims. This may suggest that an inclination for intuitive thinking boosts the effect photos have on truth judgments. However, this effect was only found in the control condition. Furthermore, a positive correlation was found between confidence scores for true responses towards true claims paired with photos and overall truthiness effects for true claims. This suggests that participants were more confident in their answer of a claim being true when they were presented with a true claim paired with a related photo. This may imply that photos influence on confidence ratings are associated with whether the claim is true. True claims bring about a greater sense of confidence in truth judgments when a photo was also present. The correlation between true responses to true claims paired with photos and truth judgments disappeared when only those who scored a 0 on the CRT were

analyzed. The truthiness effect was apparent in intuitive thinkers but displayed no significant relation to confidence ratings toward claims. The opposite set of results was found for those who scored higher than a 0 on the CRT. This may indicate that truthiness effects are not associated with confidence scores in intuitive thinkers and that the photo does not increase confidence in those participants more likely to show a truthiness effect.

Signal detection in all participants visually displayed a higher truth bias when photos were present than when photos were absent in all conditions. However, intuitive thinkers only visually displayed this difference in the high cognitive load and control condition. The fixed time condition resulted in similar biases to say true to a claim, regardless of photo presence, which may suggest that the fixed time condition diminished the effect photos have on truth ratings more so than the high cognitive load and control condition. Photos may have been ignored more in the fixed time condition than the high cognitive load condition. Furthermore, response times for each group suggests a lot more variance in the high cognitive load and control group than the fixed time group. Large standard deviation indicates that some participants are fast responders whereas others are slow responders. Future research could investigate the relationship between response time and truthiness. Fixed time condition resulted in a smaller standard deviation. This is likely due to the time pressure to respond quickly in the fixed time condition. High cognitive load and control groups were both self-paced. This extra time may have allowed for photos to have a greater influence on truth judgments and may explain why photos did not influence signal detection bias to say true to claims in the fixed time condition.

In terms of confirmation bias, an increase in cognitive load and fixed reaction times may have not allowed for participants to trawl through the photo to search for evidence that the claim is true. Thus, the current studies results may highlight on the importance of giving participants

adequate time and cognitive availability to be able to look at the photo. However, participants may not have been searching the photo for evidence that the claim is true. Another possibility is that the photo helps increase the fluency of bringing related thoughts and images to mind. Cognitive load and fixed time response have been previously used as a way to increase fluency effects (Alós-Ferrer et al., 2016; Evans & Stanovich, 2013; Hinson et al., 2003; Lee et al., 2009; Reverberi et al., 2009). However, the current results suggest that these two mechanisms diminished the truthiness effect. This may indicate that either fluency is not a factor involved in truthiness or that the cognitive load and fixed time manipulations used to increase fluency and heuristic processing may not apply to the truthiness effect. Other ways to increase fluency by ways of making it easier to bring related thoughts and images to mind may yield better results than the two manipulations used in this study (cognitive load and fixed response time). Overall, it is still unclear what heuristic mechanism is driving the truthiness effect. Cognitive load and fixed time have previously been found to increase intuitive thinking, however regarding truthiness, the manipulations may have blocked the process of trawling through photos to look for evidence that the claim is true, as well as blocked the ability to bring related thoughts and images to mind.

Further investigation into factors that have been previously shown to help bring related thoughts and images to mind should be considered. Future research may include a repeated measures study, which has been previously found to increase the truthiness effect (Fenn, et al., 2013). Participants may be inclined to believe the claim is true based solely on the familiarity of the photo, instead of the factual integrity of the claim. Moreover, using photos that induce emotional feelings may increase the likelihood of believing the claim is true. For example, using photos of cute animals may influence an individual to look at the claim in a positive light,

therefore increasing the probability of believing the claim is true. Using photos that are relevant to today's society may also have a bigger effect on truth rating than using photos related to random trivia facts. For example, using photos that are related to facts involving school, politics, or popular media items may catch participant's attention and allow them to more readily bring related thoughts and images to mind. Lastly, perhaps using more than one photo or instructing participants to purposely think of related images may increase truthiness towards claims paired with photos.

A number of limitations should be considered in regard to this study. First, participants in this study were undergraduate college students, thus caution should be used when generalizing these findings to the public (Henrich, Heine, & Norenzayan, 2010). There also may be some confounding variables involved with the Cognitive Reflection Task. Participants may have come across the questions in the past, thus their answers would not be indicative of analytical thinking, only accurate recall. Future research may include an additional question that asks the participant if they have previously come across any of the questions presented in the CRT. Moreover, many participants showed their work on the CRT but still got the question wrong. The display of work may suggest the use of analytical thinking. However, these individuals were considered as intuitive thinkers because their response was inaccurate. Future analysis may consider assessing for any type of analytical reasoning, even if the final response was incorrect. Lastly, two possible factors within the study may have altered participants way of thinking. First, the CRT is composed of possible thought-provoking questions that may have primed participants to engage in an analytical midframe, which in turn, could have worked against the task manipulations which were set in place to increase intuitive thinking (Alós-Ferrer et al., 2016; Frederick, 2005). A way to possibly counter this effect is to counterbalance when the CRT is presented so that half

the time participants take the CRT after completing the experiment. Second, the presentation of confidence scores after every claim may have also encouraged participants to engage in an analytical frame of mind which could have potentially decreased their reliance on using heuristics during truth judgments.

Conclusion

In summary, photos increase truth ratings for true claims during the control condition. In contrast manipulations of cognitive load and fixed time response decreased the truthiness effect for both true and false claims. The two manipulations have previously been found to increase fluency and heuristic thinking (Alós-Ferrer et al.,2016; Evans & Stanovich, 2013), therefore it was suggested that they would increase the influence of photos on truth judgments. The lack of significant results may suggest that fluency is not the sole factor involved in truthiness or that the manipulations used in the study were not sufficient enough for increasing heuristic thinking. Future research is needed to discover which factors will boost truth judgments for both true and false claims.

References

- Alter, A. L., & Oppenheimer, D. M. (2009). Uniting the tribes of fluency to form a metacognitive nation. *Personality and Social Psychology Review*, 13(3), 219-235. doi:10.1177/1088868309341564
- Alós-Ferrer, C., Garagnani, M., & Hügelschäfer, S. (2016). Cognitive reflection, decision biases, and response times. *Frontiers in Psychology*, 7: 402. doi:10.3389/fpsyg.2016.01402
- Bacon, F. T. (1979). Credibility of repeated statements: Memory for trivia. *Journal of Experimental Psychology: Human Learning and Memory*, 5, 241–252. doi:10.1037/0278-7393.5.3.241
- Begg, I. M., Anas, A., & Farinacci, S. (1992). Dissociation of processes in belief: Source recollection, statement familiarity, and the illusion of truth. *Journal of Experimental Psychology: General*, 121(4), 446-458. <http://dx.doi.org/10.1037/0096-3445.121.4.446>
- Cardwell, B. A., Henkel, L. A., Garry, M., Newman, E.J., & Foster, J. L. (2016). Nonprobative photos rapidly lead people to believe claims about their own (and other people's) pasts. *Memory & Cognition*, 44(6), 883-896. doi:10.3758/s13421-016-0603-1
- Cardwell, B. A., Newman, E. J., Garry, M., Mantonakis, A., & Beckett, R. (2017, January 12). Photos That Increase Feelings of Learning Promote Positive Evaluations. *Journal of Experimental Psychology: Learning, Memory, and Cognition*. Advance online publication. <http://dx.doi.org/10.1037/xlm0000358>

- Evans, J. St. B. T., & Stanovich, K. E. (2013). Dual-process theories of higher cognition: Advancing the debate. *Perspectives on Psychological Science*, 8(223–241), 263–271. doi:10.1177/1745691612460685
- Evans, J. St B. T. (2013). *Reasoning, Rationality and Dual Processes: Selected works of Jonathan St B. T. Evans* (1st ed.). East Sussex; London and New York; NY: Psychology Press. doi: 10.4324/9781315886268
- Fenn, E., Newman, E. J., Pezdek, K., & Garry, M. (2013). The effect of nonprobative photographs on truthiness persists over time. *Acta Psychologica*, 144(1), 207-211. doi: 10.1016/j.actpsy.2013.06.004
- Frederick, S. (2005). Cognitive reflection and decision making. *Journal of Economic Perspectives*, 19, 25–42. doi: 10.1257/089533005775196732
- Hasher, L., Goldstein, D., & Toppino, T. (1977). Frequency and the conference of referential validity. *Journal of Verbal Learning & Verbal Behavior*, 16(1), 107-112. doi:10.1016/S0022-5371(77)80012-1
- Henrich, J., Heine, S. J., & Norenzayan, A. (2010). The weirdest people in the world? *Behavioral and Brain Sciences*, 33, 61–83. <https://doi.org/10.1017/S0140525X0999152X>
- Hinson, J. M., Jameson, T. L., & Whitney, P. (2003). Impulsive decision making and working memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 29(2), 298-306. doi:10.1037/0278-7393.29.2.298
- Kunda, Z. (1990). The case for motivated reasoning. *Psychological Bulletin*, 108(3), 480-498. doi:10.1037/0033-2909.108.3.480

- Lee, L., Amir, O., & Ariely, D. (2009). In search of Homo Economicus: Cognitive noise and the role of emotion in preference consistency. *Journal of Consumer Research*, 36(2), 173-187. doi:10.1086/597160
- Newman, E. J., Garry, M., Bernstein, D. M., Kantner, J., & Lindsay, D. S. (2012). Nonprobative photographs (or words) inflate truthiness. *Psychonomic Bulletin & Review*, 19(5), 969-974. doi:10.3758/s13423-012-0292-0
- Newman, E. J., Sanson, M., Miller, E. K., Quigley-McBride, A., Foster, J. L., Bernstein, D. M., Garry, M. (2014). People with easier to pronounce names promote truthiness of claims. *PLoS ONE* 9(2): e88671. <https://doi.org/10.1371/journal.pone.0088671>
- Newman, E. J., Garry, M., Unkelbach, C., Bernstein, D. M., Lindsay, D. S., & Nash, R. A. (2015). Truthiness and falsiness of trivia claims depend on judgmental contexts. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 41(5), 1337-1348. doi:10.1037/xlm0000099
- Newman, E. J., Azad, T., Lindsay, D. S., & Garry, M. (2016). Evidence that photos promote rosiness for claims about the future. *Memory & Cognition*, doi:10.3758/s13421-016-0652-5
- Nickerson, R. S. (1998). Confirmation bias: A ubiquitous phenomenon in many guises. *Review of General Psychology*, 2(2), 175-220. doi:10.1037/1089-2680.2.2.175
- Reber, R., & Schwarz, N. (1999). Effects of perceptual fluency on judgments of truth. *Consciousness and Cognition: An International Journal*, 8(3), 338-342. doi:10.1006/ccog.1999.0386

- Reverberi, C., Rusconi, P., Paulesu, E., & Cherubini, P. (2009). Response demands and the recruitment of heuristic strategies in syllogistic reasoning. *The Quarterly Journal of Experimental Psychology*, 62(3), 513-530. doi:10.1080/17470210801995010
- Sloman, S. A. (1996). The empirical case for two systems of reasoning. *Psychological Bulletin*, 119, 3–22. doi:10.1037/0033-2909.119.1.3
- Stanislaw, H., & Todorov, N. (1999). Calculation of signal detection theory measures. *Behavior Research Methods, Instruments, & Computers*, 31, 137–149. doi:10.3758/BF03207704
- Toplak, M. E., West, R. F., & Stanovich, K. E. (2011). The Cognitive Reflection Test as a predictor of performance on heuristics-and-biases tasks. *Memory & Cognition*, 39(7), 1275-1289. doi:10.3758/s13421-011-0104-1
- Tversky, A., & Kahneman, D. (2005). Judgment under Uncertainty: Heuristics and Biases. In M. H. Bazerman, M. H. Bazerman (Eds.), *Negotiation, decision making and conflict management, Vol 1–3* (pp. 251-258). Northampton, MA, US: Edward Elgar Publishing. doi: 10.1126/science.185.4157.1124
- Whittlesea, B. W., Jacoby, L. L., & Girard, K. (1990). Illusions of immediate memory: Evidence of an attributional basis for feelings of familiarity and perceptual quality. *Journal of Memory and Language*, 29(6), 716-732. doi:10.1016/0749-596X(90)90045-2
- Winkielman, P., & Cacioppo, J. T. (2001). Mind at ease puts a smile on the face: Psychophysiological evidence that processing facilitation elicits positive affect. *Journal of Personality and Social Psychology*, 81(6), 989-1000. doi:10.1037/0022-3514.81.6.98