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# Eyewitness Memory in Adults

Carlos Manuel Vargas
*University of Texas at El Paso*, cmvargas3@miners.utep.edu

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CARLOS MANUEL VARGAS

Department of Psychology

APPROVED:

Matthew Scullin, Ph.D., Chair

Osvaldo Morera, Ph. D

James Wood, Ph.D.

Gang Lee, Ph.D.

Benjamin C. Flores, Ph.D.
Dean of the Graduate School

# EYEWITNESS MEMORY IN ADULTS

by

CARLOS MANUEL VARGAS, B.A.

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To my parents for their support all these years, to my older brothers for their words of advice through all my college years. Thank you.

# ABSTRACT

This study encompasses the areas of eyewitness misidentifications and eyewitness suggestibility by developing a Video Suggestibility and Eyewitness Identification Scale for adults. Two hundred one college students were recruited to test this novel psychometric scale following procedures loosely based on the Gudjonsson Suggestibility Scales. The two main subscales proposed are labeled True, which measures non-leading questions answered correctly, and Yield, which measures questions endorsed based on misinformation; two lineup identification subscales were also analyzed for exploration. Reliability estimates showed acceptable internal consistency of True and Yield subscales after negative feedback was provided; while reliability in Target Present Lineups increased and in Target Absent Lineups decreased after negative feedback was provided. True and Yield scores formed two separate distributions that were affected by negative feedback and question repetition. Remarkably, exploratory correlation analyses offered interesting associations between Yield and false positive responses to Target Absent Lineups. Following a criterion-shift model developed from Signal Detection Theory, Response criteria as measured by *c* were found to reflect a yes-saying bias for questions and a no-saying bias for lineups; both tendencies decreased after negative feedback was provided. On the other hand, participants showed an adequate ability to detect a correct signal compared while rejecting its absence as indexed by discrimination accuracy. The introduction of the VSEISA should be considered a work in progress and could ultimately create a potential shift in the theoretical direction of the assessment of interrogative suggestibility eyewitness' identification.

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***Table 3.1***

*Cronbach's alpha reliability estimates*

| | | | | | | Range | | |
|---|---|---|---|---|---|---|---|---|
| Subscale | *N* | *M* | *SD* | *α* | 95% CI | Potential | Actual | Skew |
| True 1 | 201 | 10.35 | 1.32 | 0.373 | (0.237, 0.494) | 0-12 | 9-12 | -0.93 |
| True 2 | 201 | 13.25 | 2.01 | 0.745 | (0.691, 0.794) | 0-15 | 0-15 | -3.82 |
| Yield 1 | 201 | 3.29 | 2.08 | 0.584 | (0.494, 0.663) | 0-15 | 0-9 | 0.51 |
| Yield 2 | 201 | 3.90 | 2.61 | 0.710 | (0.648, 0.766) | 0-15 | 0-11 | 0.44 |
| TP 1 | 201 | 2.87 | 1.94 | 0.607 | (0.519, 0.684) | 0-8 | 0-7 | 0.38 |
| TP 2 | 201 | 3.78 | 2.09 | 0.641 | (0.561, 0.712) | 0-8 | 0-8 | -0.01 |
| TA 1 | 201 | 1.91 | 1.92 | 0.695 | (0.627, 0.755) | 0-8 | 0-8 | 1.17 |
| TA 2 | 201 | 2.12 | 1.80 | 0.598 | (0.508, 0.677) | 0-8 | 0-8 | 0.72 |

Note. TP = Target Present; TA = Target Absent

***Table 3.2***

*Contrast of each subscale at round 1 and 2*

| | Time 1 | | Time 2 | | | | 95% CI | | |
|---|---|---|---|---|---|---|---|---|---|
| Variable | *M* | *SD* | *M* | *SD* | *t* | *P* | LL | UL | Cohen's *d* |
| True | 13.35 | 1.32 | 13.25 | 2.01 | -0.206 | 0.83 | -0.21 | 0.17 | -0.01 |
| Yield | 3.29 | 2.08 | 3.90 | 2.61 | -4.72 | <.001 | -0.87 | -0.36 | -0.26 |
| TP | 2.87 | 1.94 | 3.78 | 2.09 | -8.242 | <.001 | -1.12 | -0.69 | -0.45 |
| TA | 1.91 | 1.92 | 2.12 | 1.80 | -1.8 | 0.07 | -0.46 | -0.02 | -0.11 |

Note. CI = confidence interval; LL = lower limit; UL = upper limit.

***Table 3.3***

Pearson correlation matrix of proposed variables.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 1) True 1 | 1 | | | | | | | |
| 2) True 2 | .533** | 1 | | | | | | |
| 3) Yield 1 | -0.087 | -0.056 | 1 | | | | | |
| 4) Yield 2 | -0.043 | 0.101 | .715** | 1 | | | | |
| 5) TP 1 | 0.022 | 0.075 | -.150* | -0.102 | 1 | | | |
| 6) TP 2 | 0.094 | 0.122 | -0.095 | -0.028 | .704** | 1 | | |
| 7) TA 1 | -0.084 | -0.102 | .299** | .249** | -0.062 | -.196** | 1 | |
| 8) TA 2 | -0.017 | 0.097 | .254** | .333** | -.174* | -.171* | .573** | 1 |

*Note*: N = 201 for each group.

* $p<.05$

***Table 3.4***

*Contrast of each SDT parameter at round 1 and 2*

| | Round 1 | | Round 2 | | | | 95% CI | | |
|---|---|---|---|---|---|---|---|---|---|
| Variable | *M* | *SD* | *M* | *SD* | *T* | *p* | LL | UL | Cohen's *d* |
| QRC *c* | -0.21 | 0.31 | -0.27 | 0.39 | 2.70 | 0.01 | 0.02 | 0.10 | 0.17 |
| LRC *c* | 0.60 | 0.50 | 0.39 | 0.47 | 6.21 | <.001 | 0.14 | 0.27 | 0.43 |
| QDA *AZ_da* | 0.91 | 0.08 | 0.90 | 0.09 | 3.20 | 0.00 | 0.01 | 0.02 | 0.18 |
| LDA *AZ_da* | 0.59 | 0.24 | 0.64 | 0.24 | -3.85 | <.001 | -0.07 | -0.02 | -0.19 |

# 1. INTRODUCTION

Concern about wrongful convictions has increased since the early 1990s, as modern DNA testing absolved innocent suspects at higher rates than what the criminal justice system predicted (Scheck & Neufeld, 2001). Mistaken eyewitness identification remains the leading factor associated with wrongful conviction (Garrett, 2011), despite psychologists' expressed concern regarding this method (Wells & Olson, 2003). Cognitive and social perspectives guide this rich research line with results improving the methodology conducive to accurate eyewitness identification (Brewer & Wells, 2011).

Eyewitness suggestibility theories and concepts trace back to the nineteenth century (Coffin, 1941). Binet (1900) and Stern (1938) helped develop the construct of interrogative suggestibility due to their interest in how the formulation of a question affects memory recall and testimony. As such, eyewitness suggestibility is an evolving term defining the level to which people report misleading post-event suggestions as having been seen or heard in the witnessed event (Loftus, Miller, & Burns, 1978). Needing an objective psychometric measure to interrogative suggestibility, Gisli H. Gudjonsson (1984) developed the Gudjonsson Suggestibility Scale (GSS), a forensic tool used to identify particularly predisposed individuals (Gudjonsson, 1986). The purpose of this study encompasses the areas of eyewitness misidentifications and eyewitness suggestibility by developing a measure that may be used to study both types of eyewitness errors. Some major findings related to both lines of research are discussed, but a comprehensive examination of both areas is beyond the scope of interest in this paper.

## 1.1 Eyewitness Identification

Foundational studies proposed a leading cause of low identification accuracy: the weapon focus effect (Tooley, Brigham, Maass, & Bothwell, 1987). Studies suggest that a weapon leads to longer eye fixations on the object, decreasing accurate memories for other details surrounding the event (Loftus, Loftus, & Messo, 1987). Replications have yielded consistent support for these early findings, with

recent research suggesting that a weapon appearance lowers accuracy and confidence scores than the appearance of another unusual object in an event recollection (Hope & Wright, 2007). The theory of divided attention can explain this effect as studies demonstrate increased misattributions and suggestibility rates under more real-life scenarios; dividing attention while encoding a memory prompts false memories (Lane, 2006).

Other situational variables can affect accuracy. A recent meta-analysis confirms that heightened stress contributes to inferior identification accuracy (Deffenbacher, Bornstein, Penrod, & McGorty, 2004). Other meta-analyses found reliable associations among longer retention intervals and perceptive memory loss for previously unseen faces, even proposing an upper limit of memory accuracy at .67 on a fair six-person lineup (Deffenbacher, Bornstein, McGorty & Penrod, 2008). A meta-analysis identified an own-race bias (also known as the other-race effect) as an important factor in mistaken identifications: eyewitnesses are much more likely to make incorrect identification of other race suspects (Meissner, & Brigham, 2001). Other meta-analyses have covered the retroactive interference effect where eyewitnesses exposed to suspects' mug shots experienced increased false alarms (Deffenbacher, Bornstein, & Penrod, 2006). Other studies associate retroactive interference with phenomena such as unconscious transference, which describes the misidentification of a familiar face (Ross, Ceci, Dunning & Toglia, 1994), or memory impairment after exposure to misleading information, known as the misinformation effect (Loftus, 2005). This study focuses on retroactive interference within the context of suggestibility.

A major controversy in eyewitness identification research entails the choice between simultaneous or sequential lineup presentations applied with eyewitnesses. The most commonly used simultaneous presentation features a photographic lineup on a single page or a live lineup with a suspect and a group of fillers lined up together. A less common sequential presentation involves an exposure to a sequence of single faces before the eyewitness chooses a suspect. Early research supported the use of

sequential presentation due to decreased false identifications, while correct identifications did not change statistically (Lindsay & Wells, 1985). A recent meta-analysis lends support to this assumption (Steblay, Dysart, & Wells, 2011). However, evaluation under explicit policy models shows superiority in simultaneous lineups for most ecologically valid conditions (Malpass, 2005). This occurs because the sequential advantage appears mainly in target absent lineups as eyewitnesses are less likely to mistakenly choose a foil or designated suspect with this type of lineup; however, since target present lineups are more frequent, the actual rate of identifications would reduce overall. Due to the exploratory nature of this study, we will present only simultaneous lineups, the most common type of lineup in the US.

### 1.2 Interrogative Suggestibility

The psychological literature draws a distinction between "suggestions" and "suggestibility". The first term describes a stimulus inducing a biased response, while the second term defines the tendency to respond to that stimulus. Gheorghiu (1972) distinguishes "content" (message by suggestion), "form" (message carrier), and "mode" (content presentation and transmittion). Further developing the suggestive process, Gheorghiu proposed three stages: 1) the suggestive stimulus is presented, 2) potential suggestion is accepted, and 3) the final suggestive reaction is expressed.

Gudjonsson and Clark (1986) define interrogative suggestibility as "the extent to which, within a closed social interaction, people come to accept messages communicated during formal questioning, as the result of which, their subsequent behavioral response is affected." Gudjonsson (1987) then distinguishes five unique components related to interrogative suggestibility:

- It occurs during a closed social interaction, which commonly happens in individual interrogations.

- It entails a questioning procedure primarily concerned with retrospective memory, in which the interviewee relates past events.
- The interviewer provides suggestive stimulus, taking form of 'leading' questions containing expected responses from the interviewee.
- The interviewee accepts stimulus or acknowledges suggestions.
- The interviewee provides a behavioral response by openly accepting suggestions.

Presently, the Gudjonsson Suggestibility Scale represents the most commonly used standardized method to assess suggestibility (Gudjonsson, 2011).

### 1.3 The Gudjonsson Suggestibility Scales

Forensic interviewers utilize The Gudjonsson Suggestibility Scale (GSS 1) and its parallel second scale, GSS 2, to identify interviewees' likelihood of providing erroneous testimony during interrogation. Gudjonsson's (1997) theoretical model describes two main forms of interrogative suggestibility, defined as Yield and Shift, with their sum providing a score of Total Suggestibility. Yield represents a tendency to consent leading questions, while Shift reflects the predisposition to respond to interrogative pressure by changing responses after receiving negative feedback.

Gudjonsson (1984) designed three types of suggestive questions intended to measure the suggestibility degree through the subscale Yield:

- Leading questions which contain salient premises in their phrasing that carry an expected answer (e.g. 'Did the woman's clothes get torn in the struggle?' assuming the premise of a struggle).
- Affirmative questions which do not have salient premises, but causes an affirmative answer (e.g. 'Did one of the assailants shout at the woman?')

- False alternative questions which suggest alternative wrong answers (e.g. 'Did the couple have a dog or a cat?' proposing two alternatives only, both wrong).

In item analysis of the GSS 1 and GSS 2 models, Gudjonsson (1997) found that the distinction between "leading" and "affirmative" questions is of limited value and thus they should not be differentiated. Therefore, the subscale Yield divides into two types of suggestive questions: 10 leading questions, 5 false alternative questions.

The administration method requires an establishment of good rapport between the interviewer and the interviewee. The first step involves an audiotape of a short fictional story which is played for subjects to hear carefully. This is followed by a request for free recall about the story. Approximately 50 minutes later, free recall is requested again to assess delayed recall. This is followed by 20 interrogative questions: 15 of which are leading and 5 are non-leading. Assents to leading questions are labeled Yield 1. After the initial round of questions, subjects receive "negative feedback" in which the interviewer states: *You have made a number of errors. It is therefore necessary to go through the questions once more, and this time try to be more accurate.* After this, the 20 interrogative questions are re-administered. Assents to misleading questions the second time around provide a score for Yield 2. Meaningful changes in responses (e.g., from a "yes" to a "no" or "I don't know" and vice versa) are scored as Shifts. The sums of Yield and Shift provide a Total Suggestibility score. Yield 1 and Yield 2 receive a point for each leading question the participants "yield to" with 15 maximum points, while Shift reflects changes to all questions after negative feedback for 20 maximum points. By adding up both components, the maximum score possible score for suggestibility is 35 points. A perfect non-suggestibility score is a 0 as it reveals a perfect negative tendency to yield into suggestible questions, while the addition of negative feedback would not change responses in the re-administration of the interrogative questionnaire.

Factor analyses assessed the internal validity for the constructs (Gudjonsson, 1984; Gudjonsson, 1992) with positive loadings ranging from .39 to .68 in the Yield subscale, and .10 to .69 in the Shift subscale. Gudjonsson (1992) reported high Cronbach's alpha coefficients of .87 and .79 for Yield 1 and Shift respectively, while the coefficient for Yield 2 was .90 , demonstrating internal consistency reliability within the GSS. This is similar to findings in consequent replication studies (Merckelbach et al., 1998). However, recent studies (Gignac &Powell, 2009) raise concern about the original GSS factor structure as its reported component solution uses Varimax procedure (Gudjonsson, 1983), a rotation method that expects orthogonal components (Gorsuch, 1983). Researchers questioned the consequent use of orthogonal rotation method since Yield and Shift scores are weakly correlated, with studies reporting correlation scores ranging from .04 to .28 using different samples (Young, Powell, & Dudgeon, 2003; Lee, 2004). Gignac and Powell (2009) provided further criticism about the Shift subscale because a "Shift-standard" balance potentially measures two different processes: Shift-negative (non-endorsement of leading question first followed by endorsement the second time) and Shift-positive (endorsement of leading question first followed by reversing response the second time). Ultimately, the authors proposed that until further examinations of this "Shift-standard" is addressed; Total Suggestibility should remain limited to Yield scoring.

There are other limitations to the Gudjonsson scales related to real-life eyewitness scenarios: while GSS relies on memory for a verbally administered story, real-life eyewitness events are visual and verbal. Due to these limitations, the development of a suggestibility scale that measures visual memory is required. An example is the scale developed for children, the Video Suggestibility Scale for Children (VSSC; Scullin & Ceci, 2001), which overcomes the limitations of the oral story administration of the GSS 1 and GSS 2.

Ceci (2001) modified the procedures of the GSS to develop the VSSC, which bolsters ecological validity in real-life eyewitness research as eyewitnesses view events that contain visual elements that the

viewer must interpret. The VSSC video featured a birthday party characterized by salient events about which children would be later asked. The VSSC retained the GSS measures of Yield, Shift, and Total Suggestibility. The Cronbach's alpha coefficients of 0.85 (Yield) and 0.75 (Shift) demonstrated adequate internal consistency, similar to the ones reported by GSS (Scullin & Ceci, 2001).

A VSS designed to measure adults' suggestibility that incorporates both eyewitness identification and eyewitness suggestibility would enhance the individual difference approach in eyewitness research. For example, a video that includes a number of different individuals would permit the evaluation of the following eyewitness identification issues: an eyewitness' tendency to mistakenly identify individuals from target absent lineups (TA), his or her tendency to accurately identify individuals in target present lineups (TP), and his or her tendency to choose targets based on misinformation. Further, we could examine the relation between suggestibility and eyewitness identification accuracy. However, a limitation of GSS 1 and GSS 2 is their unequal number of suggestive and non-suggestive questions. Signal detection theory provides a theoretical rationale for using equal numbers of suggestive and non-suggestive questions, as well as equal numbers of target absent and target present lineups.

### 1.4 Signal - Detection Theory

Green and Swets's (1966) classic signal-detection theory (SDT) describes the ability to detect or fail to detect a stimulus in its actual presence or absence. SDT involves four possible outcomes: correct identification (hit), incorrect identification (false alarm), failure to identify the stimulus when it is present (miss), and correct failure to identify (correct rejection). Since target detection is difficult as inconclusive information usually influences detection judgments, according to the authors, selection based on individual response criteria affects the rates of the different outcomes, such as hits and false alarms. Situational characteristics, such as the stakes involved in a correct hit, also influence decisions:

under higher perceived risks of a miss, people incline to lower hit criteria, thus increasing false alarms. Psychological research commonly uses SDT to measure sensitivity to a range of different targets' presence; for example, choosing a test response, asking someone on a date, or identifying a suspect. SDT has been used in diverse fields including attention, perception, and memory (MacMillan, 2002).

Ebbesen and Flowe (2002) developed a criterion-shift model based on SDT to contest recent meta-analyses supporting sequential lineup presentation. In this article, the authors claim that eyewitness decisions can be separated into two different independent parameters: discrimination accuracy and response criterion. Discrimination accuracy concerns an individual's ability to correctly detect a signal compared to correctly rejecting its absence; while response criterion involves the level of evidence necessary to recognize a presented signal. Ebbesen and Flowe argued that response criterion rose in individuals when the chosen method was a sequential lineup, a higher threshold for decision when faces were viewed in isolation.

Previous studies have continued the use of SDT under the criterion-shift model. Meissner, Tredoux, Parker, and MacLin (2005) studied sequential lineups through different conditions expected to manipulate response criterion and/or discrimination accuracy, concluding that sequential lineups leads to conservative response criterion. Jones, Scullin, and Meissner (2011) explored levels of autism-spectrum traits in relation to lineup identification performance using the same SDT criterion-shift model, with results associating the subscale of Attention to detail and lineup type; it was significantly related to improved discrimination accuracy and a less conservative response criterion in sequential lineups, while impaired discrimination accuracy and a more conservative response criterion resulted from simultaneous lineups. The same statistical format will be approached in this study; however, our main interests will not concern individual performance on different lineup formats. Instead, this study will focus on simultaneous lineup comparison examining whether there are changes in discrimination accuracy or response criterion after a participant receives negative feedback.

## 1.5 The present study

The current GSS format is unsuitable for SDT as it has *a priori* assumptions that having equivalent numbers of False Alarms with True Positives (also named Hits) will facilitate examination of individual differences in discrimination accuracy and response criterion. The principles of SDT require an equal number of stimuli present and absent in order to balance accurately the possible sensitivity. The GSS assesses False Alarms with 15 inaccurate leading questions, while the important role of True Positives is limited to 5 accurate leading questions. In this study, I counterbalanced accurate and inaccurate leading questions to provide response criterion and discrimination accuracy estimations necessary for SDT analyses. In addition to Yield 1 and Yield 2 (which may be considered false positives), my interest lies with true positives, which can also be measured before and after feedback. These are labeled True 1 and True 2. As previously mentioned, leading questions are divided in two categories identified as 10 leading/affirmative questions and 5 false alternative questions under the Yield subscale; to maintain consistency with the True subscale, both categories will also be incorporated as 10 accurate leading questions and 5 correct alternative questions for the proposed True subscale.

Response criterion could potentially be tied to suggestibility by reflecting the basic evidence necessary to recognize correctly, respond to a question or identify an eyewitness suspect. Discrimination accuracy will be assessed in my lineup task by the accurate percentage of possible outcomes: in target present lineups I will examine correct identifications (hits) and failure to identify a stimulus when it is present (misses); in target absent lineups I will examine incorrect identifications (false alarms) and correct failures to identify (correct rejections). I will assess changes in response criteria and discrimination accuracy after feedback to determine how feedback affects individuals. I believe this may provide a more theoretically meaningful measure of the impact of interrogative pressure than Shift.

My study collects novel normative data regarding this combined suggestibility and eyewitness identification scale. The current hypotheses regarding the subscales are that consistent with findings for the GSS, Yield 1 and Yield 2 items will maintain satisfactory internal consistency; I will examine whether True 1 and True 2 items will also maintain satisfactory internal consistency. The internal reliabilities of Target Present/Target Absent Lineups as independent subscales are exploratory. Since no previous scholarly literature provides data regarding SDT in this proposed VSEISA, there is no basis to predict responses regarding Response Criterion and Discrimination Accuracy. However, if suggestibility and poor eyewitness identification ability reflect common underlying processes, there may be correlations between response criterion and discrimination accuracy across the suggestive questions and eyewitness identification modalities (e.g., Yields and False Positives in the eyewitness identification task). The results from this study are entirely exploratory.

# 2. METHODS

## 2.1 Sample and Procedure

Consistent with previous GSS studies (Gudjonsson, 1997), 206 college students were recruited from the University of Texas at El Paso (70 males, 131 females; age range = 18 – 47, *M* age = 21.17, *SD* = 5.19 years). Five participants had to be dropped out of the final statistical measurement either because of technical difficulties at the time of their participation, or because they had trouble understanding English, resulting in a final N of 201. All participants were recruited from the undergraduate psychology pool in which students participate for course credit.

Individually or in dual groups, participants viewed a five minute video depicting an illicit business transaction. The story involves an organized-crime deal carried in the desert where a small drug dealer's gang is tricked into receiving less money from their customers; this event is followed by an aborted physical altercation. The video features eight different people displaying a number of different personalities and physical characteristics that distinguish them apart from one another; a series of expected events in business trades are seen (money exchange, courtesy greetings) as well as other unexpected events (weapon intimidation, aggressive conflict).

Consistent with previous literature, participants engaged in a sequence of filler tasks to prolong time and test retention intervals. Two main tasks were provided to maintain a consistent 50-minute delay; the remaining time was spent filling out word games from which data was not collected. First, they completed the Autism-Spectrum Quotient (AQ; Baron-Cohen, Wheelwright, & Skinner et al., 2001), a questionnaire designed to indicate autistic-like traits in a normal population sample by assessing poor social skills, poor attention switching, exceptional attention to detail, poor communication skills, and poor imagination (Baron-Cohen et al., 2001). The second task was to fill out the Multidimensional Personality Questionnaire – Brief Form (MPQ-BF; Patrick, Curtin, & Tellegen, 2002), a 155-item questionnaire designed to measure traditional personality constructs. These two main

tools serve a dual purpose: time-delay and data collection for future research. As previously mentioned, other discrete tasks were provided to maintain a consistent time-delay across all participants. Approximately 50 minutes after viewing the video, participants answered a brief open-ended question followed by a structured questionnaire composed of 15 leading and 15 accurate leading questions. Following the GSS administration, each leading question to which the participants "yield to" measured Yield at the first round. The counterbalanced numbers of leading and accurate leading questions were used to measure Question Response Criterion and Question Discrimination Accuracy. After this, the participants were presented with a series of lineup suspects for identification of the video's characters; the participants were informed verbally that within each lineup the target face might or might not be present. The options presented for each lineup included: (1) selecting a target face, (2) indicating whether the target face "is not present". These lineups were used to measure performance in Target Present Lineups, Target Absent Lineups, as well as Lineup Response Criterion and Lineup Discrimination Accuracy. The measures derived in this first round were labeled:

- Yield 1 measuring how many questions were answered erroneously based on misinformation
- True 1 measuring how many accurate leading questions were answered correctly
- Target Present Lineup 1 measuring how many individuals were identified correctly
- Target Absent Lineup 1 measuring how many foils were mistakenly identified
- Question Response Criterion 1 measuring the level of evidence necessary to answer a question correctly, it is calculated through the total number of hits and false alarms in the questionnaire of this first round.
- Question Discrimination Accuracy 1 measuring the ability to answer correctly a non-leading question, compared with dismissing a misleading question. It is calculated through the total number of hits and false alarms in the questionnaire of this first round.

- Lineup Response Criterion 1 measuring the level of evidence necessary to identify a target accurately, it is computed through the total number of hits and false alarms in the lineup tasks of this first round.
- Lineup Discrimination Accuracy 1 measuring the ability to identify correctly a target, compared with rejecting a foil. It is computed through the total number of hits and false alarms in the lineup tasks of this first round.

Following the first sequence, the interviewer provided negative feedback: "*You have made a number of errors. It is therefore necessary to go through the questions and the lineup once more and this time try to be more accurate* ". After this the string of questions and lineup testing were re-administered. Our second set of measures included Yield 2, True 2, Target Present Lineup 2, Target Absent Lineup 2, Question Response Criterion 2, Question Discrimination Accuracy 2, Lineup Response Criterion 2 and Lineup Discrimination Accuracy 2.

### 2.2 Lineup Construction

Sixteen different sets of lineups were constructed in random order under target-present and target-absent conditions. Lineup fairness was assured by following the two general principles endorsed by the American Psychology-Law Society (Wells, et al., 1998):

- Lineups will contain fillers that represent good alternatives to the suspect
- The suspect will not stand out from the fillers, nor any filler will stand out from the suspect

Prior to the study, 50 participants were recruited to assess lineup fairness (Malpass, Tredoux, & McQuiston-Surrett, 2007). Such evaluation was conducted by estimating lineup bias and lineup size (Malpass, 1981; Malpass, & Devine, 1983; Wells, Leippe, & Ostrom, 1979). Lineup bias refers to the percentage of selecting the target correctly compared with the probability of selecting the target by chance in people without visual reference (i.e., 1/6 likelihood for 6-person lineups). Lineup size provides

the level of fillers' reliability as alternatives based on description or physical resemblance to the suspect, Tredoux's *E* (1998) was measured to adjust lineup size by revealing which fillers failed as reliable alternatives. Across the 16 lineups, statistical bias or low *E* score was diagnosed in 6 lineups which had to be adjusted and re-tested with a different sample to achieve desired fairness. The final lineups used had an average proportion of participants selecting the target face at .54 and the average *E* was 4.012 (range = 2.38 – 4.754; 95% CI = 3.642, 4.382); assuring statistical control for lineup size and lineup bias in this study.

# 3. RESULTS

## 3.1 Internal consistency of scale items

Cronbach's alpha coefficients for each subscale are presented in Table 1. The subscale True 1 presented unexpected results as three items were perfectly answered by all 201 participants and several were answered nearly perfectly, decreasing alpha level considerably and resulting in a low standard deviation for this measure. For signal detection analyses, I retained the three questions that were answered perfectly by all participants. A consistent pattern was displayed across subscales True, Yield and Target Present as Cronbach's alpha coefficients increased statistically in the second round, after negative feedback was given. The Target Absent subscale provided opposite results as the second round decreased from 0.695 to 0.598. Although we expected satisfactory internal consistency on all subscales, the results constrain reliability to True 2 and Yield 2 where the alpha coefficients resemble ranges reported by Gudjonsson (1984, 1987). Arguments can be made about the reliability of the subscales Target Present and Target Absent, because the subscales are essentially 6 response multiple choice questions.

## 3.2 Descriptive Statistics

Table 2 presents the mean and standard deviation for each variable. Differences between group means before and after receiving negative feedback were analyzed through paired sample t-tests. There was a significant increase in the scores of Yield 1 ($M$ = 3.29, $SD$ = 2.08) and Yield 2 ($M$ = 3.91, $SD$ = 2.61); $t$ = -4.72, $p < .001$. On average, participants endorsed more Yield items after receiving negative feedback. There was another significant difference in the scores of Target Present lineups 1 ($M$ = 2.87, $SD$ = 1.94) and Target Present lineups 2 ($M$ = 3.78, $SD$ = 2.09); $t$ = -8.24, $p < .001$. Participants recognized more accurately the characters from the video after receiving negative feedback. The True questions and Target Absent lineups did not significantly differ between round 1 and 2, as the paired

sample t-tests analyses provided null results. To summarize, accuracy in the target present lineups improved in the second round, but there was no change in accuracy in the target absent lineups.

### 3.3 Intercorrelations among subscales

Pearson correlations among the 8 subscales were computed to analyze associations. As expected, each round 1 subscale was significantly correlated with its round 2 counterpart with ranges from $r = .533$ to $r = .715$. A moderate correlation was found between the Yield subscale and Target Absent lineups, with the strongest associations at Yield 1 and TA1 ($r = .299$); and Yield 2 with TA 2 ($r = .333$). The results imply that participants prone to yield into suggestible questioning are inclined to select erroneously foil individuals from target absent lineups. Similar correlations among True and Target Present lineups were not found.

### 3.4 Signal Detection Measures

Hit and false alarm rates were used to compute SDT estimates of discrimination accuracy (*Az_da*) and response criterion (*c*) for both questions and lineups. Extreme true positive and false alarm scores were adjusted as 0 was replaced with 0.5/n where n = the number of trials; 1 was replaced by (n-0.5)/n (Stanislaw & Todorov, 1999). *Az_da* measures discrimination accuracy with a .5 value illustrating no difference between signal and noise trials; values greater than .5 display greater discrimination accuracy, while values less than .5 display higher rates of false positives than true negatives. *c* (B'a) describes the distance between criterion and neutral point of the signal and noise distributions with a score of 0 when neither response is favored; negative values reflect a yes-bias, while positive values reflect a no-bias. The means and standard deviations of each variable are presented in table 4.

The results from the descriptive statistics show a moderate yes-bias tendency for questions, while there was a moderate tendency for a no-bias for lineup identification tasks. A paired samples t-test was conducted to assess mean differences in *c* and *AZ_da* before and after feedback. The first result was a significant decrease in *c* between Question Response Criterion 1 ($M = -0.21$, $SD = 0.31$) and Question

Response Criterion 2 ($M$ = -0.27, $SD$ = 0.39), $t$ = 2.70, $p$ < 0.05. The yes-saying bias tendency increased moderately at round 2. The second result was a significant decrease in *c* between Lineup Response Criterion 1 ($M$ = 0.60, $SD$ = 0.50) and Lineup Response Criterion 2 ($M$ = 0.39, $SD$ = 0.47); $t$ = 6.21, $p$ <.001. The no-saying bias tendency decreased in lineup identification tasks after negative feedback was provided. A third result was a moderate, yet significant, decrease in Question Discrimination Accuracy AZ_da1 ($M$ = 0.91, $SD$ = 0.08) and Question Discrimination Accuracy AZ_da2 ($M$ = 0.90, $SD$ = 0.09), $t$ = 3.20, $p$ <0.05. Participants revealed decreasing discrimination accuracy by the second round. Another significant difference is displayed for Lineup Discrimination Accuracy AZ_da1 ($M$ = 0.59, $SD$ = 0.24) and Lineup Discrimination Accuracy AZ_da2 ($M$ = 0.64, $SD$ = 0.24); $t$ = -3.85, $p$ <.001. Participants exhibited greater discrimination accuracy for lineup identification tasks after receiving negative feedback.

# 4. DISCUSSION

This study explored the development of a Video Suggestibility and Eyewitness Identification Scale for Adults (VSEISA), which attempts to bolster the ecological validity of an eyewitness identification measure with its incorporation of eyewitness suggestibility questions and lineup identification tasks. Reliability estimates show acceptable internal consistency of True and Yield subscales after negative feedback is provided, with ranges fairly similar to reliability estimates reported on the GSS 1 and GSS2. A contrasting trend was found in lineup reliability as the highest scores are seen in Target Present tasks before feedback, while higher scores are present in Target Absent lineups after feedback. A replication study adjusting difficulty levels for some True items may generate more variability and increase internal reliability.

While on average True scores were answered correctly in 13 out of 15 questions, the rates of accepted misleading questions average below 4 out of 15 questions. The signal detection theory requirement of True and Yield forming two separate distributions is moderately confirmed, but the scale as a whole should still be considered a work in development as some harder True questions should replace overly easy ones in order to avoid ceiling effects on the measure. Exploratory correlation analyses offered interesting associations among the proposed subscales Yield and Target Absent Lineups. As Target Absent subscale may be considered a form of visual suggestibility, its moderate convergent validity with the Yield subscales reflects its intended purpose of creating parallel eyewitness inaccuracy subscales. Presently, no known studies have found a similar association, which creates a potential new area of study. Although True Questions and Target Present Lineups did not exhibit similar correlations, future research could help explain if these two recognition tasks are entirely unrelated constructs.

Signal detection theory analyses were conducted to explore response criteria and discrimination accuracy providing insightful findings. Response criteria as measured by *c* were found to reflect a yes-

saying bias for questions and a no-saying bias for lineups. The first analysis offers evidence for a moderate bias to respond to or answer each question positively, which slightly and significantly increases at the second round. However, trends in the opposite direction are seen when eyewitness tasks are incorporated into this suggestibility framework. Participants reveal a stronger no-bias when asked to identify characters from the video, a pattern that reduces significantly at the second round. The expected result from basic SDT theory is that situational characteristics such as higher perceived risks of a miss can lead people to lower hit-criteria, which can potentially increase false alarms. However, this did not happen in our study, as there was not a significant increase in false alarm rates. Assuming that the lineups were fairly easy and time-delay remained parallel for question and lineup identification tasks, this bidirectional trend suggests it may be useful to incorporate visual tasks in future research studies related to eyewitness suggestibility. On the other hand, discrimination accuracy as indexed by *AZ_da* provided fairly high discrimination for true and yield questions with an influence of negative feedback present as it decreases during the second round. Although smaller than in questions, discrimination accuracy for lineups emerged reasonably well and such discrimination statistically significantly improves during round 2. Overall, participants showed an appropriate ability to detect a correct signal compared with rejecting its absence. Participants were better at this in response to questions rather than choosing targets from lineups. In other words, participants show more ability to choose an accurate answer and dismiss a misleading question, compared to accurately identify a person in a target present lineup and dismiss a target absent lineup. Given concerns by researchers about increases in false positives when lineups are administered multiple times (Godfrey & Clark, 2009), future research could help explain why the ability to correctly detect a signal seemed to improve with lineup repetition. Perhaps an indirect effect caused by pressure from the interviewer is that it actually helps with increased discrimination. Further research will be necessary to examine why this effect occurred in my sample.

Although previous articles have discussed the statistical difficulties associated with Shift as a suggestibility subscale (Gignac & Powell, 2009), this study uses negative feedback as a way to examine changes in response criterion and discrimination accuracy in a suggestibility scale. By refocusing the use of negative feedback as a factor affecting SDT variables, rather than as a measure in itself, this may address previous literature criticizing Shift and calling for a better way to study the influence of feedback on response change in interviews (Baxter et al., 2011).

As mentioned briefly above, a major limitation of this study is related to the non-existent variability for three items and reduced overall variability in the True 1 scale, which decreased reliability estimates for the True1 subscale dramatically. Replication studies could substitute at minimum these three items with moderately difficult True items in order to increase reliability of the True subscale. A second limitation concerns the sample used to test this scale. Undergraduate students may not represent the responses from an adult forensic population, which tend on average to have significantly poorer memory and lower IQ than college students (Gudjonsson, 1992). Future studies could replicate the procedure by recruiting participants more similar to the population of interest.

Since the development of these new set of questions came from scratch due to the introduction of a novel video, future directions recall for a replication analyzing item information. Williams and Zumbo (2003) provided a framework to assess item function through Item Response Theory by using SDT data: item discrimination (a), item difficulty (b) and a pseudo-chance parameter (c) can be estimated through item characteristic curves (ICCs). The usefulness of this method lies in the transformation of SDT data to ICCs without striking deviations and its relatively simple form of interpretation. Item information provided by IRT could explore construct validity of the intended VSEISA. A second route of directions relates to the unique ethnicity of our sample. The characters chosen for the video were mostly Hispanics to control for cross-race effects, but future studies could replicate similar effects if a parallel video is provided to different samples for improved scale validity and generalization.

In conclusion, the findings for my measure were encouraging for an exploratory study; further research will improve the incorporation of visual tasks to retain scale validity as results establish moderate associations with each other. The introduction of the VSEISA could measure interrogative suggestibility accurately and create a potential shift in the theoretical direction.

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# APPENDIX – VSEISA Procedure

**Open-ended questions**

**A. Do you remember that video about a transaction? Now tell me everything you remember.**

*Repeatedly probe:* **What else do you remember?**

*Now I am going to ask you some questions about the video. Try to be as accurate as you can. I am going to refer to the group of people who initially brought money to the transaction as the* ***money group****, and the group of people who brought the drugs to the transaction as the* ***drug dealer group****.*

1. **Did men in the money group arrive in a silver-colored SUV?**

   Round 1: YES _____ NO _____ DON'T KNOW _____ OTHER _____

   Round 2: YES _____ NO _____ DON'T KNOW _____ OTHER _____

2. **Did the money group's vehicle have Texas license plates?**

   Round 1: YES _____ NO _____ DON'T KNOW _____ OTHER _____

   Round 2: YES _____ NO _____ DON'T KNOW _____ OTHER _____

3. **Did one member of the money men group stay in their vehicle?**

   Round 1: YES _____ NO _____ DON'T KNOW _____ OTHER _____

Round 2: YES _____ NO _____ DON'T KNOW _____ OTHER _____

4. **Was the leader of the money men still wearing gloves when he stepped out of the car?**

   Round 1: YES _____ NO _____ DON'T KNOW _____ OTHER _____

   Round 2: YES _____ NO _____ DON'T KNOW _____ OTHER _____

5. **Was the absent leader of the money group named Mario?**

   Round 1: YES _____ NO _____ DON'T KNOW _____ OTHER _____

   Round 2: YES _____ NO _____ DON'T KNOW _____ OTHER _____

6. **Was one of the men in the money group nervous about the deal?**

   Round 1: YES _____ NO _____ DON'T KNOW _____ OTHER _____

   Round 2: YES _____ NO _____ DON'T KNOW _____ OTHER _____

7. **Did one of the men in the money group seem desperate to steal money from the payment to the drug dealer group?**

   Round 1: YES _____ NO _____ DON'T KNOW _____ OTHER _____

   Round 2: YES _____ NO _____ DON'T KNOW _____ OTHER _____

8. **Were the main money man and his bodyguard both wearing black shirts or red shirts?**

   Round1: BLACK _____ RED _____ NEITHER _____ OTHER _____

   Round 2: BLACK _____ RED _____ NEITHER _____ OTHER _____

9. **Did the bodyguard for the money men have a gang tattoo on his neck or on his forearm?**

   Round1: NECK _____ FOREARM _____ NEITHER _____ OTHER _____

   Round 2: NECK _____ FOREARM _____ NEITHER _____ OTHER _____

10. **Was there $3,000 missing from the money men's envelope?**

    Round 1: YES _____ NO _____ DON'T KNOW _____ OTHER _____

    Round 2: YES _____ NO _____ DON'T KNOW _____ OTHER _____

11. **Did the drug dealer group arrive in a red car?**

Round 1: YES _____ NO _____ DON'T KNOW _____ OTHER _____

Round 2: YES _____ NO _____ DON'T KNOW _____ OTHER _____

**12. Were there three people in the drug dealer group?**

Round 1: YES _____ NO _____ DON'T KNOW _____ OTHER _____

Round 2: YES _____ NO _____ DON'T KNOW _____ OTHER _____

**13. Was the youngest guy in drug dealer group still in high school?**

Round 1: YES _____ NO _____ DON'T KNOW _____ OTHER _____

Round 2: YES _____ NO _____ DON'T KNOW _____ OTHER _____

**14. Had the money group and the drug dealer group made deals before?**

Round 1: YES _____ NO _____ DON'T KNOW _____ OTHER _____

Round 2: YES _____ NO _____ DON'T KNOW _____ OTHER _____

**15. Did the main drug dealer ask about the main money man's wife or about his kid?**

Round1: WIFE _____ KID _____ NEITHER _____ OTHER _____

Round 2: WIFE _____ KID _____ NEITHER _____ OTHER _____

**16. Was one of the men in the drug dealer group suspicious because Mario wasn't at the meeting?**

Round 1: YES _____ NO _____ DON'T KNOW _____ OTHER _____

Round 2: YES _____ NO _____ DON'T KNOW _____ OTHER _____

**17. Was Mario out of town because of a business trip or a vacation?**

Round1: BUSINESS _____ VACATION _____ NEITHER _____ OTHER ____

Round 2: BUSINESS _____ VACATION _____ NEITHER _____ OTHER ____

**18. Was Mario currently out of town in Tucson or LA?**

Round1: TUCSON _____ LA _____ NEITHER _____ OTHER _____

Round 2: TUCSON _____ LA _____ NEITHER _____ OTHER _____

**19. Was the transaction carried out in the desert?**

Round 1: YES _____ NO _____ DON'T KNOW _____ OTHER _____

Round 2: YES _____ NO _____ DON'T KNOW _____ OTHER _____

**20. Did the drug transaction occur during the daytime or at night?**

Round1: DAYTIME _____ NIGHT _____ NEITHER _____ OTHER _____

Round 2: DAYTIME _____ NIGHT _____ NEITHER _____ OTHER _____

**21. Was the money envelope blue or white?**

Round1: BLUE _____ WHITE _____ NEITHER _____ OTHER _____

Round 2: BLUE _____ WHITE _____ NEITHER _____ OTHER _____

**22. Were the drugs in a metal box or a plastic bag?**

Round1: BOX _____ BAG _____ NEITHER _____ OTHER _____

Round 2: BOX _____ BAG _____ NEITHER _____ OTHER _____

**23. Did you see the youngest guy in the drug dealer group count the money?**

Round 1: YES _____ NO _____ DON'T KNOW _____ OTHER _____

Round 2: YES _____ NO _____ DON'T KNOW _____ OTHER _____

**24. Did someone in the money group pull out a gun?**

Round 1: YES _____ NO _____ DON'T KNOW _____ OTHER _____

Round 2: YES _____ NO _____ DON'T KNOW _____ OTHER _____

**25. Did the bodyguard for the money group yell at the drug dealer group?**

Round 1: YES _____ NO _____ DON'T KNOW _____ OTHER _____

Round 2: YES _____ NO _____ DON'T KNOW _____ OTHER _____

**26. In the scuffle, did the bodyguard for the money man hit the youngest drug dealer in the face or the stomach?**

Round1: FACE _____ STOMACH _____ NEITHER _____ OTHER _____

Round 2: FACE _____ STOMACH _____ NEITHER _____ OTHER _____

**27. When the youngest guy in the drug dealer group fell to the ground, did he hit his head on a rock?**

Round 1: YES _____ NO _____ DON'T KNOW _____ OTHER _____

Round 2: YES _____ NO _____ DON'T KNOW _____ OTHER _____

**28. When the bodyguard for the money men fired a warning shot, did he aim at the sky or at the ground?**

Round1: SKY _____ GROUND _____ NEITHER _____ OTHER _____

Round 2: SKY _____ GROUND _____ NEITHER _____ OTHER _____

**29. Was the youngest guy in the drug dealer group's face bleeding after he fell to the ground?**

Round 1: YES _____ NO _____ DON'T KNOW _____ OTHER _____

Round 2: YES _____ NO _____ DON'T KNOW _____ OTHER _____

**30. Did the drug dealer group leader's shirt get torn in the scuffle?**

Round 1: YES _____ NO _____ DON'T KNOW _____ OTHER _____

Round 2: YES _____ NO _____ DON'T KNOW _____ OTHER _____

*"I am now going to show you a series of lineups. I want you to tell me if you recognize any of the subjects. There may or may not be a subject in each lineup.*

a. Hold up the lineups: *"Tell me the number for the corresponding subject you recognize. If there is none present then say 'not present'."*

**Lineup 1**

Round 1: 1 2 3 4 5 6 Not Present

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Round 2: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |

**Lineup 2**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Round 1: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |
| Round 2: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |

**Lineup 3**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Round 1: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |
| Round 2: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |

**Lineup 4**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Round 1: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |
| Round 2: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |

**Lineup 5**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Round 1: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |
| Round 2: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |

**Lineup 6**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Round 1: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |
| Round 2: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |

**Lineup 7**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Round 1: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |
| Round 2: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |

**Lineup 8**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Round 1: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |
| Round 2: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |

**Lineup 9**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Round 1: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Round 2: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |

**Lineup 10**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Round 1: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |
| Round 2: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |

**Lineup 11**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Round 1: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |
| Round 2: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |

**Lineup 12**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Round 1: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |
| Round 2: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |

**Lineup 13**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Round 1: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |
| Round 2: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |

**Lineup 14**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Round 1: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |
| Round 2: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |

**Lineup 15**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Round 1: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |
| Round 2: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |

**Lineup 16**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Round 1: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |
| Round 2: | 1 | 2 | 3 | 4 | 5 | 6 | Not Present |

**Negative Feedback**

*"You have made a number of errors. It is therefore necessary to go through the questions and the lineup once more and this time try to be more accurate."*

Repeat the questions and the lineup.

# VITA

Carlos Manuel Vargas was born in El Paso, Texas. The third son of Miguel Angel Vargas and Maria Concepcion Morales, he graduated from Father Yermo High School, El Paso, Texas, in the spring of 2006 and entered The University of Texas at El Paso in the fall of 2006. While pursuing a bachelor's degree in psychology, he volunteered for Dr. Scullin's research lab in studies focused on infant executive function. During the summer of 2009, he earned an internship for The University of Texas at Austin as part of the *Summer Undergraduate Research Experience* in which he had the opportunity to work with nationally renowned research faculty. From an idea developed in this internship, he successfully completed an honors thesis labeled "*Proust Phenomenon: Personality Differences in the Retrieval of Memory*" by spring of 2010. He successfully completed his bachelor's degree in the spring of 2010 graduating with honors Cum Laude for outstanding grade point average and in the fall of 2011 entered the Graduate School at The University of Texas at El Paso.

Permanent address: 9951 Rosa M. Richardson
El Paso, Texas, 79927

This thesis was typed by Carlos Manuel Vargas.