“I DISTINCTLY REMEMBER YOU!”

AN INVESTIGATION OF MEMORY FOR FACES WITH UNUSUAL FEATURES

by

Autumn Keif

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This thesis was prepared under the direction of the candidate's thesis advisor, Dr. Alan Kersten, Department of Psychology, and has been approved by the members of her supervisory committee. It was submitted to the faculty of the Charles E. Schmidt College of Science and was accepted in partial fulfillment of the requirements for the degree of Master of Arts.

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ABSTRACT

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Many errors in recognition are made because various features of a stimulus are attended inefficiently. Those features are not bound together and can then be confused with other information. One of the most common types of these errors is conjunction errors. These happen when mismatched features of memories are combined to form a composite memory. This study tests how likely conjunction errors, along with other recognition errors, occur when participants watch videos of people both with and without unusual facial features performing actions after a week time lag. It was hypothesized that participants would falsely recognize actresses in the conjunction item condition over the other conditions. The likelihood of falsely recognizing a new person increased when presented with a feature, but the conjunction items overall were most often falsely recognized.

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FIGURES

INTRODUCTION

The human face can change in extraordinary ways. It can heal from scrapes and burns, serve as a canvas for tattoos and piercings, or be covered with makeup and glasses. Changes like these may make it difficult under normal circumstances for an individual to recognize someone once they have made certain modifications, but as an eyewitness, these changes can make identifications a daunting task. Lineups must attempt to maximize eyewitness accuracy and still account for the suspect's rights to fairness. It is also necessary for law enforcement to establish procedural guidelines to account for appearance changes, while not swaying eyewitnesses too much as a result of such guidelines. An immense amount of research has been conducted on how humans recall faces from disparate areas including neuroscience, cognitive and social psychology, and criminology (e.g., Bentin, Allison, Puce, Perez, & McCarthy, 1996; Shapiro & Penrod, 1986; Yarmey, 1993).

This thesis explores the effect of the presence of a unique facial feature at initial presentation on later memory for that face, either with or without that particular feature. A variety of conditions were tested to explore if certain errors in recognition are more likely to be committed than others. This may also shed light on how faces are encoded, processed, and later recognized. Also, different features will be placed in different regions of the face to see if there are any differences in recognition. I hypothesize that features closest to the eyes will be recognized correctly more frequently than features in other regions, because of the eyes' importance in gathering social information (Bentin, et. al 1996). Also, I hypothesize that permanent features will be recognized more often because they are rarer and more resistant to change over time than temporary features.

Facial Recognition

Recognizing a human face is a complex and difficult task. It requires information from multiple processes and sources to compose the characteristics into a cohesive, accurate representation. The human face is one of the most interesting and rich images to process, remember, and distinguish (Bruce, 1998). Identikit studies have yielded interesting results regarding the nature of facial processing and the errors associated with it, even though they have been criticized as an oversimplified facial representation (Macho & Leder, 1998). In an early study, Bradshaw and Wallace (1971) discovered that various processes are at work to perceive a face. Parallel processes occur when all parts are perceived simultaneously and the face is seen as a whole. Serial processing, on the other hand, tackles more complex features. This correlates to recent neurological findings (i.e. Benuzzi, et. al 2007) that liken these processes to "core" and "extended" systems.

Earlier results from Identikit studies tended to support serial processes largely hinging upon some critical feature for later recognition. It follows, then, that the more features that were available to be processed, the more time it would take to recall the face later (Bradshaw & Wallace, 1971), and thus the more opportunities available to commit errors. For example, Hannigan and Reinitz (2000) found that when participants were presented with faces composed of features from multiple, previously-presented faces, especially those presented simultaneously, they exhibited a high rate of false recognition of those composite faces, and participants' confidence in their recognitions was surprisingly high with these composite faces. Errors most likely happened because the participants combined several features from faces that were presented side by side.

These studies bring up concerns with eyewitness identifications because of line up procedures and the frequent use of mug shots. The present study simulates conditions an eyewitness might experience as participants are bombarded with a large number of individuals performing similar actions and also sharing some features. Eyewitnesses may incorporate features from a pictured person into his or her memory for the crime. Furthermore, the eyewitness may confuse a bystander that was in the perpetrator's vicinity as the actual perpetrator, with surprising confidence (Deffenbacher, Bornstein, & Penrod, 2006). In fact, research has demonstrated that if the perpetrator is not included in a lineup, there is a twenty percent chance that an innocent bystander will be chosen from the other individuals in the lineup (David & Loftus, 1976).

Evidence from Neuroscience

The human brain processes human faces differently from other stimuli. A great deal of the complexity in the degree of processing comes from their many features and the myriad of variations that must be dealt with (Bradshaw & Wallace, 1971). This is amazingly done in milliseconds. The face can be identified as such in 80 to 120 ms and shortly after that the exact identity of the face can be recognized (Lui, Harris, & Kanswisher, 2002). These two stages can be likened to *categorization* as a human face and *identification* of a particular face, and also whether or not that face is typical or distinct (Bruce & Young, 1986).

This process is highly specialized to respond to faces. In monkeys too, there is a cluster of cells in the temporal cortex that selectively respond to other monkey faces, and differently depending on the face and its expression (Baylis, Rolls, & Leonard, 1985). Specialized brain areas with highly specific activation and responses to facial stimuli, then, are largely adaptive for different species to gather social information. Similarly, "Facial Recognition Units" or FRUs have been discovered in particular brain areas to recognize specific components of faces and to direct further processing of relevant stimuli to other regions (Bruce & Young, 1986). The brain devotes a good deal of specialized hardware to the process of facial processing.

Bentin et al. (1996) also found that the brain exhibits a specific ERP N170 to specific facial stimuli, namely the eyes, but not to animal faces or other human body parts. This particular ERP had the largest response when viewing eyes alone in comparison to whole faces or other features, such as the mouth. The eyes seem quite important in gathering social information to process a face, even more than other features. The amygdala correspondingly directs attention toward the eyes to gather information and process information about fear and social responses (Benuzzi, et al., 2007). The discovery of this ERP speaks to the complexity of facial processing and also the importance of individual features within a face to process it as a whole. Its specific initial response appears to activate other brain areas to process other regions (Bentin, et al., 1996).

The consensus, then, in neuroscience appears to be that a face is processed by diverse neurological systems that extend far beyond just the visual system, notably including emotional systems. The core system processes whole faces and socially relevant features, but isolated parts of the face and facial movements are processed by appropriate extended systems (Benuzzi et. al 2007). Extra resources are required from specific extended systems involved in processing some emotional content, such as features that an individual may stereotype to threat (for example race-related features; see Blair, Judd, Sadler, & Jenkins, 2002). Similarly, when information is incomplete, extended systems must attempt to fill in the blanks. This explains why there may be large individual differences in, for example, eyewitness testimonies based on the unique perspective of the bystanders. In the present study, too, this may explain why participants could mix up features that are unique to an individual at encoding, transferring them to another individual at recollection. Also, these processes explain the dual importance of holistic and serial processing. When only one is used, there is greater opportunity for identification mistakes, so having additional time to view the face may be necessary to recognize it correctly later.

Cognitive Research

While neuroscience has zeroed in on many specific ways the face is processed, cognitive research has discovered many interesting ways the face may be incorrectly recognized. In a meta-analysis, Shapiro & Penrod (1986) found that the aspects that affected facial recognition the most were context changes, transformation errors, depth of processing, how distinctive the target was, and how much the participant could elaborate on the target. Other important factors they discovered were target exposure time, the participant's age, cross-racial identification, time between exposure and recognition, and also a target's pose. The current study keeps all of these aspects constant other than how distinct the target was, by manipulating whether or not she had a unique feature while performing a specific action.

A face may be processed with relative ease, depending on certain aspects such as the ones listed, and it may be represented as a Gestalt chunk, for example when recognizing a familiar face. But faces may also be effortful to process, such as when Europeans attempt to differentiate various Asian faces (Bradshaw & Wallace, 1971). This brings about the debate of expertise. Faces are both important and integral to our experience as humans, and how we process them is indicative of how easy or difficult it actually is to understand what composes the face and recall it correctly later.

The Expertise Debate: Holistic versus Serial Processing. To show that the face was not much different from other complex stimuli, Diamond and Carey (1986) found that it was just as difficult for participants to recognize inverted images of various dog breeds as human faces. This may be a result of processing first and second order features. First order features are individual features and second order features are configurations of first-order features (Rhodes, 1986). A dog, then, may have roughly the same number of features as a human but the configuration may be slightly different, especially for different dog breeds. This may be related to Lui et al.'s (2009) finding of various specialized regions, such as the occipital face area and the face-selective region in the superior temporal sulcus, being sensitive to the presence of an actual face, but not its parts or configuration, while the fusiform face area is sensitive to both. Different brain regions thus represent different aspects of a stimulus, and along the way, lead to various errors in recognition. To register fully, whether it is a piece of literature, a pet's face, or a perpetrator from a crime, perceiving both parts and wholes of visual stimuli is important for creating an accurate representation.

Still, there is evidence that holistic facial processing is stronger than serial processing. Farah and colleagues (1998) found that participants often default to using whole faces to make quicker and more correct identifications. When only single features are used, correct identifications can be made, but they are much less likely than with whole faces. This would be similar to using letters to identify words, resulting in much more effortful processing than if the whole piece of information were available. If an item is presented in isolation, it is recalled differently than if it were presented in the context of the whole object (Tanaka & Farah, 1993). Also as more features are added, there is a corresponding decrease in reaction time to recognize a familiar item (Bradshaw & Wallace, 1971). The brain may emphasize configurations of the parts in relation to the whole (Wilford & Wells, 2010). The parts' relationships to each other may form a template for quicker processing. The whole face becomes a template in holistic processing. Processing a face may be similar to processing other complex stimuli where other templates could exist. These templates, such as dog faces or houses, could rely on similar processing, so "faces are special in degree, not [kind of processing]" (Farah, et. al 1998).

There are tradeoffs for holistic processing, though. People often have difficulty in detecting a change in faces when they are processed in a template-like form. While they found that participants were better at detecting that some change in human faces was made compared to when changes were made in houses, Wilford and Wells (2010) also discovered that participants could not point to exactly where the change had been made. They found that when faces and houses were inverted, errors in detecting changes virtually disappeared. So, whether faces are upright as we normally see them or inverted, so long as they have the proper feature configuration, it will be easiest to notice changes. This also emphasizes the importance of having all of the information about how features fit together as a whole face at the time of encoding and later recognizing it.

Other research (e.g., Tanaka & Farah, 1993; Tanaka & Sengco, 1997) has found similar results with inverted and scrambled faces. Parts must not only be represented in a whole for later correct identification, but the context in which they are presented (i.e., their configuration) is important for detecting changes and correct identification. Features and their configurations are interdependent for the success of holistic representation. Tanaka and Sengco (1997) found that modifying where one facial feature was in relation to other features, even if only the one feature changed position, made it difficult to later recognize the face. Collectively, these studies highlight the importance of having all of the features available in a configuration and context that is familiar so that it may be readily mapped onto a template. But these studies also address the importance of individual features, in that they are specifically representative of a larger whole. How they are incorporated into the larger whole has brought about some interesting theories and findings, especially regarding when errors are made. The current study focuses on serial processes because the face is seen as a composition of the features, especially when a great deal of resources is devoted to remembering a unique feature, such as scar or tattoo.

Feature Integration Theory. The feature integration theory poses that individual features are processed separately in the early stages of encoding and that focused attention is the factor that makes them a cohesive and accurate memory (Reinitz & Hannigan, 2001). The critical factor to bind the features together is attention. Otherwise mistakes are more likely to occur. As a result, random elements will more likely be pieced together from the given context and taken to be a true representation of the event. These errors are referred to as conjunction errors (Treisman & Gelade, 1980).

Different error types can be made depending on the nature of the event and how the various features are encoded and combined. The current study explores a few different types of errors, namely feature errors and conjunction errors. Feature errors combine parts from an old stimulus and a newly presented stimulus to make a composite representation of the event (Jones, Bartlett, and Wade, 2006). This error is tested in the current study by presenting an "old" actress at encoding performing a given action and then at the recognition phase the participant misidentifies a "new" actress as the old actress performing that same action. The new actress has never actually been seen before, but the participant believes it is the old actress. Conjunction errors, on the other hand, happen when two previously encoded separate characteristics combine to produce a completely new, but perceived as accurate, memory (Treisman & Gelade, 1980). An example of this in the current study would be if a participant saw an actress with a bandage stapling papers and a second actress with an eye patch stacking blocks, then the participant later falsely recognized the first actress with an eye patch stacking blocks.

Separate characteristics, then, do seem to be processed in a parallel manner, and in order for them to be associated, they must be attended to simultaneously. Treisman and Gelade (1980) explain that categories can be divided by perceptual characteristics, like texture and color, and cognitive characteristics, like emotional associations. Parallel processing deficits can be exemplified by patients with visual agnosia, who struggle with composing whole images from a collection of images, much like facial features are combined to compose a template of a face. They can perceive the separate parts, but are unable to describe, and thus perceive, the whole object. Top-down processing, such as using a facial template, involves combining and understanding how different elements are related and connected. Focused attention is necessary to understand an object as whole and interconnected (Treisman & Gelade, 1980).

Special characteristics require extra processing and if not thoroughly processed, they will more likely lead to conjunction errors. Visual attention, then, can be compared to a zoom lens. A small amount of a scene can be looked at in great detail- such as a facial feature- or conversely, a larger amount with less detail can be perceived. This may be important to consider with unique facial features, which the participant may focus on and miss other contextual details, because there is only so much an individual can attend to at any given moment. Treisman and Gelade (1980) found that conjunction errors occur most when interchangeable features are focused on or when features happen outside of focused attention, in other words- beyond the proposed lens of attention. Switching focused attention between two features will help strongly associate them and reduce the possibility of conjunction errors (Hannigan & Reinitz, 2001). If a participant were to focus on multiple aspects of the event, such as the facial feature, action, and person performing it, there would be fewer errors. But time and attention constraints make it difficult to form an accurate memory, especially in situations like the current study which only allow the participant a few seconds to make all the associations between actresses, features, and actions. Similarly, if an eyewitness focuses on a single, unique feature the probability for errors increases. That feature might be shared with other individuals or can be altered with time, like if it is a cut or facial hair.

Conjunction Errors. Conjunction errors are a consequence of the tenets of feature integration theory. They are common errors made when an eyewitness mistakes a bystander as the actual perpetrator. These errors are usually made unconsciously when the bystander and perpetrator are present close together in physical space or time. They are the result of a gap during the encoding process (Earles et al., 2008). Only certain characteristics are encoded and if a similar individual is presented, the individual may not have enough information at recognition to distinguish between the two people. The various parts of a memory, such as the environment, the emotional atmosphere, and the lighting, then, are stored separately (Jones et al., 2006). This is most likely due to the multiple specialized neurological systems mentioned earlier working in a parallel, but separate manner to encode various aspects of stimuli in a given context. In an attempt to make a cohesive memory, the brain may actually form a composite memory, depending on how fully different aspects were attended to during encoding.

There are many components to a memory that are encoded in a parallel manner. Sometimes these components are mismatched to create a composite, but false memory. Errors like this happen often. The resulting unique combination is mismatched and represents a conjunction event (Jones, Bartlett, & Wade, 2006). Some of the memory elements may not be exclusive to the particular memory that is being recalled, but they are recalled instead from a store of memory components of interrelated or similar types of memories. For example, an individual may not be recognized when presented in an array after a time lapse, but their location or voice might be recognized (Reinitz, Lammers, & Cochran, 1992). That individual would be more likely to be included in a conjunction event that has similar characteristics to other elements within the event that is being recalled even if they were not actually involved. In relation to the current study, someone presented at encoding might more readily be recognized later on simply because she has some unique feature, even if she is are shown doing some other action. This could be similar to a bystander being misidentified as the perpetrator because both individuals shared the same general location at the eyewitness's time of encoding.

Conjunction errors occur more frequently when participants recognize someone in an array. If they believe someone looks familiar, they will be more likely to choose them from the array (Perfect & Harris, 2003; Jones et al., 2006). Being familiar would make conjunction errors more likely because the participant would connect that face with the target action instead of the actual perpetrator, regardless of their gender or age. Eyewitnesses would associate the element of familiarity with the scene in question because of their relationship during recognition (Earles et al., 2008). This effect may be even stronger when the familiar, but innocent, person is associated with the perpetrator closely in time. For example, if the familiar person walks in to a store right before a robber, then that person is more closely associated with the robber than a person who was walking out of the store some time before the robbery even took place. Jones et al. (2006) found that conjunction errors occurred most often when conjunction pairings occurred closer in time than when the same pairs were presented separately after a time lag. Features that are encoded closely in a time sequence are more likely to be misremembered and later produce a false memory that is a composite of the original presentations. This is because they are committed to memory in close relation to each other and the probability for them to be misremembered is much higher than if they were attended to with more time in between. The current study applies this idea because at encoding the video clips are viewed continuously in succession.

Actor Binding. Mistakes in actor binding lead to conjunction errors. In the absence of context, someone may believe that a certain individual is associated with an action, when that action was actually done by another individual. This association relies on familiarity in the absence of contextual cues. Because the context and individual are separately encoded and retrieved, it is not uncommon to mistake individuals who look nothing alike physically as doing an action (Earles et al., 2008). This phenomenon has been explained with associative recognition and unconscious transference.

Associative Recognition. Associative recognition explains mistakes in actor binding by parceling out familiarity and recollection. This is an extension of dual process theory where recollection and familiarity are separate processes that occur within distinct brain regions (Stark & Squire, 2001). The hippocampus is involved in recollection tasks by making complex associations between events and is done on a conscious level. Familiarity, though, is an unconscious process and occurs in different regions from recollection (Light, Patterson, Chung, & Healy, 2004), probably including other regions of the medial temporal lobe (Stark & Squire, 2001).

Studying patients with damage to the hippocampal regions helps to clarify the neural relationship between the conscious process of recollection and the unconscious process of familiarity. Kroll, Knight, Metcalfe, Wolf, and Tulving (1996) found that individuals with damage to the hippocampus had difficulty consolidating memories. Kroll and colleagues (1996) also found that controls had significantly fewer conjunction errors when testing memory for word parings than patients with hippocampal damage. This would make sense because conjunction errors occur when characteristics are incorrectly combined to form a new and unique combination of features. Using simple illustrations of faces similar to those used by Hannigan and Reinitz (2000), the researchers found that the patients with hippocampal damage made more false alarms with conjunction illustrations than the controls. The errors may have happened because the patients with hippocampal damage had difficulty binding the features at the onset and resorted to making up events later. These results show the importance of various brain regions working together to draw up a memory at recollection and can help explain why participants in the current study will make errors during recollection, as they may be unable to bind the features properly at recollection.

Unconscious Transference. Unconscious transference is an example of a conjunction error. It results when a familiar, but innocent, person is mistaken for the target person. This error usually happens during encoding when an individual gives one person's role in a memory to a separate, but related person in that same memory (Earles, et. al 2008). This can happen if they are seen near each other physically or presented closely in time (Jones, et. al 2006). If an innocent individual is somehow associated with the perpetrator, such as an individual waiting in line at a store when a robbery took place, there is a higher likelihood that the associated individual will be mistaken for the robber regardless of their appearance or actions associated with the scene in question. Because the bystander is present in the scene, he or she will be closely associated with the robber and may even be mistaken as the robber. Simply being associated with an event may cause an individual to unconsciously associate a person within the event with another person's role (Earles, et. al 2008).

In Ross, Ceci, Dunning, and Toglia's (1994) study of unconscious transference, there were high memory blending rates. Memory blending refers to recreating of a memory using multiple sources. For example, if two people who are similar in appearance are associated by a connecting feature, such as buying merchandise at a particular store often, than the innocent person is more likely to be associated with his or her similar-looking counterpart if he or she is convicted of a robbery at that store later. This may happen in the current study when participants associate two actresses sharing the same feature to also committing the same action, even if one did not.

Memory blending may explain unconscious transference (Kersten, Earles, Curtayne, & Lane, 2008). Participants in Ross et al.'s (1994) memory blending study were divided into two conditions: a control group and an unconscious transference group. The transference group watched videos of three separate, but related, situations. The first situation was a male teacher teaching. The second was a female teacher teaching. The third was a male robber stealing money from the female teacher's purse. This set was the unconscious transference condition. In the control group, participants only watched the female teacher teaching and the robber stealing from her purse.

They found no effect of unconscious transference in the control group when the participants only saw the female teacher teaching. In the experimental group, though, participants were far more likely to identify the male teacher as the robber when they were shown both the male teacher and the robber than if they had just seen the female teacher in the control group. The experimental group also more often believed that the male robber and teacher were actually the *same* person. This demonstrates memory blending because the participants transferred the actions of one person to a separate person. The authors believed this was because the robber and male teacher were similar in appearance and that the videos occurred closely in time to one another (Ross, et. al 1994). Interestingly, Earles et. al (2008) found that actors did not even have to be similar in appearance for errors in actor binding to occur, but that they needed only to occur in similar contexts or closely in time. Even targets of different genders could be confused if seen closely in time or associated in the same situation.

Experimental Design

Memory for faces was examined in two separate phases: in the encoding phase of the experiment, participants watched a series of continuous video clips of some actresses performing simple actions, such as shuffling cards and stacking wooden blocks. These actions took no more than five seconds to perform. Some of the actresses had unique features, such as a black eye or bandage on some part of their face. Participants were told to remember which actresses performed the actions. Then, a week later participants were presented with a new set of videos including actresses with and without the various features seen previously performing various actions. The participants were be asked if each actress performed that action the previous week. The combinations of actresses, features, and actions tested the effects of introducing new actors and actions, conjunction events, and of re-presenting old actors. I hypothesized that participants would be more likely to falsely recognize an action performed by the wrong actress if that actress had been seen performing a different action a week earlier, and was thus familiar. Also, participants would be more likely to falsely recognize an action performed by the wrong actress if that actress shared a unique facial feature with the actress that had actually performed that action.

METHOD

Participants

One hundred and five Florida Atlantic University students were tested. They received course credit for their participation. There were 65 males and 40 females. Participants were on average 19.74 years of age (*SD*=3.00). Participants' average years of education was 12.5 years (*SD*=1.06). Of all the participants, 79% did not identify themselves as Hispanic, while 14.3% did, and 6.7% declined to answer. The majority of the participants identified their race as white (60%), then black and African American (14.3%), followed by American Indian or Alaskan Native (5.7%) and more than one race (5.7%). The remaining 14.4% identified as another race. Participants rated their overall health on a 1-5 scale as "good" (*M*=4.40, *SD*=0.62). In this sample, most participants took no prescription medications (*M*=0.22, *SD*=0.46).

Materials

Ninety-six female volunteers (hereafter referred to as "actresses") between the ages of 18 and 25 were filmed in the laboratory using a digital camera secured on a tripod. The video clips were edited using Adobe Premiere Video Editor. Actresses were asked to wear light makeup and conservative clothing without writing or logos so as to avoid being more recognizable in the video arrays.

Video clips. Actresses were filmed performing simple actions (e.g., stapling papers, polishing a spoon, etc.). Each actress performed two different actions. They were seated for all actions with a gray backdrop and a table in front of them. Each action took no more than 5 seconds to complete. The clips were edited so that the table, hands, and upper body were visible along with the actress's face.

Sixteen actresses were filmed with unique facial features to test the effects these might have on recognition. These features were inspired by actual mug shot images viewed on thesmokinggun.com. Features were divided into two equal groups: temporary features and permanent features. Some examples of temporary features were gauze wrapped around the forehead or a black eye. Temporary features are of particular interest because they address changes that often make correct identifications difficult after a period of time has passed due to their inherent malleability. Examples of the permanent features were a tattoo or beauty mark that- in contrast to the temporary features- would not be changed easily or at all over time.

Each participant viewed one of eight encoding lists of 66 total videos. For the control condition, none of the 66 actresses had unique features. For the experimental condition, none of the 88 video clips involved actresses with unique features, while the remaining clips were identical to those seen by the control group.

Eight retrieval lists of 88 video clips each were created to correspond to the 8 encoding lists. The 88 clips were divided into four item types: old items, conjunction items, new action items, and new actress items. The old actress item type consists of the same actress performing the same action as at encoding. The conjunction actress item type consists of a familiar, but incorrect, actress performing a different action from the one she had performed at encoding. The new actress item type consists of actions that were seen during the encoding phase but now performed by a new actress. The new action item type consists of actresses seen at encoding, performing actions that were not seen at encoding. The video clips were counterbalanced by making one video clip one item type for one list and then using that same clip as a different item type in another list.

For participants in the experimental condition, 16 of the 88 video clips in each retrieval list involved actors with unusual features. The four old items involving unusual features were identical to video clips seen at encoding. The four conjunction items involved an actress seen at encoding now performing an action that had been performed by a different actress with unusual features at encoding, with the actress performing the action at retrieval now possessing the same unusual feature that had been possessed by the actress who had performed that action at encoding. The four new actor items involved an actress not seen at encoding performing an action that had been performed by a different actress with unusual features at encoding, again with the actress performing the action at retrieval possessing the same unusual feature that had been possessed by the actress who had performed that action at encoding. Finally, the four new action items involved an actress seen with an unusual feature at encoding now performing a new action.

PROCEDURE

Part 1: Encoding Phase

Participants watched 66 actresses perform 66 actions in succession on a computer monitor. Participants were divided into the control group, which saw only actresses without unusual features, or into the experimental group, which saw actresses both with and without unusual features. Before the experiment, participants were directed to remember which actress performed what action. After participants viewed the array, they answered general demographic questions and took the Shipley Vocabulary Test. They were then invited to return one week later for testing.

Part 2: Recognition Phase

This phase was designed to measure how many correct recognitions participants could make after a one week time lag. The participants were asked to make 88 identifications based on the video clips they had seen of the actions during the encoding phase from the corresponding retrieval lists. Participants were presented with an action clip of an actress and simply asked if they had seen this actress performing this action the previous week.

RESULTS

Presence of Unusual Feature

Two repeated measures ANOVAs were performed to determine whether the effects were driven by the actions or the features. The ANOVA run for the control group yielded a non-significant interaction of item type by group ($F(3,46)=3.7$, $p=ns$). This suggests that the actions participants saw did not matter whether the participants were in the control or experimental group. Then, another ANOVA was run for just the experimental group to show that the features were the factor that was driving the proportion of yes responses to the various item types. This ANOVA yielded a significant interaction of group by item type, which included actresses with and without features ($F(3,59)=4.77$, $p<.05$). This result suggests that the features were responsible, not the actions, for determining how participants responded when making recognitions.

The two-way repeated measures ANOVA was examined further to understand the effects within the experimental group. The reasoning behind this was that the experimental group had a built in control because it tested the no feature items along with the feature items. Thus, a two-way repeated measures ANOVA was performed on the results of the experimental group, with item type and unusual feature presence as independent variables. This analysis yielded a significant effect of item type ($F(3,174)=89.49$, $p<0.01$). There was also an interaction of unusual feature presence or absence and item type ($F(3,174)=3.38$, $p<0.05$).

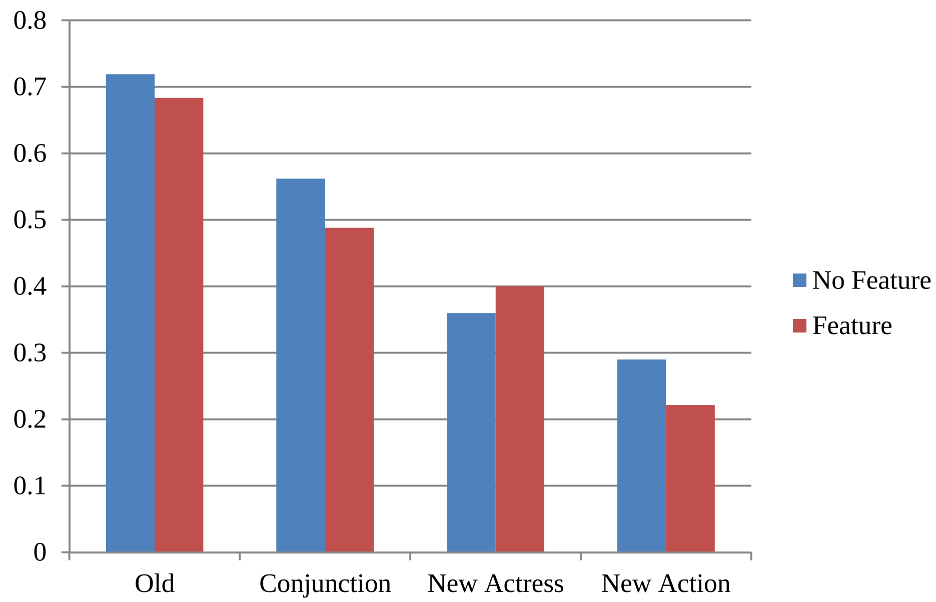

Figure 1. Proportion of "yes" responses dependent on item type during recognition phase for entire sample

In order to understand the significant interaction of item type and unusual feature presence, paired samples t-tests compared unusual feature present items to unusual feature absent items for each item type. There was a significant difference between new action items with no unusual features (*M*=0.29, *SD*=0.21) and new action items with unusual features (*M*=0.19, *SD*=0.25) ($t(58)=2.93$, $p<0.05$). The comparison between conjunction items with no unusual features (*M*=0.56, *SD*=0.17) and conjunction items with unusual features (*M*=0.50, *SD*=0.30) was in the direction of significance ($t(58)=1.59$, $p>0.10$), with a higher rate of false recognition for conjunction items that did not involve unusual features. The comparison between new actress items with no unusual features (*M*= 0.38, *SD*=0.18) and new actress items with unusual features (*M*= 0.43, *SD*=0.28) also was in the appropriate direction towards significance ($t(58)=1.36$, $p>0.10$), with a higher rate of false recognition for new actress items that did involve unusual features. The effects of unusual features on the conjunction and new actress items were thus in opposite directions. These results will be discussed further in the Discussion section.

Further Analyses

Because there was a trend for more false recognition of new actress items involving unusual features, a paired samples t-test was conducted to analyze whether temporary or permanent features resulted in more false recognitions of new actresses. This paired samples t-test was not significant ($t(55)=0.42$, $p>0.10$). This suggests there was no difference between the two types of features, whether temporary ($M= 0.42$, $SD=0.37$) or permanent ($M=0.39$, $SD=0.37$). This suggests that whether a feature is temporary or permanent does not affect recognition, although the small number of items of each type limits the conclusions that can be drawn.

Another paired samples t-test was performed to compare false recognition for features near the eyes versus features removed from the eyes. This paired samples t-test was significant ($t(57)=2.73$, $p<0.05$). Features near the eyes ($M=0.54$, $SD=0.45$) and far from the eyes ($M=0.34$, $SD=0.33$) showed significant differences in participants' number of "yes" responses. The implications of these results will be discussed in the proceeding section.

DISCUSSION

There was a significant interaction of item type and unusual feature presence. This result suggests that the effect of the presence or absence of an unusual feature is different across item types. Further tests revealed that the new actress and conjunction item types were affected differently by the presence of an unusual feature. The presence of an unusual feature made participants more likely to falsely recognize a new actress compared to when there was no unusual feature. Conjunction items, though, were more likely to be falsely recognized when they did not involve unusual features.

In this study, actresses were shown with various features during both phases. Participants may have associated a given actress with a specific feature at encoding and later at recognition been alerted to a change when they saw that same actress with another feature. Participants were overall very likely to falsely recognize conjunction items, but this seems to be because of the familiarity of the person rather than the unusual feature. Participants were actually less likely to falsely recognize conjunction items involving unusual features than those involving no unusual features. Despite this cue that an actress had changed based on the change in feature, however, the conjunction item type resulted in the most false recognitions of any of the distracter items. Based on this data alone, then, it cannot be teased apart whether the participants used *just* the feature or the action performed or some combination of these two to determine whether or not they recognized an actress. Future research should attempt to address some of these issues. The ordering of when a feature is seen, whether it is at encoding or retrieval, might help eliminate the feature-actress association effects seen here.

In contrast to the conjunction items, the new actress items were more likely to be falsely recognized when that new actress shared an unusual feature with the actress who had originally performed that same action. Because the actress in these items was new, participants would not be able to remember having seen that same actress with a different facial feature earlier. Thus, the presence of the familiar facial feature in the absence of memory for the rest of the face of the actress may have caused participants to be more likely to believe that they had seen that actress perform that action earlier. This research suggests, then, that an innocent person who possesses a similar facial feature to a perpetrator of a crime is more likely to be accused of committing the crimes.

It would be interesting in future studies to test the presence of one feature used among many individuals and explore what differences arise in recognition. This might be more directly applicable to the challenges eyewitnesses face when making identifications, especially when considering the implications for the bystander effect based on the findings of the current study. Also, various types of features could be studied more in depth in future research. This study did not find any significant results for feature type, which may have been due to the small sample sizes for each item. Future research may focus specifically on different types of features, like temporary and permanent features, so that measures like the appearance change instruction can be verified. This instruction is a requirement of law enforcement to inform eyewitnesses of the potential that a perpetrator may have changed since the eyewitness last saw the individual. Research has shown this instruction actually decreases positive identifications and witness confidence (Charman & Wells, 2007), but the exact nature of *why* eyewitnesses perform worse after this instruction remains unclear. By performing a similar study to the current one and simply changing the instructions to reference a person might look differently during the different stages, may directly test whether the appearance change instruction is beneficial or detrimental to eyewitness identifications.

The significant result of feature placement may be of interest to researchers wishing to expand upon the neuroscience literature involving the social importance of eyes discussed earlier. This particular significant result should be interpreted with caution, however, as the sample sizes used to gather the information about placement were small. It follows, then, that research for unusual facial features, memory for faces and actions, and eyewitness testimony has a great deal to expand upon.

APPENDIX A

Shipley Vocabulary Test

Vocabulary Test

Please circle the lower-case word next to each capitalized word that is MOST SIMILAR in meaning to the capitalized word.

1.	TALK	draw	eat	speak	sleep
2.	PERMIT	allow	sew	cut	drive
3.	PARDON	forgive	pound	divide	tell
4.	COUCH	pin	eraser	sofa	glass
5.	REMEMBER	swim	recall	number	defy
6.	TUMBLE	drink	dress	fall	think
7.	HIDEOUS	silvery	tilted	young	dreadful
8.	CORDIAL	swift	muddy	leafy	hearty
9.	EVIDENT	green	obvious	skeptical	afraid
10.	IMPOSTOR	conductor	officer	book	pretender
11.	MERIT	deserve	distrust	fight	separate
12.	FASCINATE	welcome	fix	stir	enchant
13.	INDICATE	defy	excite	signify	bicker
14.	IGNORANT	red	sharp	uninformed	precise

15.	FORTIFY	submerge	strengthen	vent	deaden
16.	RENOWN	length	head	fame	loyalty
17.	NARRATE	yield	buy	associate	tell
18.	MASSIVE	bright	large	speedy	low
19.	HILARITY	laughter	speed	grace	malice
20.	SMIRCHED	stolen	pointed	remade	soiled
21.	SQUANDER	tease	belittle	cut	waste
22.	CAPTION	drum	ballast	heading	ape
23.	FACILITATE	help	turn	strip	bewilder
24.	JOCOSE	humorous	paltry	fervid	plain
25.	APPRISE	reduce	strew	inform	delight
26.	RUE	eat	lament	dominate	cure
27.	DENIZEN	senator	inhabitant	fish	atom
28.	DIVEST	dispossess	intrude	rally	pledge
29.	AMULET	charm	orphan	dingo	pond
30.	INEXORABLE	untidy	involatile	rigid	sparse
31.	SERRATED	dried	notched	armed	blunt
32.	LISSOM	moldy	loose	supple	convex
33.	MOLLIFY	mitigate	direct	pertain	abuse
34.	PLAGIARIZE	appropriate	intend	revoke	maintain
35.	ORIFICE	brush	hole	building	lute
36.	QUERULOUS	maniacal	curious	devout	complaining
37.	PARIAH	outcast	priest	lentil	locker
38.	ABET	waken	ensue	incite	placate

39.	TEMERITY	rashness	timidity	desire	kindness
40.	PRISTINE	vain	sound	first	level

APPENDIX B

Demographics Questions

1. What is your date of birth? ____________

2. How many years of education have you completed (for example, 12 = completed high school, 16 = completed college)? ________________

3. Are you male or female? _________________

4. What is your ethnic group?

   1. Hispanic or Latino

   2. Not Hispanic or Latino

5. What is your race?

   1. American Indian or Alaskan Native

   2. Asian

   3. Native Hawaiian or Other Pacific Islander

   4. Black or African American

5. White

6. More than one race

7. Other

6. How would you rate your health at the present time? (Circle one)

1. Poor

2. Fair

3. O.K.

4. Good

5. Excellent

7. How many prescription medications are you currently taking? __________

8. Have you ever been treated for high blood pressure or cardiovascular disease?

____

9. Did you have any difficulty seeing any of the items during this experiment?

____

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