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FACE EMOTION RECOGNITION

EFFECT OF EMOTIONAL COUNTENANCE ON WITNESS MEMORY

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Abstract:

Memory is an extensively-tested mechanism within psychology that is affected by a wide variety of factors. In this study, participants view 40 faces with either a neutral or negative emotional expression. Then, participants' are tested on if they remember the face. For 20 of the faces, the emotional expression is changed (either from neutral at encoding to negative at retrieval, or vice-versa) while for the other 20, the emotion is kept the same. In each case, participants showed memory above chance-level (compared to 14 distractor photographs with neutral expressions and 14 distractor photographs with negative expressions). Participants showed better memory for faces initially displayed as negatively expressive. Participants also showed statistically-significant impaired performance for the neutral to negative condition compared to that of the neutral to neutral, negative to negative, and negative to neutral conditions. This suggests that if an emotional countenance change occurs, a negative expression at retrieval interferes with a participant's memory. Possible explanations for this result are explored as well as possible directions for further study.

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Emotional Face Recognition

Introduction

Within the realm of memory, recognizing faces is a well-tested paradigm. It has wide-reaching applications ranging from proper identification to sending the right (or in many cases, the wrong) man or woman to prison. There have been data that give us insight into how inaccurate eye-witness testimony can be, usually focusing on recollection of the memories. Little has been done, however, on what can affect the memories of faces at the time of encoding – that is, can there be factors that influence how well a witness remembers a face as he or she sees the face?

Recently, four states have ordered people to remain neutral-faced in their drivers' license photos in order to ensure facial recognition software's accuracy in identifying the same face between two photos (Frank, 2009). A smile is all it takes to confuse the software into thinking the same face belongs to two different people. Is this true for the human evaluation as well? When an eye-witness observes a scowling suspect robbing a bank, will that eyewitness be able to accurately identify that face in a neutral disposition later?

So far, the evidence is unclear. Research from Dolcos, LaBar, & Cabeza, (2004) has found that emotional-laden stimuli can generate stronger memories than neutral ones when participants were better able to remember and describe in greater detail negatively- and positively-valenced pictures 45 minutes after seeing them. Other evidence has found that

recollection of faces can be an altogether inaccurate procedure (see Zhao, Chellappa, Phillips, & Rosenfeld, 2003 for a full literature review). Furthermore, emotional expressions involve neural mechanisms beyond simple memory and therefore are more susceptible to factors affecting formation and recollection of the memory of faces. My goal is to address what is known and what is not regarding identification of faces when the emotional expression is changed between emotional and neutral. It seems that although certain aspects and factors of facial memory impede identification, an emotional expression will make a face more memorable and thus enhance later recognition of that face even if the emotion is changed to a neutral expression.

An important aspect of studying emotional expression on memory is how emotion alone affects memory. Generally, an emotional event will strengthen one's memory of a particular stimulus (Christianson & Loftus, 1987, Bradley, Greenwald, Petry, & Lang, 1992) due to additional brain activation beyond normal memory in the amygdala (Hamann, 2001). The Christianson & Loftus (1987) study gives an excellent demonstration of this effect. Participants were shown one of two 15 color slides series. In one set, the slides depicted a neutral event: a mother and her son leaving home, walking through a park, making a phone call, and returning home. In the other set, participants saw a traumatic series of events: after leaving the home, the son was hit by a car and taken to the hospital, where the mother eventually left him. The results of this study found that participants had a much greater memory for the details of the pictures from the traumatic series than those from the neutral series. Neuro-imaging research provides support for the phenomenon as well. A study conducted by Dolcos, LaBar, and Cabeza (2004) demonstrated that more activity in the brain occurs for emotional stimuli (such as pictures that are rated as pleasant or unpleasant by a participant, like a snake) in the anterior regions of the

medial temporal lobe during recall and amygdala during encoding than for memories of neutral stimuli (such as pictures that are rated as neutral, like a brick wall) which involved activity in the posterior regions of the MTL but no amygdala activity. This increased activity can provide better recollection for the emotional events (Dolcos, LaBar, & Cabeza, 2004). An interesting caveat to these findings however, is that while a participant may be confident in their recollection, that recollection may not be accurate, which is an extremely important aspect to truly analyzing the effectiveness of memory.

Research supports that it is indeed the emotional aspect that forms these memories and not associated factors such as attention (Christianson, Loftus, Hoffman, & Loftus, 1991). Christianson et al did observe differences in attention (described as duration of eye fixation and number of eye movements on stimuli) between emotional, neutral, and unusual stimuli. These stimuli were a variation of the same picture. In the emotional version, a woman was seen in front of a car, having fallen off of her bicycle and bleeding from a head wound. In the neutral, she had not fallen, but was instead riding the bike by that same car. In the third, unusual picture, she was carrying her bicycle on her shoulder instead of riding it. Research found that the attention did not account for the finding that emotional stimuli were remembered better than others. Thus, if the emotional disposition is the only difference between two facial expressions, and not aspects such as background, setting, or context, it follows with research that an emotional expression alone could cause a positive effect on memory.

Memory research implies that if a stimulus is emotionally-laden by having a scene, image, word, etc that evokes emotion it will form a stronger memory during encoding than a

neutral one and provide for easier retrieval later. Likewise, if emotional faces are processed similarly to emotional stimuli by stimulating an emotional reaction, (like seeing an injured woman in the Dolcos, LaBar, & Cabeza, 2004 study), then participants should form a better memory for that face than if it were presented in a neutral expression. For example, if a participant were to view an angry face, they may react the same way as they would to a fear-prompting stimulus, such as an angry-faced attacker. Previous research suggests that this is very likely the case. In a 2008 study, Jackson, Wolf, Johnston Raymond, & Linden found that participants showed better memory performance for angry faces than neutral or happy. The fact that the effect of emotional countenance only emerged for angry faces shows how unclear the effect of emotional expression on memory can be. Other research (Hansen, C. H., & Hansen R. D., 1988) suggests this effect is due to a threat identification of an angry face suggesting a mental process beyond simple emotional memory. Furthermore, since this study did not change emotional expression between encoding and retrieval phases of memory, it remains unknown as to whether the emotional countenance affects memory during encoding, retrieval, or both.

On the other side of the question of what is remembered is the consideration of how accurately we can remember faces. Fairly extensive research has been done into the recollection of faces, especially pertaining to accuracy of eye-witness testimony. One variable that can cause an issue in proper identification is the issue of confidence. If a participant is urged to guess regarding the accuracy of a presented face in a situation where they have low confidence, they are more susceptible to false alarms (or thinking a face that has been shown before, when it had not been) because they have to make a judgment, despite being relatively unsure. Furthermore, if a participant commits to a false alarm, they are likely to increase their confidence in later

questioning if the (false alarm) face is the previously-presented one (Hastie, Landsman, &Loftus, 1978). This experiment into confidence speaks to the question of confidence and accuracy in both short- and long-term effectiveness of memory and provides support that simply having a participant attempt to identify a face once is adequate to observe effects on memory.

Obviously, the question of confidence is important in eye-witness testimony because that testimony may mean the difference between acquittal and the death penalty, but also for memory tasks as well. Experiments in memory often ask how confident a participant is, or if they "remember" (being able to remember specific details, such as what they visualized, when a stimuli was presented) the stimulus versus merely "recollecting," (where they seem to have a memory of the presentation, but cannot remember specific details) assuming it is not "new" (in which case the stimulus had not been presented before, and was new when the participant was asked if they had seen it before). This Remember-Recollect-New paradigm has been shown in past research (Yonelinas, Otten, Shaw, & Rugg, 2005) to measuring two different neural memory processes. Whether emotional dispositions would affect the initial confidence of recollection is an important aspect. If the better memory for emotional stimuli effect is observed, it would likely cause an increase in confidence because participants have clearer memories of the face being displayed, as well as accuracy because the memories are better. If the emotional effect does not hold however, the emotional disposition may cause participants to be less sure, given that the facial features are in a slightly different position and orientation than a neutral presentation.

Another important consideration in facial recognition and memory is how the physical aspects of facial characteristics change between emotional and neutral disposition of the stimuli itself. For example, are holistic or feature approaches more likely to be used when recognizing faces? If holistic features are to be used, then memory will likely be less affected than if a feature method is, as the position and design of facial features will be distorted between the two dispositions. However, which approach will be utilized can depend on the face. For example, if a face has a prominent feature, we are likely to use a feature-approach. However, evidence also suggests use of holistic approaches in which manipulations to parts of the face impair our ability to recognize the face (Zhao, Chellappa, Phillips, & Rosenfeld, 2003). Other research has shown that the effects of repositioning and changes in facial expression are minimal, as faces can still be distinguished from "new" faces (Patterson & Baddeley, 1977) suggesting a holistic approach for facial memory.

In another experiment, Tanaka and Sengco (1997) found strong support for holistic approaches as well. They found that when normal faces (that is, faces without inverted or scrambled features) were re-presented with features that were manipulated spatially, participants had a much harder time identifying the face as being previously presented. They did find, however, that participants performed above chance levels when recognizing individual features, isolated from the rest of the face (Tanaka, & Sengco, 1997). These results show that our memory seems to have capacity for both failures to remember a face (if a holistic approach is utilized and the facial features are positioned differently in a neutral expression than an emotional one) as well as success in identifying the neutral face (if features can be processed individually).

It is clear that there are numerous and extremely varied processes at work when identifying and remembering faces. Being able to recognize a face is an issue that is not measurable by a simple yes or no. Confidence must be measured as well in order to truly analyze how accurate memory for faces is and whether or not it is simply a guess. Furthermore, by manipulating the expression on the presented face and then asking participants to recognize that face in a neutral disposition, factors are present that both help and deter better retrieval. The emotional response of the participant to an emotional face would cause stronger memories. On the other hand, the distortion of the facial features given the change in expression would impede a holistic view of the face and create weaker memories. It is also clear that an attempt to address this question must control for several factors raised by the effects of emotional stimulation and facial distortion. First, stimuli must be presented in such a way as to not elicit any emotional response outside of the emotional expression. This detracts from real world applicability, as it is almost impossible to witness someone without a background context or scene, but is important in order to address whether or not the emotion expressed causes a difference in memory. Second, confidence must be measured in order to get a full view on how emotional expression would affect later remembering and whether it would be prone to the same sort of recognition errors found with other facial recognition studies. Finally, all facial stimuli need to be consistent in the facial displays of the specified emotions so that we can accurately measure the effect it has on memory. This can easily be solved by only presenting stimuli of only two easily recognizable emotional expressions – neutral and negative. With those two emotions being the only ones expressed, there is enough variety in the distortion of the faces to analyze how distorted a face can be and still be recognizable, without being so outlandish or unusual that a participant pays more attention to a some stimuli than others.

Previous research is clear that emotional facial expression can affect memory, yet it remains to be seen if that effect is carried over when the expression changes. I believe that these effects will be stronger than those possibly caused by factors impeding memory due to the expression change - as such, I expect to see enhanced memory for faces displayed during encoding as negative as compared to those displayed as neutral, even if the facial expression changes. There should also be a stronger memory for negative faces as well, demonstrated by more Remember hits.

Method:

Participants were 20 undergraduate students from Penn State University (mean age =19.35), 7 male and 13 female. Participants were given credit for introductory to psychology class requirements as compensation for their participation in the study.

Stimuli:

Stimuli were 108 shoulders-up color photographs of people looking straight at the camera with a white background, taken from the AR Face Database (Martinez, A.M., Benavente, R., 1998). Photographs used displayed either a neutral or negative emotion, as listed by the AR Face Database's own description. Expressed emotions were confirmed as either neutral or negative by research assistants rating the emotions expressed for each photograph without any knowledge of

the database- labeled emotion. Photographs that did not receive consensus amongst the research assistants' ratings were not used. For 40 of the photographs, the same person was shown in another photograph at Retrieval phase; these second photographs were taken on a different day than the first photograph and thus minor differences are present, such as shirt color, small hair differences, etc. Photographs with major differences (such as different color hair, hair styles, changes in facial hair) were not used. These minor differences were included in order to avoid a photograph recognition effect.

Stimuli were categorized into one of five experimental conditions. 10 individuals were shown as negative at encoding and negative at retrieval and so were a negative/negative group. 10 individuals were neutral at encoding and neutral at retrieval, comprising the neutral/neutral condition. Two other conditions involved shifting the emotional expression between encoding and retrieval phases. 10 individuals were displayed with negative expression at encoding but a neutral expression at retrieval for a negative/neutral group. 10 individuals were displayed as neutral at encoding but negative at retrieval, creating a neutral/negative group. Finally, 28 photographs were used as distracters. This condition was used only at retrieval and was comprised of 14 neutrally expressive and 14 negatively expressive novel individuals. Equal numbers of photographs showing male and female individuals were used. (For example stimuli for each experimental condition see Figure 1-4)

Procedure:

Participants were issued informed consent forms and received a brief description of the study. Then, they completed the Encoding task on a computer. During encoding participants viewed 40 photographs in which different individuals displayed either neutral or negative countenances, split evenly into two blocks. A focus cross screen was presented for one second, followed by the photograph stimuli for four seconds. Then, the photograph would disappear and participants were asked to rate the emotion expressed by the individual in the photograph by either pressing the 1 key for a negative emotion expression or the 2 key for a neutral emotion expression. Upon the participant's response, the display would then change to a focus cross screen for one second and subsequently present the next stimuli. This task took approximately 5 minutes.

Next, participants were given a 10 minute interference task in the form of a WAIS-IV vocabulary segment. Finally, participants completed the retrieval phase on a computer as well to test their memory of the faces shown at encoding. The retrieval phase consisted of 68 photographs: 40 of which were the same individual (but not the same picture) pictured at encoding and 28 were photographs of new individuals, or people not shown in the encoding phase. For the faces that were shown at encoding (or "targets") half of the faces had the same countenance as at encoding (10 negative/negative and 10 neutral/neutral) while the other half are shown in the alternate expression (10 negative/neutral and 10 neutral/negative). Participants were instructed to respond in one of three ways based on their memory. If participants determined that they had seen the presented individual at encoding and the memory was very strong, via being able to remember specific details, what they thought when they saw the person, etc, they responded with a Remember designation. If participants thought they had seen the face before

but did not have clear memories and were less sure than Remember-type responses – that is, a general sense of familiarity for the face – they responded with a Familiar designation. These two responses represent the two forms of memory from the Remember-Know memory paradigm. Finally, if participants thought the face was not presented at encoding and retrieval was the first time they had seen the face, they responded with New.

After completing the retrieval task, participants filled out a brief demographic information form and were debriefed.

Data analysis:

Participant responses were recorded as either a Remember (high confidence, high detail memory for seeing the stimulus before), Familiar (lower confidence, lower detailed memory for seeing the stimulus before), or New (having no memory for the presented stimulus). These three responses provide information on both whether or not the stimulus is correctly identified or rejected as well as the participant's strength of memory. For the target stimuli, Remember Hits were the correct number of Remember responses and Familiar Hits were the correct number of familiar responses. Misses for target stimuli were New responses. For the distracter stimuli, a false alarm was a Remember or Familiar response and correct rejections were New responses. Total Hits were calculated by adding the correct Remember and Familiar responses for target stimuli. False alarm and correct rejections for distracter stimuli were separated for neutral and

negative faces in order to calculate d' for each of the target stimuli conditions. In order to calculate d' values, the neutral/neutral and negative/neutral hit rates were compared to the neutral distracter false alarm rates and the negative/negative and neutral/negative hit rates were compared to the negative distracter false alarm rates.

Results:

Overall hit data were submitted to a 2 x 2 within-subject ANOVA with two levels of encoding emotion (negative or neutral) and two levels of retrieval emotion (negative or neutral). There was a main effect for overall hits for encoding emotion ($F(1,19)=50.25$, $p<.001$) where memory was better for faces displayed as negative at encoding ($M=0.685$) than for faces displayed as neutral at encoding ($M=0.495$). There was also a main effect for overall hits for retrieval emotion effect ($F(1,19)=11.26$, $p=.003$) where memory was better for neutral faces ($M=0.638$) than for negative faces ($M=0.543$). There interaction for these two effects was significant, $F(1,19)=10.62$, $p=.004$.

Follow up t-tests showed that for total hits (correct Remember plus correct Familiar responses) participants showed the best memory for the negative/negative ($M=0.690$) condition and this was significantly better than the neutral/neutral ($M=0.595$, $t(19)=2.50$, $p=.022$) condition and neutral/negative condition ($M=0.395$, $t(19)=7.25$ $p<.001$) but was not significantly better than the negative/neutral condition ($M=0.680$, $t(19)=0.25$, $p=.807$). The neutral/negative stimuli

was also significantly worse than the negative/negative (M=0.690, t(19)=7.248 p<.001), neutral/neutral (M=0.595,t(19)=4.41 , p<.001), and negative/neutral (M=0.680, t(19)=7.140 p<.001) conditions. Finally, the relationship between the neutral/neutral condition (M=0.595) and negative/neutral condition (M=0.680) is notable in that it is marginally significant (t(19)=1.97, p=0.063) (see Table 1). These data show that participants had the best total hits performance for conditions in which negatively affective faces were displayed at encoding and that participants had the most difficulty with remembering the neutral/negative condition stimuli.

Analysis on the participant's Remember and Familiar hits were performed as well (see Table 2). No significant differences were observed in Familiar hits. However, correct Remember determinations showed the same trend as overall hits: participants showed the best memory for the negative/negative (M=0.385) condition and this was significantly better than the neutral/neutral (M=0.275, t(19)=2.82, p=.011) condition and neutral/negative condition (M=0.135, t(19)=5.87, p<.001) but was not significantly better than the negative/neutral condition (M=0.370, t(19)=0.438, p=.67). The neutral/negative stimuli was also significantly worse than the negative/negative (M=0.385, t(19)=8.87 p<.001), neutral/neutral (M=0.275,t(19)=3.69 , p=.002), and negative/neutral (M=0.370, t(19)=4.92 p<.001) conditions. Finally, the relationship between the neutral/neutral condition (M=0.275) and negative/neutral condition (M=0.370) is notable in that it is marginally significant (t(19)=2.03, p=0.056) (see Table 3). This shows that participants' overall performance on identifying the stimuli is related to strength and confidence of memory, as well as giving even stronger evidence that a negative face at encoding allows for better memory given the marginally significant relationship between the negative/neutral and neutral/neutral conditions.

Finally, d' values were submitted to a within-subject 2x2 ANOVA with two levels of encoding emotion (negative or neutral) and two levels of retrieval emotion (negative or neutral). A main effect emerged for the d' values at encoding ($F(1,19)=16.255$, $p=.001$) where stimuli displayed as negative at encoding were remembered better ($M=1.453$) than stimuli displayed as neutral at encoding ($M=0.891$). There was no significant effect for d' for stimuli with a neutral expression at retrieval. However there was a significant interaction for d' values, $F(1,19)=13.56$ $p=.002$. Follow-up t-tests showed the same trend as total hits and Remember hits comparisons. Notably, the only statistically significant relationships that emerged were that of each condition compared to the neutral/negative condition: negative/negative vs. neutral/negative ($M=1.452$ and $M=.476$, $t(19)=5.57$, $p<.001$), neutral/neutral vs. neutral/negative ($M=1.307$ and $M=0.476$, $t(19)=2.89$, $p<.009$), and negative/neutral vs. neutral/negative ($M=1.454$, and $M=0.0476$, $t(19)=3.87$, $p<.001$).

Discussion

The initial prediction that memory for negatively expressive faces is supported by the data, as participants performed markedly better in the trials where stimuli were presented as negative affect at encoding. The same trend occurred for the strength of memory and confidence as well, where stimuli that were negative at encoding were correctly identified with a Remember designation more than those presented as neutral. There emerged no effect on memory as a result of the facial expression displayed at retrieval in terms of memory strength or memory

performance. There was an effect of facial expression at encoding for both strength of memory and memory performance. Finally, given the sharp decrement for the neutral/negative condition, there appears to be an interaction; however the exact mechanism is unknown.

The fact that participants showed the best memory for the negative/negative condition coincides with past research (Hansen, C. H., & Hansen R. D., 1988). These results verify what is suspected, but perhaps not widely recognized as to emotional expression enhancing both memory performance and strength of memory for facial memory as compared to neutral faces. This enhancement effect appears to influence the encoding of the memory process however, rather than the retrieval phase as is demonstrated by the better performance for negative/negative and negative/neutral conditions (where negative expression is at encoding) than the neutral/negative condition (where negative expression is only present at retrieval). In fact, the extremely poor memory performance for the neutral/negative condition suggests that a face where negative affect information is novel can impede memory to a strong degree.

In addition to overall memory performance, the same effect of memory enhancement due to negative expression at encoding was observed for Remember responses. Past research has suggested that Remember and Recollect memory responses actually measure different memory processes (Gardiner & Richardson-Klavehn, 2000, Yonelinas, Otten, Shaw, & Rugg, 2005). Furthermore, evidence exists that negative and arousing word stimuli are recruiting additional memory resources than neutral (Kensinger & Corkin, 2004). Based on this, it seems negative expression is tapping into this deeper processing than neutral expression is in the same way

negative versus neutral words do. This is consistent with the prior research that emotional stimuli are encoded differently than neutral stimuli and shows that emotional faces are received as emotional stimuli and gain similar memory-enhancement effects in the strength, confidence, and attention to detail.

While these results were quite pronounced, there are certainly limitations. One such limitation is the subtlety of the emotional expression for the stimuli. The fact that all of the photographs are realistic in terms of emotional expression rather than overblown is a strength – however, each it is difficult to dictate the degree to which each emotion is received by the participants. Certain stimuli may have been "more negative" than others which presents a variable that is difficult to measure. As such, any sort of within-condition differences are immeasurable and the data relies on the assumption that all the negative faces were "equally negative" and the neutral "equally neutral." Another concern for participant reaction to stimuli would be possible race and age biases, which show marked effect on facial memory (Meissner & Brigham, 2001, Brigham & Barkowitz, 2006 and Anastasi & Rhodes, 2005). All of the photographs were white, late-20's to early-30's individuals. Since the mean age of participants (M=19.35) and most common self-designated race was white, it seems unlikely these biases effected the results but cannot be ruled out completely.

How easily these data can be generalized to the real world is also a matter of concern. It almost never occurs outside of a lab where we are focusing on studying a face with no surrounding context. Even in something as controlled as an eyewitness line-up at a police station,

a viewer is seeing more information than the shoulders-up view of a person. It is difficult to say how the observed effects from this study would emerge when much more information is presented at encoding. Another concern is the reliability of photographs for determining identity. In a study on the use of photographs for identification, researchers found that there exists a substantial amount of within-subject variability between pictures and this factor is often overlooked by those seeking correct identification (Jenkins, White, Montfort, & Burton 2011). It is difficult to say how the results from this study would compare to the same study using live subjects as stimuli as opposed to mere photographs which would present a more realistic context for viewing and recalling faces. Finally, the interference task lasted only 10 minutes. In a real-world scenario, the time between viewing an individual and making a memory determination is closer to days or weeks rather than minutes. This study's results cannot be generalized to a much longer time period between encoding and retrieval that is more realistic.

Even with these limitations, this study provides some interesting applications for both theoretical and practical applications of facial memory. These results provide evidence that facial memory processing goes beyond simple identification information. One would suspect that a neutral face would be the easiest to remember given that the only type of information one is observing is facial details. However, memory appears to be better as long as negative emotional expression is observed at encoding as well. These results also suggest that information at encoding is more important than information at retrieval when making a memory determination. Finally, it appears that memory can be impeded by adding in emotional information at retrieval that was not present at encoding.

In practice, these results have important implications for situations in which memory for faces is important. In terms of eyewitness memory this demonstrates that, in the case of a crime for example, a negative expression for viewing an individual (which is far more realistic than a neutral expression) can actually help witnesses identify a suspect at a later time. Furthermore, a face that is displayed as neutral at retrieval (that is, when a suspect is in a line up for recognition) appears to have no deleterious effect on memory, regardless of the original encoding expression. These two factors combined indicate that a real-world scenario of viewing a suspect and later making a memory determination of the individual is either unaffected or even improved by realistic factors. These results also show that memory for realistic faces (that is, emotionally-expressive) can also improve the quality of the memory as well since Remember determinations had a higher correct response rate for the negatively-expressive encoding stimuli.

Another implication of this study is that eyewitness memory can be improved by an uncontrollable factor and hindered by a controllable one. Since neither the police nor the witness has very little control over what is happening when a suspect is observed, it is promising for proper identification that memory is enhanced by a realistic emotional expression. On the other hand, being able to control a suspect's facial expression during the line-up is important, being that the worst identification condition would be a neutral expression at encoding and then a negative expression at retrieval. In an ideal condition, a witness's memory would be enhanced by a negative emotion during the crime. On the other hand, if the suspect had a neutral expression,

police could minimize the effect of memory by making sure the suspect displays a neutral emotion at the time of the line-up.

While this study does provide interesting results, it also opens the door to further examination of the considerations observed. While past research has shown that negative and positive expressive faces show different effects on memory, it remains to be seen how this study would be affected by positive emotions being displayed rather than negative emotions. It seems likely that positively-expressive stimuli would yield better memory given the strength of significance between negative and neutral stimuli, however the effect may be minimized substantially. Another series of considerations is how the effect of emotional expression would emerge when applied to other memory-enhancing and memory-impairing situations. By introducing context considerations to the stimuli faces, a great amount could be learned about the interaction of this and other factors. These results could also be tested in more realistic situations and help to determine how much impact the effect of negatively-expressive faces have in more realistic scenarios for facial memory.

Ultimately, the considerations and psychological processes that go into facial memory and memory determinations are almost too many to count. Even though emotional expression is one of the most prominent features one notices about a face, it is but a single piece of information that influences the ability to remember what you saw. It is encouraging that something so common and so noticeable as facial expression can help our memory of people we

have seen, yet it remains to be discovered as to exactly how important and how reliable this single factor is.

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Figure

Negative -

Figure

Figure

Neutral -

Figure

Figure

Negative -

Figure

Figure

Neutral -

Figure

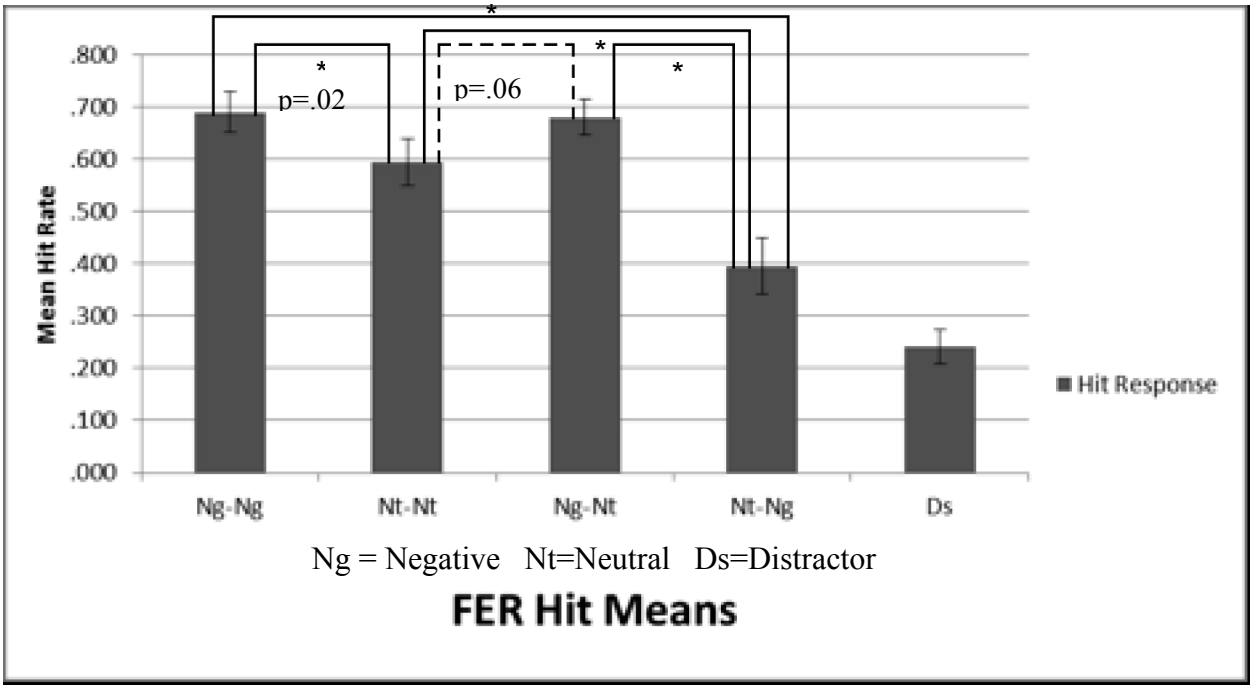

Table 1. Total hits (Remember hits + Familiar hits). All relationships to the Distractor category are significant and all significance levels are $p<.001$ unless otherwise noted

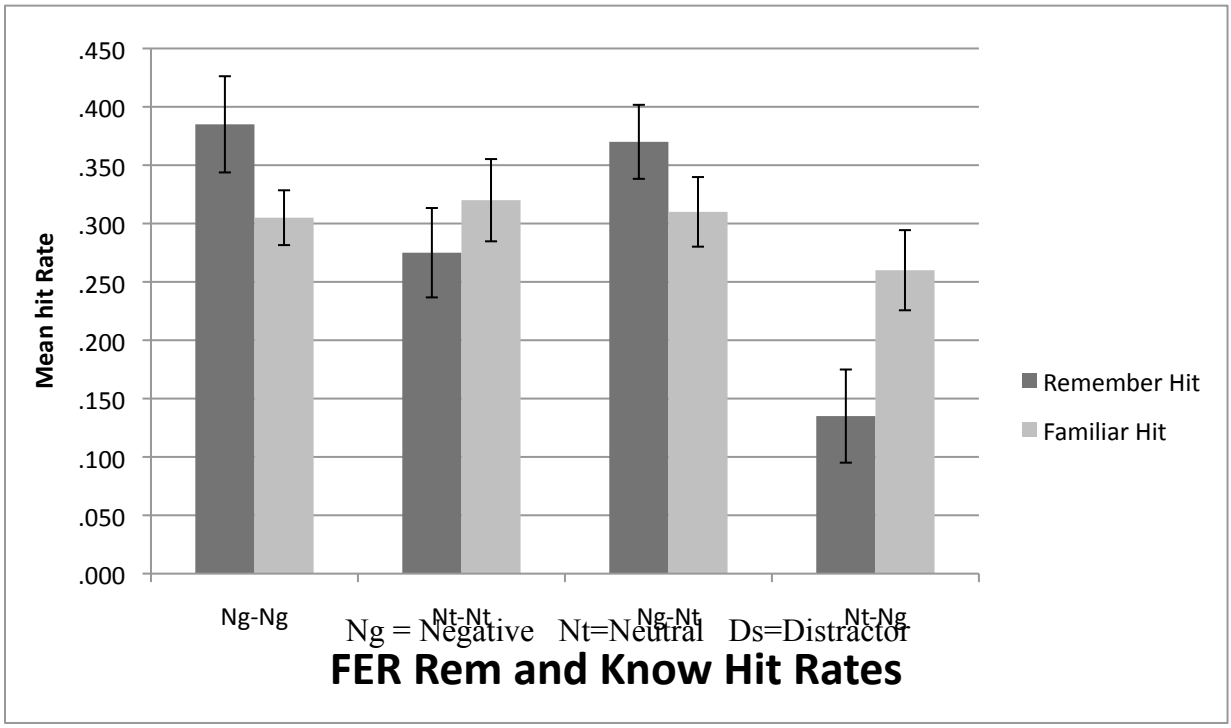

Table 2. Hits for correct Remember and correct Familiar responses.

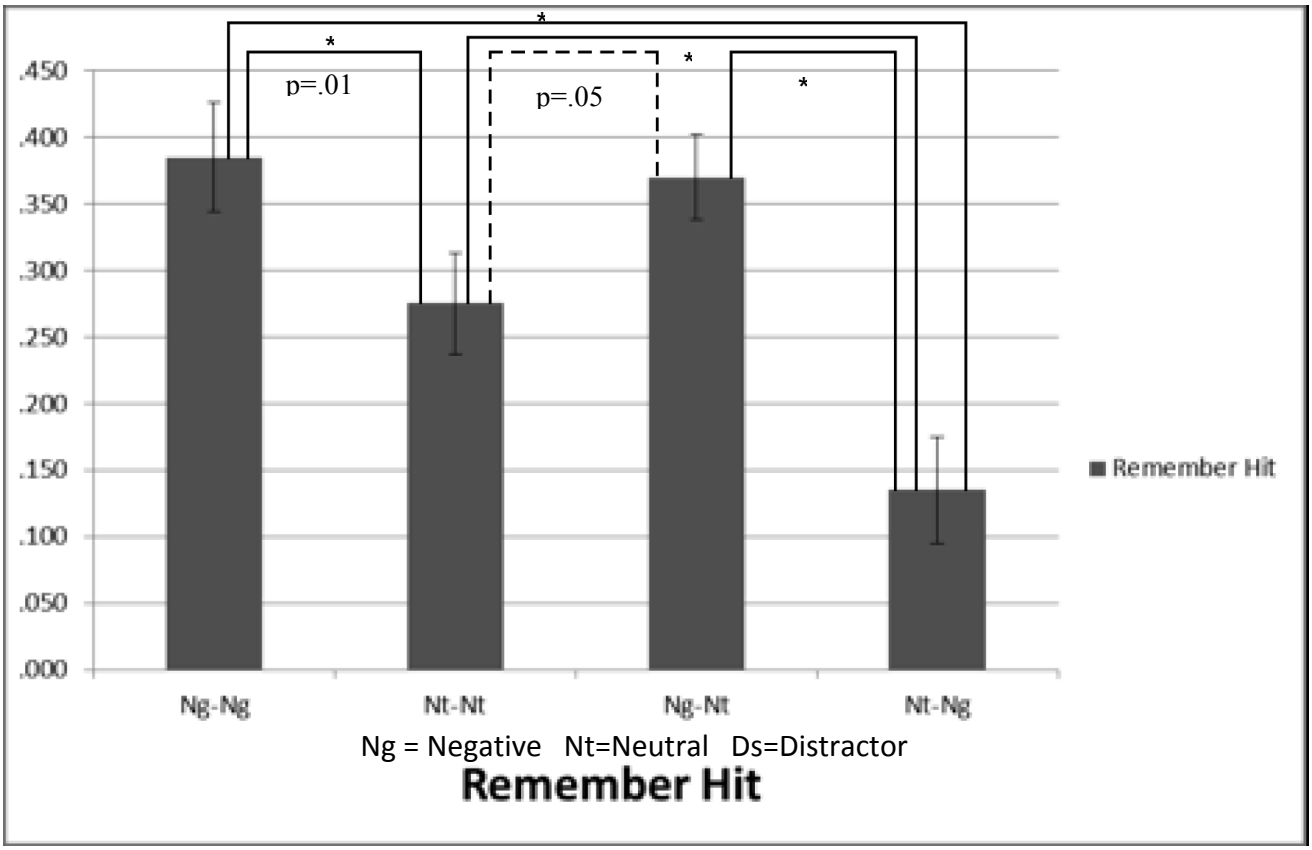

Table 1. Remember hits. All relationships all significance levels are p<.001 unless otherwise noted

Academic Vita

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EDUCATION Pennsylvania State University, Schreyer Honors College
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Member of Psi Chi Psychology Honors Fraternity, Penn State Chapter
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Research Experience and Presentations

Cognitive Imaging and Aging Research Lab at Penn State
-August 2010 – present
-Duties include experiment administration (MMSE, WAIS-IV, Matrix Reasoning tasks), data analysis, experimental design, interacting with subjects, study and participant information organization

Honors Thesis "Face Emotion Recognition: Effect of Emotional Countenance on Witness Memory"
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