DECEPTION DETECTION, TRANSMISSION, & MODALITY IN AGE, SEX,

SOCIAL CLASS, & PERSONALITY

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SOCIAL CLASS, & PERSONALITY

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The present research examined age, gender, social class, and personality in lie detection and transmission. This is the first study, to the best of our knowledge, where older adults and college students lied pro-socially. The pilot study examined prosocial lying and found that neither age nor socioeconomic status predicted lying behavior. However, individuals who were more trusting were more likely to lie prosocially. In the main study, both older adults and college students were best in the audiovisual modality and worst in the visual modality. Overall, college students were better detectors than older adults. There was an age-matching effect for college students but not for older adults. Older adult males were the hardest to detect. The older the adult was the worse the ability to detect deception. There was no interaction between senders' and raters' socioeconomic statuses. Since audio is vital for accurate deception detection the researchers recommend that older adults keep up-to-date hearing aid devices to insure accurate stimulus detection and decrease victimization due to deception.

BIOGRAPHICAL SKETCH

Charlotte Sweeney received her bachelor's degree from the College of Human Ecology at Cornell University in 2004, majoring in Human Development with a concentration in gerontology. She received Honors in Human Development Studies for her thesis examining the effects of repetition modality on false recognition in older adults. She continued in the graduate field of the Department of Human Development at Cornell University in the fall of 2005. She received her M.A. in developmental psychology from Cornell University in 2009. Her research interests include studying deception detection across age groups from childhood to older adulthood, memory, stereotypes of older adults, and elder abuse.

To

Nathaniel Rand

1990-2011

for helping me not only with their emotional support but also with material resources as well. This one is for you!

Finally, I am especially grateful to all of the participants, both college students and older adults, without whom this research would not be possible. I appreciate your time, patience, and faith in the research method.

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CHAPTER 1

INTRODUCTION

A Brief History of Deception Detection

Deception is defined as an individual's deliberate attempt to convince another person to accept as true what the liar knows to be false, to gain some type of benefit or to avoid loss (Abe, 2011; Agosta, Pezzoli, & Astori, 2013). The desire to accurately detect lies has been a goal through much of human history. In 900 B.C. India, one of the Vedas provided specific instructions for detecting poisoners by their behavior. The Greek physician Erasistratus (300-250 B.C.) attempted to detect deception by feeling the pulse. From the Common Era through the Middle Ages, superstition led to different cultural forms of the "ordeal" to allow proof of guilt or innocence to come from the divine (Trovillo, 1939). In the 1980s, proponents of Neuro-Linguistic Programming (NLP) claimed that when right-handed people looked up to their right they were visualizing an image that they created, while when they looked up to their left they were visualizing a memory of an event that actually took place. Despite the widespread belief in this claim, Wiseman, Watt, ten Brinke, Porter, Couper, & Rankin (2012) found no empirical support. These behavioral cues were not shown to correlate with deception. Studies suggest that Americans on average lie once or twice a day, but this distribution is highly skewed and the mean number of lies per day is misleading. Thus many people do not lie on any given day (Serota, Levine, & Boster, 2010). Men are significantly more likely than women to lie to gain monetary benefit (Dreber & Johannesson, 2008). Serota, Levine, and Boster (2010) found a marginally significant trend of men lying more than women, but they state that some researchers have found

the opposite, and that women lie more than men. Clearly, more research is needed to explore lying behavior in general and possible differences between sexes in particular. It is difficult to say how far laypeople, the legal system, and researchers have progressed in developing ways to detect deception.

For example, in the case of Jerry Hobbs, who falsely confessed to murdering his daughter and her best friend, the judge permitted the lead detective to testify to the "behavioral cues of deception" that were exhibited by Hobbs during his interrogation and which led to his arrest. DNA evidence linked the true killer and rapist and the charges against Hobbs were dropped. In *People v. Stevens*, a Michigan appellate court held that it was erroneous to admit these behavioral cues because it makes the police officer appear to be a human lie detector (2012 WL 974984 (Mich. App.).

The ability to detect "micro momentary expressions," a term first coined by Haggard and Isaacs (1966) and shortened to "micro expressions" by Ekman and Friesen (1969), is a key skill for understanding a person's true emotional state by his or her quick, microsecond long facial expression, but these quick, facial expressions are often difficult to detect.

Recently, Hurley (2012) found that training improved the recognition of micro expressions and found the greatest success when a knowledgeable instructor facilitated the training and used diverse training techniques such as description, practice, and feedback. Hurley (2012) cautions that training individuals to accurately detect micro expressions requires further testing to conclusively demonstrate its usability across a wide array of daily life situations. Caution should be taken with these findings since lay people's wishful thinking may lead them to believe that they can detect lies, when

accuracy in detecting lies has been at chance levels in most studies (Vrij, 2000; Bond & DePaulo, 2008; Edelstein, Luten, Ekman, & Goodman, 2006).

Why Study Deception Detection in Older Adults?

In the United States the demographics indicate a need for the study of deception detection in older adults. The population aged 65 and older will more than double by 2050, rising from 39 million today to 89 million. Also by 2050, in the United States the under 15 population is expected to fall below the older population (United States Census Bureau, 2009). Thus, in sheer numbers alone, issues involving older adults cannot be ignored.

It is important to study deception detection in older adults for four reasons. First, older adults need to detect deception in others, especially in cases where they may become targets of financial scams. Older adults may be particularly susceptible to con artists and be seen as lucrative and easy targets for financial exploitation (Castle, Eisenberger, Seeman, Moons, Boggero, Grinblatt, & Taylor, 2012; Pinsker, McFarland, & Pachana, 2010). A number of general risk factors associated with abuse and exploitation in later life have been identified, but currently there is no widely accepted or validated clinical framework to assist clinicians with identifying individuals who may be at heightened risk of financial exploitation (Pinsker, et al 2010).

About 75% of all fraud incidents target people over the age of 60 years (Mackin, 1994). Financial abuse accounts for up to one-half of all types of elder abuse in the United States, accounting for over 500,000 victims (Tueth, 2000). The most

serious crimes are committed by young males between the ages of 14 to 24 (Flynn, 1996, 2000). Thus it is crucial to examine whether older adults are easily deceived by younger adults.

Second, it is important for older adults to be able to detect deception in others when serving as jurors. Little is known about older adult jurors. Many states do not collect age information about their jury panels (Enzel, Dunlop, & Rothman, 2000). However, in Florida, from 2000-2006, adults aged 60 and over made up a significant proportion of jurors sitting on criminal juries (between 20% to 28%) (Ruva & Hudak, 2013).

It is possible that the youngest older adults (ages 65-74) might be more likely to serve as jurors because of their more flexible hours (Enzel et al., 2000). When younger and older adults have been compared in mock jury studies, differences do emerge (Hart, Evans, Wissler, Feehan, & Saks, 1997). Hart et al., 1997 found that older adults were more likely than college students to mention concrete and specific injuries resulting from medical malpractice. Older adults have these differing experiences since they have had a greater opportunity for exposure to medical malpractice over the course of their lifetimes. Older adults may have much to bring to jury deliberations since they have a rich set of diverse life experiences that may greatly affect the outcome of a case (Enzel et al., 2000).

Ruva & Hudak (2013) found that pretrial publicity had a significant positive effect on older adult's verdicts and impressions, while pretrial publicity had a significant negative effect on younger jurors' verdicts. These researchers point to socioemotional selectivity theory to explain the positivity effect found in older adults.

According to socioemotional selectivity theory, older adults are motivated to regulate their emotions by focusing attention on information that enhances positive emotions and diminishes negative emotions. When time is perceived as limited and overall cognitive functioning is decreasing, emotionally meaningful goals take priority (Fung & Carstensen, 2003). These positive effects have been found to influence important decisions made by older adults (Lockenhoff & Carstensen, 2007; Mikels et al., 2010) suggesting that these effects could influence decisions made by jurors (Ruva & Hudak, 2013). Defense lawyers and prosecutors would be helped in jury selection and justice would be better served if courts had a better understanding of age differences in potential jurors.

Third, it is important to study deception detection in older adults because others may need to detect deception in older adults, especially in cases of elder abuse. Elder abuse is a pervasive and growing problem (Lachs & Pillemer, 2004). Caregiver stress is the most often cited factor leading to elder mistreatment (McGreevey, 2005). Abused elders may lie about their abuse to avoid being placed in a nursing home, which is a legitimate concern (Lachs, Williams, O'Brien, & Pillemer, 2002), or to avoid negative repercussions from an abusive caregiver (Davis & Medina-Ariza, 2001; Pillemer, Breckman, Sweeney, Brownell, Fulmer, Berman, et al (2011).

Fourth, it is critical to study deception detection in older adults because older adults may also be party to criminal acts of deception, even though they are infrequent perpetrators. Crime in older adults does not significantly contribute to the nation's crime rate, but as the older adult population has increased, so too have older adult crimes (Flynn, 2000). Some assume that older adults are less likely to offend because

of the physical effects of aging (Flynn, 1996), but with the Internet, committing some forms of fraud and sex offenses are not as physically challenging. Although older generations may not use the Internet much at present, as younger generations age, their Internet skills will be more advanced.

Literature on Deception Detection in Older Adults

In the deception detection literature very few studies have examined older adults' abilities to detect deception and, of those studies, the results are conflicting. For example, Bond, Thompson, & Malloy (2005) found that older adult females were more accurate at detecting deception than younger adults, while Stanley & Blanchard-Fields (2008) found that older adults were worse at deception detection than younger adults and no gender difference was found. The different findings between the two studies may result from differences between the methods and design of their studies. One key difference was that Bond et al. (2005) had both older adults and younger adults only rating younger adults, but they had no conditions whereby older adults were rating other older adults and younger adults rating older adults. Stanley et al. (2008) had older adults and college students only rate young males. First, it is important to have both age groups (older and college) rate their own age group as well as rate the other age group. Second it is crucial to have both males and females rate both their own sex and the other sex. This would help researchers determine whether there are age matching effects or sex differences.

In addition, Stanley et al., 2008, showed younger and older adults interviews in one of three modalities: visual, audio, or audiovisual. One way to improve Stanley et al.'s (2008) design would be to make modality a within subjects variable whereby

each participant would receive all three modalities, not just one.

However, Stanley et al. (2008) did find that reduced emotion recognition in older adults was related to poor deception detection in the visual condition for the crime interviews only. It would be interesting to see if this finding replicates.

Recently, Ruffman, Murray, Halberstadt, & Vater (2012) examined younger and older participants' judging the truthfulness of other younger and older speakers' opinions. All participants found it easier to judge when an older adult was lying relative to a young adult, and older adults were worse than young adults at detecting when speakers were telling the truth versus lying. Neither younger nor older adults were advantaged when judging a speaker from the same age group. Overall, older adults were more transparent as liars and were worse at detecting lies, with older adults' worse emotion recognition mediating the relation between age group and lie detection failures.

The present study seeks to enhance research on deception detection whereby each age group will rate its own age group as well as the other. In addition, the present study seeks to examine differences in detection ability between the rater age groups by employing each of the three modalities (audio, visual, and audiovisual) randomly and within-subjects, so that each participant receives each of the three modalities. Literature on modality and age-related changes in recognition of emotional expression in body, face, and voice will be discussed next.

Modality and Age-related Changes in Recognition of Emotional Expressions in Body, Face, & Voice

Being able to match information from faces, voices, and bodies may be key to detecting deception. The inability to detect a miss-match between what a person says and his or her body language may be problematic in detecting deception, and here is where older adults, due to neural changes, may be most susceptible to deception (Castle, Eisenberger, Seeman, Moons, Boggero, Grinblatt, & Taylor, 2012).

When comparing younger and older adults' ability to recognize and match body and facial expressions to vocal expressions, Ruffman, Sullivan, & Dittrich (2009) found that older adults were worse than younger adults, at least some of the time, in recognizing anger, sadness, fear, and happiness in body expressions and of anger in vocal expressions.

Ruffman, Henry, Livingstone, and Phillips' (2008) performed meta-analyses of emotion recognition in faces, voices, bodies, and face-voice matching while looking at differences between younger and older adult participants. They found that for older adults, facial expressions of anger, sadness, and fear were particularly difficult to identify. Older adults were worse when identifying happy and surprised faces, but the magnitude of these difficulties was substantially smaller. There was a tendency for older adults to be better at recognizing facial expressions of disgust, but the effect size failed to reach statistical significance. For voices, older adults found angry, sad, and happy voices difficult to identify, whereas they were not worse at identifying fear, surprise or disgust. For bodies, older adults were worse at identifying angry, sad, and fearful bodily expressions. There was no difference on happiness, and there was no

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data for surprise or disgust. For face-voice matching, older adults were worse at identifying all emotions when matching faces to voices. In general, while expressions of disgust were one of the most difficult emotions for younger participants to identify from faces, there was a trend for older adults to be better at recognizing this emotion. Sadness was the easiest of the negative emotions for younger people to identify but among the most difficult for older adults.

Younger adults tend to pay more attention to the eyes than older adults and this may be why older adults are worse than younger adults at recognizing sad, angry, and fearful expressions (Murphy and Isaacowitz, 2010). Research on gaze aversion and the "deceiver stereotype" found that older adults, like younger adults, associate gaze aversion with intent to deceive, but older adults are less sensitive to differences in gaze direction when making judgments about whether an individual is being deceitful (Murphy and Isaacowitz, 2010).

Older adults show less evidence of gaze following, but this was based on the age of the face that was being viewed (Slessor, Laird, Phillips, Bull, and Filippou, 2010). Younger adults showed an own-age bias by following the gaze cues of stimuli depicting people in their own age range to a greater extent than stimuli depicting older adults. However, a similar own-age effect was not found for older adults. These findings suggest that age differences in gaze following may be driven by younger adults having an advantage for processing the gaze cues from the faces of younger adults (Slessor, et al., 2010).

Research on whether cross-modal information helps older adults is conflicting. Hunter, Phillips, MacPherson, (2010) found that older adults perform as well as

younger adults on tasks where congruent auditory and visual emotional information are presented concurrently, but there are age-related differences in matching incongruent cross-modal information. Older adults were impaired at identifying emotions from one modality (faces or voices alone); they benefited from congruent multisensory information, which eliminated age differences.

Some researchers believe that multisensory information enhances older adult performance and may be a compensatory strategy for age-related reduction of brain activity of sensory cortex responding to a single modality (Cabeza, Anderson, Locantore, & McIntosh, 2002; Peiffer, Mozolic, Hugenschmidt, & Laurienti, 2007; Hunter, Phillips, & MacPherson; 2010). Older adults may need multisensory input because of cognitive changes due to shrinkage in the following areas: the caudate, the cerebellum, the hippocampus and associated cortical areas, the entorhinal cortices, the inferior temporal cortex, and the prefrontal white matter (Raz, 2005). Also, there may be sex differences. Women tend to integrate multisensory emotional stimuli more efficiently than do men (Hunter et al., 2010 and Collingnon, Girard, Gosselin, Saint-Amour, Lepore, & Lassonde, 2010). Research has shown that older adults are more verbose than younger adults. Older men's (but not older women's) verbosity was related to poorer emotion recognition. The researchers concluded that older men who talk more do so, in part, because they fail to decipher the emotional cues of a listener (Ruffman, Murray, Halberstadt, & Taumoepeau, 2010).

Yet, Cocks, Morgan, & Kita (2011) found that when comparing older adults and college students on a task that required comprehension of information presented in three different conditions: verbal only, gesture only, and verbal and gesture combined,

older adults did not benefit as much from the multi-modal input as the younger adults and were more likely to ignore gestures when decoding the multi-modal information.

In summary, some possible causes for older adults' worse performance in emotion recognition tasks when compared with younger adults are: 1) neurological deterioration of certain brain areas with age, 2) a focus on positive as opposed to negative information (socioemotional selectivity effect), 3) age-related cognitive decline, 4) fixation on the lower half of the face, rather than the upper half which is key to deciphering emotions like anger, fear, and sadness, which show up in the eyes. Because older adults do not show serious interpersonal deficits, their emotion recognition failure is not that debilitating in the real world (Isaacowitz & Stanley, 2011).

It appears that older adults may have an age-related deficit only for certain emotions and not a global deficit for all emotions. An age-related inability to detect certain emotions may have implications for deception detection. The ability to recognize micro-expressions of emotion is important in deception detection. Older adults may not be detecting the emotional leakage cues that younger adults are detecting because older adults are not paying attention to the eyes as much.

Ecological Validity and Classic Deception Detection Studies

In classic deception detection paradigms, participants are either instructed to lie or pretend. This minimizes ecological validity for the rater who views these clips because telling senders to lie may lessen their anxiety or guilt because the guilt of lying now rests on the researcher, not on the sender. This may lessen the emotional

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leakage cues of the sender, making it unnaturally harder for a rater to detect a lie in the sender. For example, Stanley et al. (2008) used videotape stimuli created by Frank & Ekman (1997, 2004) where participants were motivated to lie, or to tell the truth with the opportunity to earn additional compensation if they could convince the interviewer that they were telling the truth. The present study addresses this problem in ecological validity by motivating people to lie without asking them to lie.

In summary, since older adults are known to be more susceptible to scams and are prone to focus on the positive due to socioemotional selectivity, it is important to examine deception detection abilities within older adults and between older adults and college students. There are five major contributions of the present study. First, this study examines deception detection within and between age groups. Second, this study explores within subject age differences in deception detection based on modality (audio, visual, and audiovisual). Third, senders and raters of both sexes were used to determine gender differences. Fourth, senders of either age were not asked to lie, but lied or told the truth of their own volition. Finally, this study tests participants (both senders and raters) in settings in which they are familiar. Older adults were tested in their own homes. Both the testing setting and freedom to lie or tell the truth add to the ecological validity of the present study.

Other variables that were examined were socioeconomic index (S.E.I.) and personality of both senders and raters. Research shows that lower class individuals are more generous, charitable, and helpful compared with upper class individuals (Piff, Kraus, Cote, Cheng, & Keltner, 2010), thus one would predict that lower S.E.I. senders would be more likely to lie to protect the undergraduate research assistant's

job than higher S.E.I. senders. In regards to personality, individuals differ in dispositional interpersonal tendencies that may affect their likelihood to bend the truth in favor of others. Two subcomponents of agreeableness: trust and straightforwardness, were examined. It was expected that individuals scoring high on these variables would be more likely to tell the truth.

The following are hypotheses, exploratory analyses, and post hoc analyses of interest:

HYPOTHESIS 1: Older adults rating both college students and other older adults would do equally well in accuracy in deception detection in the audio and the audiovisual conditions because they may not benefit from visual information (or be able to integrate it) to the same extent as younger adults (Stanley, et al, 2008; Ruffman, et al, 2008; Hunter et al., 2010).

HYPOTHESIS 2: While one might expect peers to be more accurate in reading each other because people have more experience with and have spent more time with peers than with individuals outside of their own age group, however, based on previous research (Ruffman et al., 2012) no age matching effect is expected in the current study.

HYPOTHESIS 3: College students should be better at detecting deception than older adults (Stanely et al., 2008) since older adults have worse emotion recognition (Ruffman, et al, 2012).

HYPOTHSEIS 4: Women should be better than men at detecting deception (Bond et al., 2005) and one reason might be women's ability to integrate multisensory

emotional stimuli more efficiently than men (Hunter et al., 2010).

Exploratory Analysis on Age: Interpersonal goals and intentions may differ by age. Specifically, older adults were previously shown to be more likely to avoid confrontations and promote positive experiences (Charles & Carstensen, 2010). Thus it was predicted that older adults would be more likely to engage in pro-social lies.

Exploratory Analysis on Personality: Individuals differ in dispositional interpersonal tendencies that may affect their likelihood to bend the truth in favor of others. Two subcomponents of agreeableness: trust and straightforwardness, were examined. It was expected that individuals scoring high on these variables would be more likely to tell the truth.

Exploratory Analysis on Socioeconomic Index (S.E.I.) predicting prosocial lying: Based on research by Piff et al. (2010) lower class individuals are more generous, charitable, and helpful compared with upper class individuals and we predict that lower S.E.I. senders will be more likely to lie to protect the undergraduate research assistant's job than higher S.E.I. senders.

Exploratory Analysis on interaction between sender's S.E.I. and rater's S.E.I.: Does a rater's S.E.I. predict whether he or she classifies a sender as either lying or telling the truth based on what the rater perceives the sender's S.E.I. to be? Does rater's S.E.I. and sender's S.E.I. interact to predict deception accurately? In other words, would a high S.E.I. rater be more apt to think a lower S.E.I. sender was lying vs telling the truth, or would a lower S.E.I. rater be more apt to think a higher S.E.I. sender was lying or telling the truth?

Post hoc analysis on detecting lies by sender age: Is one age group easier to detect

than the other? Are college students or are older adults more readable?

Post hoc analysis on detecting lies by sender sex: Is one sex easier to detect than the other? Are women or are men more readable?

Post hoc analyses on older adult raters: Within older adults, is there any impact on accuracy as older adults age? Are younger-older adults more accurate than older-older adults?

CHAPTER 2

Pilot Study: Stimulus Design

The goal for the present study was to create a set of 24 audiovisual clips showing realistic instances of lying or truth-telling split by age group (college aged vs. older adult) and gender. Previous literature was extended by examining lies that were spontaneous (i.e., not prompted by the experimenter) and of a pro-social nature. Such types of lies map more closely onto everyday life and since older adults were interviewed in their own homes this increased ecological validity.

A setting conducive to pro-social lies was created, by asking participants to evaluate the skills of an undergraduate research assistant who was ostensibly considered as a candidate for a research position. While interviewing the participant, the assistant made a set of preordained mistakes. Later, the participant was questioned by the research supervisor on the number of mistakes. This created an incentive to protect the assistant by lying about the number of mistakes the assistant had made.

Twenty-four out of ninety-five clips were selected to show to participant raters such that the three variables of age, gender, and truth-lie condition were presented in each of the three modalities (audio, visual, audiovisual).

Although the primary goal was to develop a balanced stimulus set, exploratory analyses examined individual differences in lying in response to the prompt. Specifically, the role of sex, socioeconomic status, personality, and age were examined.

Exploratory analysis on age: Interpersonal goals and intentions may differ by age. Specifically, older adults were previously shown to be more likely to avoid

confrontations and promote positive experiences (Charles & Carstensen, 2010). Thus it was predicted that older adults would be more likely to engage in pro-social lies.

Exploratory analysis on personality: Individuals differ in dispositional interpersonal tendencies that may affect their likelihood to bend the truth in favor of others. Two subcomponents of agreeableness: trust and straightforwardness, were examined. It was expected that individuals scoring high on these variables would be more likely to tell the truth.

Exploratory analysis on socioeconomic status (S.E.I.) predicting prosocial lying: Research shows that lower class individuals are more generous, charitable, and helpful compared with upper class individuals (Piff, Kraus, Cote, Cheng, & Keltner, 2010), thus it was predicted that lower S.E.I. senders would be more likely to lie to protect the undergraduate research assistant's job than higher S.E.I. senders.

Method

Participants

Fifty-one older adults (31 females, 20 males) ranging in age from 65 to 86 years ($M = 68.57$, $SD = 4.69$) were recruited from a list of participants provided by the Cornell Institute for Translational Research on Aging (CITRA). Participants on this list were prescreened to exclude individuals with dementia and other memory and psychological health issues. All participants lived in Tompkins County, in upstate New York. Older adults received $20 for participating in the study.

Forty-four college students (25 females, 19 males) ranging in age from 18 to 23 years ($M = 19.82$, $SD = 1.27$) were recruited from two university campuses in upstate New York. All college students were recruited from majors outside of human

development and psychology to minimize raters in the main study recognizing participant senders in the video clips.   College students received $10-20 for participating in the study. Participant accrual continued for both age groups until a balanced set of stimuli was obtained.

Procedure

To increase ecological validity, data were collected in an environment that participants would feel comfortable in and perceive as familiar. To this end, students were interviewed in a campus setting and older adults were given the option to be interviewed in their homes or on campus.

Upon arrival, participants were provided with a cover-story indicating that a prospective research assistant was going to conduct a practice interview and would later be evaluated by a supervisor according to his or her accuracy and interpersonal skills. Participants gave informed consent to the specific activities involved, including consent to videotaping.

After video recording began and the research supervisor had left the room, the research assistant initiated a closely scripted conversation in which he or she disclosed a strong need to obtain the position. Next, the assistant asked a series of demographic questions and recorded the participants' answers. In repeating back participants' answers, the assistant made a series of preordained mistakes.

Next, the research supervisor entered the room. She first asked the participant to describe the assistant's interpersonal skills, nervousness, and ability to put the participant at ease. She then stated that her decision to hire the assistant would depend on the number of mistakes being 2 or below. She asked the participant whether the

mistakes made by the assistant had been below that threshold.

After this key question had been answered, the research supervisor left the room and the research assistant fully debriefed the participant. Next, the research assistant completed a memory check by asking the participants to specify on which questions the research assistant had made mistakes. If the number of recalled mistakes differed from the number that the participant had admitted to the supervisor, the assistant also asked the participant: "For clarification purposes did you protect me by lying about the number of mistakes I made?" After this question was asked the research supervisor entered the room and asked the participant if he or she had any further questions that the research assistant may not have been able to answer during the debriefing.

Measures

Socioeconomic Index (S.E.I.)

Out of 51 older adults, S.E.I. scores were obtained for 37. Older adults were asked what their occupations were, or if they were retired, what their occupations had been. Occupations were coded according to their occupational prestige on a scale from 0 (lowest) to 100 (highest) based on Nakao and Treas' S.E.I. scores (1994). Students were not asked for their occupations because student status was not considered a formal occupation.

Trust and Straightforwardness

Trust and straightforwardness scales from the NEO Personality Inventory (Costa & McCrae, 1992) were administered. Each subscale consisted of eight questions and a simplified response format was used where participants answered

"yes" or "no" to each question. After reversing the appropriate items, tallies for each subscale were computed with higher scores corresponding to higher levels of trust and straightforwardness.

Results and Discussion

Descriptive Analysis

Stimulus Selection & Characteristics

Since the research assistant made three planned mistakes, a participant whose response indicated that the assistant made two or fewer mistakes was initially coded as having made a pro-social lie to protect the assistant. The participant was coded as having told the truth if she or he said the assistant made three mistakes. If the participant said she or he lied to protect the assistant, then the participant was coded as having lied pro-socially. This is a conservative estimate given that some participants who lied probably endeavored to hide it by lying again. After the memory check and the clarifying question, participants were given the NEO Personality subtests for Trust and Straightforwardness. In addition, older adults were asked what their occupations had been prior to retirement, if they were retired, to approximate their socioeconomic index, which will be discussed in the Main Study.

To be categorized as having told the truth, the participant had to either state that three mistakes had been made or, if they failed to correctly remember the mistakes, state the number of mistakes that she or he remembered (as verified in the memory check and the discussion following the memory check). To be categorized as having lied a participant had to fit the following three criteria: 1) state that fewer than three mistakes had been made, 2) accurately remember that three mistakes had been

made, and 3) state that she or he did protect the assistant by lying about the number of mistakes. When categorizing lies, a participant could be classified in one of three categories: lied, told the truth, or was not classifiable due to either memory problems, contradictory statements made by the participant, or experimenter error.

Twenty-four clips were selected, with three clips in each age (older vs college student), gender (male vs. female), and veracity category (truth vs. lie). The average length of the clips was in minutes : seconds. milliseconds: M = 1:24.37, with a range from 0:51.23 to 2:17.98, *S.D.* = 0:23.00 seconds.

The clips showed the participant sender from the head to the knees. The research assistant and the research supervisor could be heard but not seen.

Predictors of lying or truth telling by age and sex

Exploratory analyses examined the predictors of lying or truth-telling as stated above. Neither senders' age nor senders' sex predicted whether a participant was more likely to lie.

NEO Personality Inventory subtests for trust and straightforwardness and Socioeconomic Index (S.E.I.)

For older adults, their NEO Personality Inventory trust scores were M=7.41, SD = 0.94, and their NEO straightforwardness scores were M=6.43, SD = 1.44. For college students, their NEO trust scores were M = 6.01, SD = 1.84, and their NEO straightforwardness scores were M = 4.96, SD=1.80. Older adults had significantly higher NEO trust scores t (93) = 4.47, p< .001, as well as NEO straightforwardness scores t (92) = 4.40, p<.001. This is compatible with previous research which finds that with age people become more agreeable (showing higher rates of trust and

straightforwardness) (Terracciano, McCrae, Brant, & Costa, 2005; Roberts, Walton, & Viechtbauer, 2006).

Next, NEO trust and NEO straightforwardness scores were examined to predict whether a participant was likely to lie. Binary logistic regressions were conducted using lie/truth likelihood as a response variable and NEO trust and NEO straightforwardness as predictors. NEO straightforwardness did not predict whether a participant lied. However, NEO trust marginally predicted whether a participant lied, $B = 0.35$, S.E. $= 0.18$, *Wald* $\chi^2 = 3.82$, $p = 0.05$. This means that the more trusting of others a participant is as indicated by a NEO trust score, the more likely the participant was to lie to protect another. One interpretation of this finding is that participants who were more trusting of others were more likely to believe that mistakes made by the research assistant were benign.

In a separate analysis, binary logistic regressions were conducted using lie/truth likelihood as a response variable and S.E.I. as the predictor for older senders. S.E.I. did not predict whether the older sender lied.

Summary and Conclusions

In summary, older adults were no more likely to lie to protect than college students. Senders of both ages who were more trusting were more likely to lie to protect. Socioeconomic index, sex, and NEO straightforwardness scores did not predict lying to protect. This pilot study can give researchers an idea of the characteristics of the participant senders and how these may influence participant raters in the main part of this study. However, to understand rates of lying and sex differences in lying such research would need to be conducted by sociologists and

demographers with large, national, randomly sampled data sets.

CHAPTER 3

Main Study: Raters viewing the clips

Of the ninety-five participant sender clips made, twelve older adult sender clips and twelve college student sender clips, split by gender, were selected to show to participant raters. In each of the two age groups, there were: three females telling the truth, three females lying, and three males telling the truth, three males lying. Modality (audio, visual, and audiovisual) was randomly assigned such that for each age, sex, and veracity condition, each of the three modalities was presented.

Main Study Hypotheses:

HYPOTHESIS 1: Older adults rating college students and older adults would do equally well in accuracy in deception detection in the audio and the audiovisual conditions because older adults may not benefit from visual information (or be able to integrate it) to the same extent as younger adults (Stanley, et al, 2008; Ruffman, et al, 2008; Hunter et al., 2010).

HYPOTHESIS 2: While one might expect peers to be more accurate in reading each other because people have more experience with and have spent more time with peers than with individuals outside of their own age group, based on previous research (Ruffman et al., 2012) no age matching effect is expected in the current study.

HYPOTHESIS 3: College students should be better at detecting deception than older adults (Stanely et al., 2008) since older adults have worse emotion recognition (Ruffman, et al, 2012).

HYPOTHSEIS 4: Women should be better than men at detecting deception (Bond et al., 2005) and one reason might be women's ability to integrate multisensory

emotional stimuli more efficiently than men (Hunter et al., 2010).

Main study exploratory analysis and post hoc analyses:

Exploratory Analysis on interaction between sender's S.E.I. and rater's S.E.I.:

Does a rater's S.E.I. predict whether he or she classifies a sender as either lying or telling the truth based on what the rater perceives the sender's S.E.I. to be? Does rater's S.E.I. and sender's S.E.I. interact to predict deception accurately? In other words, would a high S.E.I. rater be more apt to think a lower S.E.I. sender was lying vs telling the truth, or would a lower S.E.I. rater be more apt to think a higher S.E.I. sender is lying or telling the truth?

Post hoc analysis on detecting lies by sender age: Is one age group easier to detect than the other? Are college students or are older adults more readable?

Post hoc analysis on detecting lies by sender sex: Is one sex easier to detect than the other? Are women or are men more readable?

Post hoc analyses on older adult raters: Within older adults, is there any impact on accuracy as older adults age? Are younger-older adults more accurate than older-older adults?

Method

Participants

Seventy-seven older adults (38 females, 39 males), age range = 60 to 93, *M* = 73.77, *SD* = 7.79 were recruited from the CITRA list, as in the pilot study above. Older adult raters were paid $20 for participating in the study.

Eighty-four college students (41 females, 43 males), age range = 18 to 23, *M* = 19.58, *SD* = 1.25 were recruited from two university campuses in upstate New York

and they received 1-2 course credits that were applied to their psychology course work. All raters (both older and college) were Caucasian so as not to introduce race as one of the variables at this time.

Procedure

As in the pilot study, older adults were tested in their own homes, unless they specifically requested that the interview take place on campus, which as stated in the pilot study increased the ecological validity of the study since older adults were tested in environments in which they were familiar and comfortable. College students were tested on campus. Older adult and college student participants were asked to determine whether the person in each video clip was lying or telling the truth. The study design was a 2 (rater age: older adult, college student) x 2 (sender age: older adult, college student) x 2 (sex of sender) x 2 (sex of rater) x 3 (modality: audio, visual, audiovisual) x 2 (condition: truth versus lie) mixed model design. Rater age was a between-subject variable, the age and sex of the sender in the video clip were within-subject variables. Modality and truth-lie condition were within-subject variables. Subject was a random factor. The clips were presented randomly regarding modality, sex, age, and truth value. Raters were not told in advance what percent of senders in the clips were lying, since this information would reveal a base-line which might obscure raters' natural abilities (Leach, Talwar, Lee, Bala, & Lindsay, 2004).

Showing all twenty-four clips took approximately thirty minutes for college raters and forty-five minutes for older adult raters. In addition, all participant raters were asked basic background demographic questions (age, race, country of origin, years of education or highest degree attained, occupation prior to retirement if retired).

Modality of clip was presented randomly. A third of all clips were presented via audio, another third were presented via visual, and another third were presented via audiovisual.

Raters were shown two sample test clips. The first clip was used to test for vision and sound. No raters complained about having trouble seeing, since raters could move the laptop wherever they could best see. Raters who were hard of hearing wore a headset. The second clip was an example of a typical clip, so raters would know what to expect and could ask any questions before viewing the actual clips. Raters were shown the clips, while an assistant recorded the raters' responses as to whether they thought the senders were lying or telling the truth. The assistant recorded the length of time it took for the rater to make a truth-lie response. Then raters were asked how confident they were of their truth-lie response on a five-point Likert scale with 1 = very unsure, to 5 = very sure.

After seeing all twenty-four clips, participants were asked what helped them guess when someone was lying or telling the truth. They were also asked what hindered their ability to guess. Participants rank-ordered in terms of preference which modality they preferred (audio, visual, or audiovisual). Raters were queried regarding whether other aspects of the clips helped them determine deception, such as: body language, tone of voice, facial expression, content (the verbal exchange between people in the clips), and whether the participant rater him / herself thought people in general (not in the clips, but in the rater's own life experience) tell the truth or lie. Raters were asked about their own base-line beliefs regarding the truthfulness of college students in general and about the college students specifically in the clips.

They were also asked about their base-line beliefs regarding the truthfulness of older adults in general and about the older adults specifically in the clips. Raters were asked how often they interact with both college students and older adults.

Measures

To comply with university procedures, participant testing of college students could only take approximately thirty minutes in duration. Thus, it was not possible to include all of the measures that were employed with older adults, such as the *Mini-Mental State Exam* and the *WAIS-R* vocabulary. Years of education are as follows: college ($N = 83$, $M = 13.31$, $SD = 1.09$) and older adults ($N = 77$, $M = 17.19$, $SD = 3.68$).

Socioeconomic Index (S.E.I.)

S.E.I. in the main study ranged from 17-97 (numerical scores based on Nakao & Treas, 1994). An interaction between senders' S.E.I. and raters' S.E.I. was tested to determine whether there was any bias in raters' assessments of veracity based on perceived wealth. The response variables were raters' S.E.I. and senders' S.E.I. No interaction was found between raters' S.E.I. and senders' S.E.I., $F (1, 797) = 0.080$, p = NS. Hence, a rater with a high S.E.I. was not apt to judge a sender with a low S.E.I. as any more or less likely to lie or tell the truth than a sender with a high S.E.I. and vice versa (**Exploratory Analysis on interaction between sender's S.E.I. and rater's S.E.I.**).

NEO Personality Inventory subtests: trust and straightforwardness

Older adults' trust scores were, $M = 6.92$, $SD = 1.54$, while college students' trust scores were $M = 5.80$, $SD = 2.18$. Older adults' straightforwardness scores were,

M = 5.68, *SD* = 1.77, while college students' straightforwardness scores were *M* = 4.64, *SD* = 1.80. These developmental differences are consistent with the age trends found in the literature, with young adults being less trusting and less straightforward. This reflects the general trend of growing more agreeable with age (McCrae et al 2005; and Roberts and Mroczek, 2008).

General beliefs about lying

To establish baseline beliefs about raters' trust, raters were asked, "In general, in your own life, do you think people lie or tell the truth?" This was a forced choice, with 92% of older adults believing people tell the truth (*SD* = .27) and 65% of college students believing people tell the truth (*SD* = .48). This developmental trend was expected, since people have been found to become more agreeable with age. This is in agreement with the deception detection literature which shows that older adults tend to have a truth bias, believing that others are telling the truth more than they are lying (Bond et al, 2005).

Time spent with own age and other age group

Both older and college raters were asked how many times they interact with *college students* per year and then asked how many times they interact with *older adults* per year, to determine whether time spent with a particular age group enhanced detection abilities when observing that particular age group.

Perceived truthfulness of own and other age group in general

College and older raters were asked, *"In general, what part of the time do college students tell the truth,"* and *"In general, what part of the time do older adults tell the truth?"* Responses for both of these questions were categorical, with 1 = all of

the time, 2 = most of the time, 3 = some of the time, 4 = rarely, and 5 = never. These questions were asked to determine whether one age group had a deception bias regarding either age group.

Perceived truthfulness of own and other age group in the clips

Both college and older raters were asked, *"When you watched the computer with me, did you think the college students: 1 = all told the truth, 2 = mostly told the truth, 3 = sometimes told the truth, 4 = rarely told the truth, 5 = never told the truth."* They were also asked, *"When you watched the computer with me, did you think the older adults: 1 = all told the truth, 2 = mostly told the truth, 3 = sometimes told the truth, 4 = rarely told the truth, 5 = never told the truth."* These questions were asked to determine whether the clips presented of the two age groups were different from their overall experience of the age groups in real life.

Raters' Modality Preference

Raters were asked which modality they preferred most (which modality helped them the most in making a truth / lie decision) and which they preferred least. They rank ordered their preferences from 1 = most preferred modality, 2 = next most preferred modality, and 3 = least preferred modality. Raters were not allowed to give any of the three modalities the same level rank.

Modified mini-mental state exam

All older adults took a modified six question version of the Mini-Mental State Exam to screen for dementia and memory impairment (Folstein, Folstein, & McHugh, 1975). Some of the college students were given the Mini-Mental State Exam to see how older adults compared to college students, but it can be assumed that to perform

at college these students did not have dementia or memory impairment.

The cut-off for the modified *Mini-Mental State Exam* inclusion for being in the study was scoring at least 3 out of 6. No one received less than a 3 out of 6 (Older adults: $N = 77$, $M = 5.75$, $SD = 0.52$; College: $N = 36$, $M = 5.86$, $SD = 0.42$).

WAIS-R Vocabulary

The highest an older adult participant could score on the WAIS was 70 (Older: $N = 77$, $M = 58.34$, $SD = 6.02$; College: $N = 11$, $M = 53.64$, $SD = 4.95$). It took an hour and a half to test each older adult.

Snellen Test for Visual Acuity

All older raters and some college raters were given the *Snellen Visual Acuity test*. For older adult raters the mean corrected vision score was about 20/30 and for college raters the mean corrected vision score was about 20/20.

Coding

Analysis Plan. The study design was a 2 (sender age: college, older adult) x 2 (sender sex: female, male) x 2 (rater age: college, older adult) x 2 (rater sex: female, male) x 2 (veracity: truth vs lie) x 3 (modality: audio, visual, audiovisual) repeated measures design. Each rater saw all 24 clips in random order. The following were within subject variables: sender age, sender sex, veracity, and modality. Rater age and rater sex were between subject variables. For each of these observations participants were asked for a binary response as to whether the participant believed the person in the video clip was lying or telling the truth. Two types of statistical analyses were employed to assess ability to detect deception, Generalized Estimating Equations (GEE) and Signal Detection Theory (SDT).

Generalized Estimating Equations (GEE). GEE were used to model accuracy in detecting both truths and lies. Since each rater saw all 24 clips, the data were clustered such that each rater was his or her own cluster. When the correlation among participants within clusters is not accounted for in statistical analysis, the standard errors are biased. GEE uses a simple correction of the estimated standard errors to account for the within-cluster correlation (Norton, Bieler, Ennett, & Zarkin, 1996).

Signal Detection Analysis. Signal detection has an advantage over analyses based on mean accuracy alone. Signal detection was used to determine the rater's ability to discriminate between truth-tellers and lie-tellers. The added benefit of using signal detection is that it allows researchers to determine whether raters of each age group manifested a truth-bias or a lie-bias in how raters labeled the senders. Signal detection theory allows one to break down raters' decisions into two parts: (1) the rater's ability to discriminate between truth- and lie-tellers (d'), and (2) a measure of rater's bias C (Leach et al, 2004).

In this study, a *hit* was a correct detection of a lie. A *false alarm* was when a rater thought a sender was lying, when the sender was really telling the truth. In signal detection there are two probabilities, the hit rate, which is the number of hits divided by the number of signal (lie) trials, and the false alarm rate, which is the number of false alarms divided by the number of noise (truth) trials (Wickens, 2002, p. 8). Neither the hit rate nor the false alarm rate is sufficient on its own. A single number that represents the rater's sensitivity to the signal is best. This number is represented by discriminability (d').

Discriminability (d') is estimated: Z_{hits} - $Z_{false\ alarms}$, which is a measure that

corrects for response bias and for guessing (Bond et al, 2005). Z_{hits} represent the z score of the number of lie decisions that were made when lies were presented in the clips. $Z_{false\ alarms}$, represents the number of lie decisions made when truthful statements were presented in the clips. To summarize, d' is a measure of a rater's ability to discriminate between the noise and signal, or in this case a rater's ability to detect a difference between people who are lying and people who are telling the truth.

The false alarm rate and the noise distribution are used to estimate the criterion C, or participant bias (Wickens, 2002). C is defined as the distance of criterion from the intersection of the two underlying distributions (Snodgrass & Corwin, 1988).

$$C = Z_{False\ Alarms} - d'/2$$

The larger the d', the better the discriminability will be. When the C-value is 0, this indicates no bias. When assessing lie as the signal, a negative C-value indicates a truth-bias and a positive C-value indicates a lie-bias.

Results and Discussion

Descriptive Analyses

Binary logistic regression and generalized estimating equations (GEE) were used to calculate the estimated marginal means (EMMeans) to demonstrate pairwise comparisons. Table 1 shows the full model and Table 2 shows the final model for those variables and interactions that were significant or meaningful. For all pairwise comparisons throughout this paper, Bonferroni corrections were made.

Table 1. *Full GEE Model*

Variable	Generalized Score Chi-Square	df	Significance
Sender Age	11.641	1	$p = 0.001$
Sender Sex	8.527	1	$p = 0.003$
Rater Age	19.319	1	$p = 0.000$
Modality	61.914	2	$p = 0.000$
Sender Age x Sender Sex	43.344	1	$p = 0.000$
Sender Age x Rater Age	2.973	1	$p = 0.085$
Sender Age x Modality	10.090	2	$p = 0.006$
Sender Sex x Rater Age	0.029	1	$p = 0.865$
Sender Sex x Modality	1.249	2	$p = 0.536$
Rater Age x Modality	12.838	2	$p = 0.002$
Sender Age x Sender Sex x Rater Age	0.268	1	$p = 0.605$
Sender Age x Sender Sex x Modality	1.871	2	$p = 0.392$
Sender Age x Rater Age x Modality	0.996	2	$p = 0.608$
Sender Sex x Rater Age x Modality	0.143	2	$p = 0.931$
Sender Age x Sender Sex x Rater Age x Modality	3.492	2	$p = 0.174$

Table 2. *Test of Model Effects(GEE)*

Variable	Generalized Score Chi-Square	df	Significance
Sender Age	11.256	1	$p = 0.001$
Sender Sex	8.200	1	$p = 0.004$
Rater Age	17.945	1	$p = 0.000$
Modality	45.185	2	$p = 0.000$
Sender Age x Sender Sex	34.595	1	$p = 0.000$
Sender Age x Modality	9.679	2	$p = 0.008$
Rater Age x Modality	12.321	2	$p = 0.002$
Sender Age x Rater Age	3.230	1	$p = 0.072$

Main study Hypotheses

HYPOTHESIS 1: Older adults rating college students and other older adults would

do equally well in accuracy in deception detection in the audio and the audiovisual

conditions because they may not benefit from visual information (or be able to

integrate it) to the same extent as younger adults (Stanley, et al, 2008; Ruffman, et al,

2008; Hunter et al., 2010).

Modality

Estimated marginal means for modality show mean accuracy for audiovisual to be 68%, *S.E.* = 1.4%; mean accuracy for audio to be 64%, *S.E.* = 1.4%; and mean accuracy for visual to be 54%, *S.E.* = 1.3%. The overall chi-square of these pairwise comparisons revealed significant differences for the three conditions, $\chi^2_{(2)} = 63.029$, $p < 0.001$. There was no significant difference between audiovisual (68%) audio (65%), *S.E.* = 1.8%, however, audio (65%) was significantly more likely to lead to greater accuracy than visual (54%), *S.E.* = 1.8%, $p = 0.000$, and audiovisual (68%) was significantly more likely to increase accuracy than visual (54%), *S.E.* = 1.9%, $p < 0.001$.

 Senders' Age and Modality

Mean accuracy of modality and senders' age was examined. Mean accuracy of raters viewing college student senders in the: audiovisual modality was 72%, *S.E.* = 1.8%, audio modality was 69%, *S.E.* = 1.8%, and visual modality was 53%, *S.E.* = 1.8%. Mean accuracy of raters viewing older adult senders in the: audiovisual modality was 64%, *S.E.* = 1.9%, audio modality was 60%, S.E. = 1.8%, and visual modality was 55%, *S.E.* = 1.8%. To determine which comparisons were significant, pairwise comparisons were examined.

The overall chi-square of these pairwise comparisons revealed significant differences for the six conditions, $\chi^2_{(5)} = 83.698$, $p < 0.001$. Raters viewing college senders in the audiovisual modality were significantly more accurate (72%) than raters viewing college senders in the visual modality (53%), *S.E.* = 2.7%, $p < 0.001$. Raters

viewing college senders were significantly more accurate in the audio modality (69%) than when viewing college senders in the visual modality (53%), *S.E.* = 2.5%, *p* < 0.001. Thus, raters viewing college senders were negatively impacted in terms of accuracy by the removal of the audio modality.

Raters viewing college senders in the audiovisual modality were significantly more accurate (72%) than when the raters viewed older senders in the audiovisual modality (64%), *S.E.* = 2.4%, *p* = 0.006. Raters viewing college senders in the audio modality were significantly more accurate (69%) than when the raters viewed older senders in the audio modality (60%), *S.E.* = 2.3%, *p* < 0.001. Thus, when raters were in either the audiovisual or the audio modalities, college students were easier to detect than older adults.

Raters viewing older senders in the audiovisual modality were significantly more accurate (64%) than when the raters viewed older senders in the visual modality (55%), *S.E.* = 2.6%, *p* < 0.001. There were no significant differences between raters' accuracy for older senders in either the audio or visual modalities. Thus, raters were more accurate when judging an older adult in the audiovisual modality than in either the audio or visual alone.

Raters' Age and Modality

Estimated marginal means show that in the audiovisual modality college rater accuracy was 75%, *S.E.* = 1.8% and older rater accuracy was 61%, *S.E.* = 2.2%. In the audio modality college rater accuracy was 68%, *S.E.* = 1.8% and older rater accuracy was 61%, *S.E.* = 2.1%. In the visual modality college rater accuracy was 54%, *S.E.* =

1.8% and older adult accuracy was 53%, *S.E.* = 1.8%. To see which comparisons were significant, pairwise comparisons were made *within each age group.*

The overall chi-square of these pairwise comparisons revealed significant differences for the six conditions, $\chi^2_{(5)} = 113.226\ p < 0.001$. College raters were significantly better at accuracy in the audiovisual modality (75%) than in the visual modality (54%), *S.E.* = 2.4%, $p < 0.001$. College raters were significantly better at accuracy in the audio modality (68%) than in the visual modality (54%), *S.E.* = 2.2%, $p < 0.001$. College raters were only marginally better at accuracy in the audiovisual modality (75%) than in the audio modality (68%), *S.E.* = 2.4%, $p = 0.063$. Thus, college raters' accuracy declined when audio was removed.

Older raters were not significantly different in either the audio modality (61%) or in the audiovisual modality (61%), *S.E.* = 2.5%, $p = $ NS. Older raters were marginally better in the audiovisual modality (61%) than in the visual modality (53%), *S.E.* = 2.8%, $p = 0.072$. Older raters were marginally better at accuracy in the audio modality (61%) than in the visual modality (53%), *S.E.* = 2.7%, $p = 0.063$. Thus, older raters did equally well in the audiovisual and audio modalities and showed a marginal decline when audio was removed.

Comparing modality between age groups

In the audiovisual modality, college raters were more accurate (75%) than older raters (61%), *S.E.* = 2.8%, $p < 0.001$. In the audio modality, college raters were marginally more accurate (68%) than older raters (61%), *S.E.* = 2.7%, $p = 0.045$, whereas in the visual modality, there was no difference, $\chi^2_{(5)} = 113.226\ p < 0.001$.

Thus, college raters appear to be gaining more from combining the audiovisual modality than older raters.

HYPOTHESIS 2: While one might expect peers to be more accurate in reading each other because people have more experience with and have spent more time with peers than with individuals outside of their own age group, based on previous research (Ruffman et al., 2012) no age matching effect is expected in the current study.

Rater Age and Sender Age

Estimated marginal means were calculated to answer the question: Are raters better at detecting lies of senders within their own age group? In other words was there an age matching effect? Mean accuracy rates for college rating other college students were 70%, *S.E.* = 1.6%, while mean accuracy rates for older rating older were 57%, *S.E.* = 1.6%. Mean accuracy for college rating older were 62%, *S.E.* = 1.7%, while mean accuracy rates for older rating college students were 60%, *S.E.* = 1.6%.

There appeared to be an age-matching effect for college students but not for older adults. The difference in mean accuracy between college students rating college senders (70%) and older participants rating older senders (57%) was significant, mean difference = .13, *S.E.* = 2.3%, *p* < 0.001. Thus, college raters were significantly better at rating their peers than older raters were at rating their own peers. The difference in accuracy between college students rating other college students (70%) and older raters rating college students (60%) was also significant, *S.E.* = 2.3%, mean difference = .08, *p* < 0.001. College students were better at rating other college students than older adults were at rating college students. And finally, the difference in mean accuracy between college students rating college students (70%) and college students rating

older adults (62%) was significant, $S.E. = 2.3\%$, mean difference $= .10$, $p = 0.004$; $\chi^2_{(3)} = 33.744$ $p < 0.001$. College raters were better at rating their peers than they were at rating older adults. However, the difference in accuracy between college rating older (62%) and older rating older (57%) was not significant. Thus it was challenging for both rater age groups to accurately detect older adult senders.

Signal Detection: Modality

Linear mixed models were used to control for repeated measures, since there were three different modalities (audio, visual, and audiovisual) for each rater. Estimated marginal means were used to compute pairwise comparisons. For each test, the dependent measures were individually d' and C. The results were as follows. Table 3 shows the final model for d'discrimination when lie was the signal.

Table 3. *SDT Final model of d' (discriminability) when lie was the signal*

Source	Numerator *df*	Denominator *df*	*F*	Significance
Modality	2	316	28.516	$p < 0.001$
RatersSex	1	157	0.459	$p = 0.499$
RaterAge	1	157	9.036	$p = 0.003$
Modality x RaterAge	2	316	3.723	$p = 0.025$

Pairwise comparisons for modality within each age group for mean d' discriminability were conducted. College raters were significantly better at discrimination in the audio modality ($M = 2.803$) than in the visual modality ($M = 0.542$), $S.E. = 0.457$, $p < 0.001$. College raters were significantly better at discrimination in the audiovisual modality ($M = 3.757$) than in the visual modality ($M = 0.542$), $S.E. = 0.457$, $p < 0.001$. Older raters were significantly better at discrimination in the audio modality ($M = 2.065$) than the visual modality ($M = $

0.459), *S.E.* = 0.457, *p* = 0.005. Older raters were significantly better at discrimination in the audiovisual modality (*M* = 1.895) than the visual modality (*M* = 0.459), *S.E.* = 0.457, *p* = 0.015. These pairwise comparisons show that both college and older raters were less accurate when audio was removed.

Next, mean differences in d' discrimination were examined within each modality between the two age groups. In the audiovisual modality, college raters were significantly better at discrimination (*M* = 3.757, *S.E.* = 0.335) than older adults (*M* = 1.895, *S.E.* = 0.348), *p* < 0.001. In the audio modality, college raters were not significantly better at discrimination (*M* = 2.803, *S.E.* = 0.335) than older adults (*M* = 2.065, *S.E.* = 0.348), *p* = NS. In the visual modality, college raters were not significantly better at discrimination (*M* = 0.542, *S.E.* = 0.335) than older adults (*M* = 0.459, *S.E.* = 0.348), *p* = NS. Thus, college raters were helped more than older raters in the audiovisual modality, but not more than older raters in either the audio or visual alone. Table 4 shows the final model for C bias when lie was the signal.

Table 4. *SDT Final model of C bias when lie was the signal*

Source	Numerator *df*	Denominator *df*	*F*	Significance
Modality	2	318	45.717	*p* = 0.000
RatersSex	1	157	0.102	*p* = 0.750
RaterAge	1	157	0.068	*p* = 0.795

Raters showed a truth-bias for all three modalities: audiovisual C bias = -4.002, *S.E.* = 0.276, audio C bias = -3.925, *S.E.* = 0.276, and for visual C = -0.853, *S.E.* = 0.276. The only significant differences were: raters in the audiovisual modality showed a greater truth-bias than raters in the visual modality, *S.E.* = 0.376, *p* < 0.001; and raters in the audio modality showed a greater truth-bias than raters in the visual

modality, *S.E.* = 0.376, p < 0.001. There was no significant truth bias between

audiovisual and audio, *S.E.* = 0.376, *p* = NS. Thus, any modality with audio in it led

to a greater truth-bias than visual.

There was no significant difference in C bias for either rater sex (female raters'

C bias was -2.981, *S.E.* = 0.244; male raters' C bias was -2.872, *S.E.* = 0.238) or rater

age (college raters' C bias was -2.971, *S.E.* = 0.237; older raters' C bias was -2.883,

S.E. = 0.246).

HYPOTHESIS 3: College students should be better at detecting deception than older

adults (Stanely et al., 2008) since older adults have worse emotion recognition

(Ruffman, et al, 2012). Pairwise comparisons showed that indeed, college raters were

significantly more accurate than older adult raters (66% for college, *S.E.* = 1.2%; 58%

for older adult, *S.E.* = 1.3%), $\chi^2_{(1)} = 20.123$, $p < 0.001$. Signal detection analyses

were conducted to examine overall developmental trends, not taking into account

modality.

Signal Detection: Overall developmental trends (not taking into account modality)

Signal detection analyses were calculated for raters' responses without taking

into account the modality of the clips, to determine raters' responses by age group.

Table 5 shows means and standard deviations for d' and C bias when lie was the

signal. For d' discriminability there was a significant difference between college (*M* =

1.05, *SD* = 1.10) and older adults (*M* = 0.56, *SD* = 1.08), *t* (158) = 2.82, *p* = 0.005.

Overall college students were significantly better at detecting lies (college students

had a significantly higher d' discrimination value for lies).

For C bias there were no significant differences between college (M = -1.36, SD = 1.54) and older adults (M = -1.26, SD = 1.49), t (158) = -0.41, p = 0.681. College students and older adults were not significantly different from each other in terms of bias (C), and they both had a truth bias.

Table 5. *SDT Means and standard deviation for d' and C when the signal was lie*

Age Group Rater	d'(*lie* detection ability)		Bias C criterion	
	M	**SD**	**M**	**SD**
College	1.05	1.10	-1.36	1.54
Older Adult	0.56	1.08	-1.26	1.49

Signal Detection: Absolute age-levels (not taking into account modality)

After looking at overall developmental trends between college students and older adults' abilities to discriminate truths from lies (d') as well as to determine their biases (C), absolute levels between college students in terms of d' and C were examined. Examining absolute levels provides a determination of the nature of the age trends. A one-sample t-test was conducted for each age group to determine whether each age groups' d' and C bias differed from zero, zero indicating no bias. Table 6 shows a one-sample t-test for d' when lie was the signal. For college students, their ability to discriminate lies from noise (d') M = 1.05 was significantly greater than 0, p < 0.001. For older adults, their ability to discriminate lies from noise was significantly greater than 0, M = 0.56, p < 0.001. This means, looking at each age group by itself (not comparing age groups to each other), both groups could detect lies greater than 0, where 0 = no ability to detect lies.

Table 6. *SDT One-sample T-test for d' when lie was the signal*

Age Grp	N	Mean	S.D.	S.E.	t	df	Sig (2-tailed)
College	83	**1.05**	1.10	0.12	8.667	82	**0.000**
Older	77	**0.56**	1.08	0.12	4.547	76	**0.000**

Table 7 shows a one-sample t-test for C when lie was the signal. For college students, their truth bias (C) was statistically less than 0, $M = -1.36$, $p < 0.001$. For older adults, their truth bias was statistically less than 0, $M = -1.26$, $p < 0.001$. This means, examining each age group by itself (not comparing age groups to each other), older adults and college students each had a truth bias that was significantly different from 0, where 0 = no bias.

Table 7. *SDT One-sample T-test for C when lie was the signal*

Age Grp	N	Mean	S.D.	S.E.	t	df	Sig (2-tailed)
College	83	**-1.36**	1.54	0.17	-8.030	82	**0.000**
Older	77	**-1.26**	1.49	0.17	-7.421	76	**0.000**

Post hoc analysis on detecting lies by sender age: Is one age group easier to detect than the other? Are college students or are older adults more readable?

Pairwise comparisons show sender age led to significant differences in accuracy, with raters' accuracy being higher when viewing college senders ($M = 65\%$, $S.E. = 1.2\%$) than when viewing older adults ($M = 60\%$, $S.E. = 1.2\%$), $\chi^2_{(1)} = 12.1222$, $p < 0.001$.

Estimated marginal means for senders' age and senders' sex were performed. Mean accuracy for participants rating: college females was 63%, $S.E. = 1.4\%$, college males was 67%, $S.E. = 1.5\%$, older females was 66%, $S.E. = 1.5\%$, and older males was 53%, $S.E. = 1.4\%$.

Mean accuracy for participants rating an older female ($M = 66\%$) were

significantly greater than for an older male ($M = 53\%$, *S.E.* = 1.8%, $p = 0.000$. There

were no significant differences for participants rating a college male ($M = 67\%$) than a

college female ($M = 63\%$), *S.E.* = 1.8%, $p = $ NS. Mean accuracy for participants

rating a college male (67%) were significantly greater than rating an older male ($M =$

53%), *S.E.* = 1.8%, p < 0.001. There were no significant differences for participants

rating an older female (66%) compared to a college female ($M = 63\%$), *S.E.* = 1.9%, *p*

$=$ NS; $\chi^2_{(3)} = 71.491$, $p < 0.001$. Older males were the most difficult for raters to

detect deception.

HYPOTHSEIS 4: Women should be better than men at detecting deception (Bond et

al., 2005) and one reason might be women's ability to integrate multisensory

emotional stimuli more efficiently than men (Hunter et al., 2010). In this study there

were no sex differences in ability to detect deception.

Post hoc analysis on detecting lies by sender sex: Is one sex easier to detect than the

other? Are women or are men more readable? Using estimated marginal means and

pairwise comparisons, sender's sex led to significant differences in accuracy with

rater's accuracy being higher when viewing a female sender (64% accuracy rate, S.E.

$= 1.1\%$) than when viewing a male sender (60% accuracy rate, S.E. = 1.2%), $\chi^2_{(1)} =$

8.624, $p = 0.003$. Thus female senders were significantly easier to detect than male

senders.

Post hoc analysis on older adult raters: Within older adults, is there any impact on

accuracy for the oldest old? A regression analysis with lie as the signal (d') as the

dependent variable and the numerical value of older adult raters' age as the

independent variable was conducted. The younger the older adult was the more

accurate, or alternatively, the older the older adult was, the less accurate, B = -0.048,

$S.E.$ = -0.015; t = -3.200; p = 0.002. Also, the oldest old were worse at detecting truth

as the signal.

Next, time spent with own and other age group, perceived truthfulness of own

and other age group in general, perceived truthfulness of own and other age group in

the clips in particular, confidence and latency, modality preferences, and the modified

mini-mental state exam and accuracy were examined.

Time spent with own and other age group

A general linear model was employed, with dependent measures d' and C, to

determine whether time spent with one's own age group or the other age group

impacted accuracy. Age group (college and older adult) was a fixed factor and the

two questions (time spent with one's own age group and time spent with the other age

group) were covariates. Time spent with either college students or older adults did not

significantly predict discrimination ability. College raters (N = 83) interacted with

other college students M = 365 (days per year), $S.D.$ = 0.0000, and with older adults M

= 72.542 (days per year), $S.D.$ = 100.3655. Older raters (N = 77) interacted with

college students M = 68.416 (days per year), and with other older adults M = 315.468

(days per year), $S.D.$ = 97.3662.

Perceived truthfulness of own and other age group in general

One question asked was, *"In general, what part of the time do college students*

tell the truth." Responses were categorical, with 1 = all of the time, 2 = most of the

time, 3 = some of the time, 4 = rarely, and 5 = never. The most common response to this question for both college and older adults was "most of the time" (college $N = 83$, $M = 2.45$, $S.E. = 0.524$; older $N = 77$, $M = 2.17$, $S.E. = 0.377$). The other question asked was, *"In general, what part of the time do older adults tell the truth?"* The most common response to this question for both college and older adults was "most of the time" (college $N = 83$, $M = 2.12$, $S.E. = 0.395$; older $N = 77$, $M = 2.09$, $S.E. = 0.403$). In general both college and older raters believe that their own group and the other group tell the truth most of the time. This finding is predictable, since both age groups showed a truth bias.

Perceived truthfulness of own and other age group in the clips

This question asked, *"When you watched the computer with me, did you think the college students: 1 = all told the truth, 2 = mostly told the truth, 3 = sometimes told the truth, 4 = rarely told the truth, 5 = never told the truth."* The most common responses for both college and older adults were "mostly told the truth" and "sometimes told the truth" (college $N = 83$, $M = 2.72$, $S.E. = 0.611$; older $N = 77$, $M = 2.25$, $S.E. = 0.610$). The other question asked, *"When you watched the computer with me, did you think the older adults: 1 = all told the truth, 2 = mostly told the truth, 3 = sometimes told the truth, 4 = rarely told the truth, 5 = never told the truth."* The most common response for both college and older adults was "mostly told the truth" (college $N = 83$, $M = 2.42$, $S.E. = 0.587$; older $N = 77$, $M = 2.17$, $S.E. = 0.497$). Thus, when watching the clips of college and older senders, the college and older raters thought the senders were mostly and sometimes telling the truth. This is reassuring,

since one could infer that these clips elicited similar overall truthfulness ratings as those experienced in everyday life.

To determine whether rater's beliefs impacted accuracy a general linear model was used with dependent measures d' and C. A fixed factor was age group (college and older adult); for the questions pertaining to perceived truthfulness of own and other age groups *in general* and perceived truthfulness of own and other age groups *in the clips*.

D' was not significant for any of the questions pertaining to perception of truthfulness in either the general or specific clips questions. However, in terms of C bias, the question, *"When you watched the computer with me, did you think the college students 1= all told the truth, 2 = mostly told the truth, 3 = sometimes told the truth, 4 = rarely told the truth, 5 = never told the truth"*, showed a significant main effect for C bias, $p = 0.000$. College raters showed a lie-bias and older raters showed a truth-bias when both college and older raters answered this question. College raters' multiple choice responses indicated that they thought college senders told the truth, but college raters' behavior showed a lie-bias. Either the college raters may not have been completely honest when filling out the self-report part of the survey, possibly wanting to show that they trusted college students in an effort not to offend the college-aged research assistant administering the survey, or college raters may have lacked self-insight. When the perception of truthfulness in either the general or specific clip questions were tested with age group as an interaction term, none of the interactions were significant.

Confidence and Latency

GEE were used to assess confidence and latency. Signal detection could not be used because there were 24 confidence values and 24 latency values per rater since each rater made a confidence decision and a latency time was recorded after seeing every clip. Signal detection would involve grouping the data by collapsing it into categories and each confidence rating and latency measure would be lost. Both confidence and latency were categorized as continuous variables. The test of model effects for confidence and latency are below in Table 8.

Table 8. *Test of Model Effects: Confidence and Latency*

Variable	Generalized Score Chi-Square	df	p-value
Confidence	0.015	1	0.901
Latency	0.045	1	0.832
Confidence x Latency	5.291	1	0.021

Parameter estimates were conducted for confidence and latency. When confidence was $B = 0.015$ (*S.D.* = 0.1190), the slope, or effect on latency was 0. When latency was $B = -0.001$ (*S.D.* = 0.0047), the slope or effect on confidence was 0. When the interaction of confidence x latency was $B = 0.003$ (*S.D.* = 0.0013), the slope of one variable changed when the other variable increased by one unit. For every one unit increase in latency, the slope of confidence increased by 0.003. When confidence increased by one unit, the response variable (accuracy) increased by 0.015; the higher the confidence, the higher the accuracy and the higher the confidence, the higher the slope of latency, the greater the latency, the more accurate. The longer raters took to make a decision, the greater their accuracy. The more confident the raters were, the greater the raters' accuracy.

However, centering the variables of Confidence and Latency make the B parameter estimates more meaningful. Having the parameter estimates set at 0 was not meaningful because 0 was not a value that was ever selected by a rater. There was no zero on the confidence scale and no participant made a truth / lie decision at time zero since this would mean the rater made the decision without seeing the clip. The mean for confidence was 3.51, where 1 = very unsure and 5 = very sure. The mean for latency was 01:21.70, in minutes, seconds, and milliseconds, and this was the amount of time it took raters to make a truth / lie decision for each sender clip. The parameter estimates for confidence centered were $B = 0.286$, $S.E. = 0.0355$, Wald $\chi^2 = 64.876$, df = 1, $p < 0.001$. For latency centered, the parameter estimates were $B = 0.011$, $S.E. = 0.0016$, Wald $\chi^2 = 45.053$, df = 1, $p < 0.001$. The interaction between confidence centered and latency centered was $B = 0.003$, $S.E. = 0.0013$, Wald $\chi^2 = 5.466$, df = 1, $p = 0.019$. This means that for each additional unit for latency the slope of confidence increased by 0.003 and that for each additional confidence, the slope of latency on accuracy increased by 0.003. In short, as confidence increased, accuracy increased. Likewise, as latency increased, accuracy increased. Raters who were more confident were more accurate and raters who took longer to make a decision were also more accurate.

Modality Preferences

The majority of raters ranked audiovisual first, audio as second, and visual as third for modality preferences. When running a univariate analysis with d' and C as the dependent variables when lie was the signal, the fixed factors included: age group, preference ranking for audio, preference ranking for visual, and preference ranking for

audiovisual. The main effect of each of the three preference rankings for d' and C did not show any significant impact as a result of raters' preferences.

Modified Mini-Mental State Exam

The modified Mini-Mental State Exam scores did not predicted either overall accuracy or d' discrimination ability when lie was the signal. However, the modified Mini-Mental State Exam scores did predict C bias, $B = -1.12$, $S.E. = 0.48$, $p = 0.02$. Lower modified Mini-Mental State Exams scores significantly predict truth bias.

Differences in Latency between College Student and Older Adult Raters

College student raters had significantly shorter latencies (faster reaction times) than older adult raters, $F = 12.217$, $t (3822) = -8.327$, $p < 0.001$. College student rater average latency was $M = 0.01:18$, $N = 1985$, $S.D. = 0.00:24$, while average latency for older adult raters was $M = 0.01:25$, $N = 1839$, $S.D. = 0.00:27$, where latency was in minutes . seconds : milliseconds.

CHAPTER 4

GENERAL DISCUSSION

The goal of the present research was to examine age, gender, social class, and personality in lie detection and transmission. In the pilot study, sender's age, personality, and socioeconomic status were explored while creating stimuli to show to participant raters. The sender data was examined for patterns in participant deception. Neither age nor socioeconomic status of sender predicted prosocial lying (**exploratory analyses on age and S.E.I.**). However, individuals who were more trusting were more willing to lie to protect (**exploratory analysis on personality**) possibly believing in the good nature of the research assistant.

In the main study it was hypothesized that older adults rating college students and other older adults would do equally well in accuracy in deception detection in the audio and the audiovisual conditions because older adults may not benefit from visual information (or be able to integrate it) to the same extent as young adults (Stanley & Blanchard-Fields, 2008) **(HYPOTHESIS 1).** Regardless of age, audio and audiovisual modalities led to greater accuracy than visual. Overall, the difference between audio and audiovisual was not significant for raters.

Older adults performed better in the audio modality than in the visual modality, but this difference was not significant. Older raters did equally well in the audio and audiovisual modalities. College raters were better at detecting lies in the audio than in the visual modalities and were better at detecting lies in the audiovisual than the visual modalities. College raters were helped to a greater extent in the audiovisual modality than were older raters. Thus **HYPOTHESIS 1** was partially supported.

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The main age difference was that, in general, college students were more accurate than older adults (which supports Stanley et al., 2008), and neither older adults nor college students benefited as much from the visual modality. This supports Stanley et al.'s (2008) finding that older adults were less accurate in the visual condition for their crime interviews, but in the present study both older adults and college students were less accurate in the visual modality. Another way to look at modality is that by taking away audio input, all age groups' deception detection accuracy was reduced.

One device that may help older adults detect deception is the use of hearing aids and eyeglasses. Without up-to-date hearing- and vision-wear, older adults may experience stimulus deprivation because they may not be receiving the stimulus input that younger adults are receiving. It is important for older adults to maintain good sensory-aids to help them navigate complex social environments so that they can maintain active and engaging lifestyles.

HYPOTHESIS 2 There was an age-matching effect for college students but not for older adults. College students were significantly more accurate at detecting deception in their peers, while older adults were not significantly different in detecting deception in peers than in college students. This refutes Ruffman et al's (2012) finding of no age-matching effect.

HYPOTHESIS 3 was supported, since college raters were more accurate overall than older raters. College students were hypothesized to be better at detecting deception than older adults (Stanley et al., 2008) since older adults have worse emotion recognition (Ruffman, et al., 2012). In the present study, college raters may

have been better at deception detection than older raters for several reasons. First, older adults are experiencing neurological changes that may make them more trusting of others than is warranted (Castle, et al., 2012). Second, since audiovisual is so fundamental to accurate deception detection, it may be older adults' weaker hearing and vision that may be contributing to this age difference in accuracy. Future research is needed to test differences in abilities between older adults utilizing adequate or even optimal hearing aids and eyewear as compared to older adults who may be using less than adequate sensory aids.

Future studies will need to have an audiologist test hearing by using the Weber and the Rinne tests, and the Hearing in Noise (HINT) test, in addition to the Snellen Test used in the present study to explore to what extent vision and hearing deficits play a role in deception detection abilities.

No sex differences were found in ability to detect deception. Contrary to Bond et al., 2005, women were no better than men at deception detection (**HYPOTHESIS 4**). College students' lies were easier to detect than older adults' and older adult males were the most difficult to detect (**Post hoc analysis on age**). Perhaps older males may have displayed less affect and may have given less verbal information than the other three groups (college females, college males, and older females), but this finding would require further testing. Females were easier to detect than males (**Post hoc analysis on sex**). One possibility for this finding is that females may be more emotionally expressive in attempting to connect with the interviewers. Examining gender differences in emotional expression and communication styles might aid in the explanation of why older adult males were the hardest to detect and women the easiest

to detect.

The older the raters were, the worse they were at detecting deception (**post hoc analysis regarding accuracy with increasing age**). This may be due to changes in cognitive and neuroanatomy with age, but keeping sensory perception devices like hearing- and vision-aids as up-to-date as possible might help lessen this change, but this remains to be tested.

There was no interaction between senders' social class and raters' social class (**Post hoc analysis regarding interaction of sender S.E.I. and rater S.E.I.**). This means that raters were not basing their deception detection responses on how economically well off they perceived the senders.

While the present study found older adult males the most difficult to detect, Ruffman, Murray, Halberstadt, & Vater (2012) discovered just the opposite. They found older adults to be more transparent in their lying. One possible explanation for this difference was that older adults in Ruffman et al.'s (2012) study were asked to lie about their opinions. However, older adults have had a lifetime of practice telling the truth about their opinions and may not have been as good about lying about their opinions because they most likely have not had an equal amount of practice lying about their beliefs as they have had in telling the truth about these beliefs. College students, however, most likely are still experimenting with their belief systems and they may not find it as challenging to lie about their opinions as older adults might, thus making college students more believable liars. In the present study, both older adults and college student senders were lying or telling the truth about how an undergraduate research assistant performed while conducting an interview. This

experimental setting may have been less biasing for either age group.

Truth-bias and age

When detecting lies, both college and older raters showed a truth-bias and were comparable to each other in that bias. This is an interesting finding, because in the literature it has been well documented that older adults have a truth-bias, but, to the best of our knowledge, it has not been documented that college students also have a truth-bias when detecting lies.

While raters showed a truth-bias for all three modalities, the only significant differences were that raters in the audiovisual modality showed a greater truth-bias than raters in the visual modality; and raters in the audio modality showed a greater truth-bias than raters in the visual modality. Raters of both ages and both sexes had the same level of bias when trying to detect lies. This may be because, in general, most people are trusting, at least those who do not have a psychopathology (Fenster & Fenster, 1998; Roth, Newman, Pelcovitz, van der Kolk, & Mandel, 1997; American Psychiatric Association, 1994).

Confidence

The current study found that as confidence increases, accuracy increases. This may be due to the ecological validity of the senders' lies, since senders were not instructed to lie or tell the truth and older adult senders were taped in their own homes. Thus raters may have felt more certain in their truth or lie decisions, which increased their confidence.

Most studies have found that raters' confidence in their truth / lie decisions are not a good indicator of accuracy. Ekman and O'Sullivan (1991) found confidence

ratings of the Secret Service were negatively correlated with their accuracy scores. Most studies have found that police officers are more confident in their ability to detect lies but not more accurate (DePaulo & Pfeifer, 1986; Garrido, Masip, Herrero, 2004). It is believed that confidence may be a hindrance since individuals who are highly confident in their ability to detect deception are less likely to scrutinize a person's behavior (Levine & McCornack, 1992). Decisions are made more hastily and based on limited information when confidence is high (Vriji, 2000).

In addition, confidence in making truth judgments is higher than when making lie judgments (Bond, Thompson, & Malloy, 2005; and DePaulo, Charlton, Cooper, Lindsay, & Muhlenbruck, 1997). In studies by Ekman and O'Sullivan (1991), Garrido, et al. (1998), and Levine and McCornack (1992), senders were told to lie and told to tell the truth. DePaulo and Pfeifer (1986) had senders tell one planned lie, one planned truth, one spontaneous lie, and one spontaneous truth. The difference between these studies and the present study is that participants were not asked to lie or to tell the truth. Whether a sender is told to plan or create a lie spontaneously does not matter, because being told to lie minimizes the ecological validity of the study. Telling senders to lie may lessen their anxiety or guilt about lying, because by the researcher telling senders to lie, the guilt of the lie rests on the researcher and not on the sender, who is less apt to "leak" emotional cues. The ecological method of this study may account, at least in part, for the difference in the relationship between confidence and accuracy. In addition, it should be noted, that these studies included senders who were: college students, college student romantic partners, and college-aged women interested in careers in nursing. Raters in these studies were: law-

enforcement personnel, college students, and college student romantic partners. Older

adults were not tested as either senders or raters.

Real World Implications

Since the population of older adults ages 65 and older will more than double

by 2050 in the United States (United States Census Bureau, 2009) and since older

adults are choosing to remain engaged and active both in public service and work

(Ruva & Hudak, 2013), it is imperative that psychological researchers understand both

the cognitive and sensory strengths and weaknesses of older adults.

First, understanding the deception detection strengths and weaknesses of older

adults as compared with college students is important since older adults are often the

target of financial scams, con artists, abuse, and exploitation. Thus, in the present

study, by having older adults detect deception in college students and in other older

adults, we can see age differences and similarities between these two age groups. For

one, college students and older adults perform best in the audiovisual modality, but

college students overall were better at detecting deception than older adults. There

was an age-matching effect for college students but not for older adults. The more

time spent with a particular age group did not enhance accuracy in detecting deception

in that age group.

In addition, while researchers have found that older adults do not look at the

sender's eyes as much as younger adults and this is one reason thought to explain why

older adults are not as accurate at recognizing certain emotional facial expressions

(Murphy & Isaacowitz, 2010; and Slessor et al., 2010), it might be the case that older

adults are looking at the lower part of the sender's face because older adults, who may be hard of hearing, may be trying to lip-read what the sender is saying. This hypothesis merits testing and is in accord with the suggestion that older adults would be helped in obtaining state-of-the-art hearing aids and other sensory perception devices.

Second, another reason it is important to understand the strengths and limitations of older adult deception detectors is that more older adults are participating on juries (Ruva & Hudak, 2013). The socioemotional goals of older adults can be different from younger adults as shown with the positivity effect in socioemotional selectivity and may determine how older jurors render their verdicts in the legal setting.

Third, older adults, though infrequent, may also be perpetrators of criminal acts. Therefore it is important to determine whether other older adults as well as college students can detect deception. Older adult criminals have a different constellation of diagnoses and disorders as compared with the younger prison population. Future research may benefit by exploring deception detection in older adult prisoners.

Limitations

First, caution should be taken when generalizing these findings outside of this study, since the paradigm (trying to get older adults and college students to lie in an ecological setting) was so specific. It may be that raters had to pay more attention to auditory cues to get a better grasp of what the study was about and what would be required of them. However, this study's finding that older adult raters performed

better in the auditory modalities (audio and audiovisual) as compared with the visual modality is supported by Stanley et al's (2008) findings.

Second, deception detection research appears to be heading into the area of lying about intent, that is, lying about one's future activities (including reasoning, planning, and committing) and intended actions (Vrij, Granhag, Mann, & Leal, 2011). An interesting next step would be to see how well older adults can lie about their future intentions and how they compare to college students. Since older adults sometimes struggle with memory problems, lying about intentions may be more challenging for older adults than for college students. Older adults may be harder to detect because gravity and weakening facial muscles appear to draw the face downward, making it appear more negative in affect and potentially harder to read or interpret for both older and college raters.

Detecting deception has been a goal throughout much of human history. Trying to detect deception in family, in friends, in institutions, and in the geo-political realm is a universal experience regardless of one's age, sex, social class, or personality. Understanding what contributes to deception detection accuracy is important for researchers, lawyers, policy makers, and us all.

APPENDIX

I. Research assistant questions posed to participant senders:

I am going to ask you some background questions.

*1. What is your name?

*2. What is your birth date?

3. What is your favorite physical activity?

4. What is your least favorite physical activity?

*5. How many siblings do you have including half or step siblings?

6. How many years of education have you had?

* = Questions where a mistake was intentionally made for all interviews.

II. Researcher interviews participant sender about whether to hire the assistant:

As you know I am deciding whether to hire [insert assistant's name] for a study that I
will be doing in the future. I was wondering how [s/he] did.

1. How were [his / her] people skills?

2. Did [s/he] seem nervous?

3. Was [s/he] able to put you at ease?

*4. I'm not going to hire [assistant's name] is s/he made more than 2 mistakes, so did
she make more than 2 mistakes?

[Counter balanced with: I'm only going to hire [assistant's name] if s/he made fewer
than 2 mistakes, so did s/he make fewer than 2 mistakes?

5. Would you hire him/her?

III. **Assistant asked the following questions to check for memory and to verify
whether the participant sender lied:**

1. When I asked your name, did I make any mistakes or slip-ups?

2. When I asked for your birth date, did I make any mistakes or slip-ups?

3. When I asked you about your favorite physical activity, did I make any mistakes or slip-ups?

4. When I asked you about your least favorite physical activity, did I make any mistakes or slip-ups?

5. When I asked you how many siblings do you have, did I make any mistakes or slip-ups?

6. When I asked you about the years of education that you had, did I make any mistakes or slip-ups?

7. For clarification purposes, did you protect me by lying about the number of mistakes I made?

Other questions that we exchanged for question regarding years of education of sender:

5A. What is your height?

5B. When I asked you about your height, did I make any mistakes or slip-ups?

Directions for raters viewing the clips (read this slowly)

I am going to show you 24 short video clips. On average the clips are 1 minute and 30 seconds (shortest = 50s) (longest = 2min).

Each of the people in the clips was interviewed twice. You will only see the 2nd interview.

In the 1st interview, which you will NOT see, an undergraduate interviewed the people.

In the 2nd interview, which you WILL see, Lottie ,the grad student running the study, interviewed the people to see how accurate the undergraduate was.

Lottie will ask each person several questions about how well the undergrad did. The main question for you to focus on, as to whether the person is lying or telling the truth, is when Lottie asks the person about the number of mistakes made by the undergrad. Is the person lying or telling the truth about the number of mistakes?

People in the clips will know the number of mistakes made, because, while the undergrad was recording the participant sender's responses, the undergrad would verbalize what s/he was recording to confirm that the sender's information was correct.

Some people are lying and some are telling the truth (*that's all we can say at this point – we can tell them how the clips were made at the end of study, during the debriefing*).

The people are NOT actors and they were NOT told to lie.

(*Repeat the above information, just to make sure the person understood you correctly.*)

After you see each clip, I will ask you two questions:

1) Was the person in the clip lying or telling the truth about the number of mistakes made?

2) How confident are you in your decision, with 1 = very unsure…. and 5 = very sure. (*Tell them they can use #3 even though it is not labeled*). Numbers 1-5 are increasing in confidence.

A third of the clips will be **audio-only**, where you will only hear what the person is saying. I will be turning down the lid of the lap top (or turning the monitor dark) and we will just listen.

A third of the clips will be **visual-only**, where I will press mute, and you will only see what the people are doing. In this case, you may not know when the key question regarding the number of mistakes comes up, so use your best guess.

A third of the clips will be **both audio-&-visual**, like regular TV, so you will both see and hear what is going on.

Finally, I will be **timing you**, but I want you to forget that I am timing you, because I am NOT interested in speed, but I am interested in ACCURACY. I just need to record how long it takes for people, in general, to make a decision.

The first clip is a test clip (*always test clip 1*). Don't worry about whether he is lying or not. I am just using him to test for sound and vision. I am going to play the clip, so let me know if you can hear and see him alright. If you want it louder I can turn it up. If it is not loud enough, I have a head-set (it helps us if you can hear what the people are saying). Also, for seeing, feel free to move the lap top to wherever you can see best. Let me know at any time if you cannot see the screen well.

The next clip (always test clip 3), will be like the real clips, so when I play this clip, let me know whether you think he is lying or telling the truth about the number of mistakes. The other clips will be a lot like this one.

Let me know if you recognize anyone in the clips. (*Make a note next to the clip number if person knows someone in the clips. Find out how well they know the person, ie, grew up together vs have seen the person, but don't know his/her name*).

Fill this out:
Test Clip 3   a,v,**b**   T / L   1…2…3…4…5   _____ (minutes : seconds . milliseconds)

This is what the other clips will be like, for the most part.   Do you have any questions?

(*Once you get though the first half, ask them if they need a break, for the most part they won't… and if they take a break, the break shouldn't be more than 3 minutes… or you will be late for your next appointment*.)

(*Do not answer their question about how the clips were made. They have all the info above that they need. You can tell them, "That's a very good question, but I cannot answer that now. Ask me at the end and I will tell you." If you do not know the answer tell them to call me at my home phone ###-###-#### and leave a message and I will get back to them. If they pressure you, and some will, be encouraging, but stand your ground and tell them: "Just do your best." "I know this is a hard task." "Labeling someone a liar, here, does not mean that he / she is a bad person." "Take a wild guess." "If you were forced to choose only one, would it be truth / lie … unfortunately, you cannot pick something in between.") Always thank them for their time and effort, and let them know how much they have helped us.*)

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