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Running Head: LINEUPS FOR SUSPECTS WITH DISTINCTIVE FEATURES

Creating Fair Lineups for Suspects with Distinctive Features

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Abstract

In their descriptions, eyewitnesses often refer to a culprit's distinctive facial features. But in a police lineup, to select the only member with the distinctive feature is both unfair to the suspect and provides the police with no further information. To provide information over and above the presence of the distinctive feature, the distinctive feature should either be replicated across foils or concealed on the target. In the present experiments, replication produced more correct identifications in target-present lineups –without increasing the incorrect identification of foils in target-absent line ups– than did concealment. This pattern –and only this pattern– is predicted by the hybrid-similarity model of recognition.

Creating Fair Lineups for Suspects with Distinctive Features

Imagine that you witness a crime and the culprit has an obvious marking on his forehead. You would probably feel confident that you could easily identify the culprit from a lineup at a later time. Imagine now that, using your description, the police arrest an innocent man with a similar marking on his forehead. They present you with a photo-lineup in which only one person has a marking similar to the one you hold in your memory. Would you identify the innocent suspect as the actual perpetrator?

Eyewitness research shows that errant identifications are more likely to occur when an innocent suspect matches the eyewitness's description of the culprit, yet the foils do not. Put another way, an innocent suspect who stands out in a lineup is likely to be falsely identified as the culprit (Wells et al., 1998). In simultaneous lineups where lineup members are presented all together, eyewitnesses tend to compare the lineup members to each other and then select the person who most closely resembles the culprit (i.e., a *relative judgement strategy*, Wells, 1984; Wells et al., 1998). In cases where the suspect stands out then, the eyewitness will disproportionately focus on the suspect and the suspect will have a higher probability of being selected than any other lineup member.

The question that immediately arises is how can we ensure that every lineup member –including an innocent suspect with a distinctive feature– will have an equal chance of being selected? The police typically use one of two techniques to overcome this issue. One technique is to replicate the suspect's distinctive feature across lineup members (*replication*) and the other is to conceal the area of the distinctive feature on the face of every lineup member including the suspect (*concealment*). Both techniques ensure that the suspect does not stand out because of his distinctive feature. Although police officers employ these procedures daily and 34% of lineups in England and Wales are digitally manipulated in these ways because the suspects have distinctive features (P. Burton, West Yorkshire Police, personal communication, November 3, 2008), to our knowledge there is no empirical research on the effects of either technique on identification accuracy. Currently, there is no standard regulation for using one technique over the other amongst UK or US police forces. Rather, the police officer responsible for each case decides how to construct the lineup that will be presented to eyewitnesses. According to Wogalter, Malpass, and McQuiston's (2004) survey (including non-mutually exclusive items) of 220 jurisdictions in the US, 77% of police officers reported replicating the marks across foils, 23% reported adding *similar* marks to the foils, and 18% had tried to conceal the area of the markings. Surprisingly, 30% answered that they do nothing about distinctive features.

Both replication and concealment make the identification task more difficult for eyewitnesses. Eyewitnesses must rely solely on their memory of other specific facial features. But which technique allows the police to extract more information from the eyewitness's memory and therefore improve identification performance?

Nosofsky and Zaki's (2003) Hybrid-Similarity (HS) model of recognition predicts better performance under replication than under concealment. The HS model is a general model of the effects of distinctive features on recognition memory, and has been applied to face recognition (Knapp, Nosofsky, & Busey, 2006), thus it is most suited to modelling these effects. To decide whether they have seen a particular face before, participants assess the face's *familiarity*, and this familiarity will determine the probability that the face will be selected. In the HS model, familiarity is defined as the average similarity between a test face and the sum of the faces seen during the study phase (hereafter, the *exemplars*). Similarity between two faces is a joint function of their distance in a large multidimensional space (after Nosofsky, 1986) and the counts of the number of shared and unshared, discrete features (after Tversky, 1997). So two faces will be similar if they are near one another in the face space, have many discrete features (e.g., scars) in common, and few unshared discrete features.

Under replication and under concealment, the target face will be, on average, more similar to the exemplars than will a foil. This is because the target matches the exemplar formed when the target was first encountered (hereafter, the *target exemplar*). Therefore, for both techniques, familiarity of the target is higher than familiarity of the foils. However, having features replicated across foils between study and test exaggerates this difference in familiarity between the target and the foils. Specifically, in the HS model, the common distinctive feature provides a multiplicative boost in the similarity between the target and the target exemplar and also provides a multiplicative boost in the similarity between the foils and the target exemplar. Thus the absolute difference between the similarities of the target and the foils is increased. Conversely, having distinctive features concealed between study and test attenuates the difference in familiarity between the target and the foils. So, when these familiarities are combined with the general familiarity to other, background faces, the target:foil familiarity ratio is higher for replication than for concealment. In summary, replication should increase the difference in familiarity between the target and the foils, whereas concealment should reduce this difference. The HS model, therefore, must predict better performance under replication than under concealment in target-present (TP) lineups.

In two experiments we compared replication to concealment. During the study phase participants viewed a series of faces, a small proportion of which had a distinctive feature. During the test phase a series of six-person lineups was presented. Experiment 1 used only TP lineups and participants were forced to select a face. Experiment 2 included target-absent (TA) lineups and participants were allowed to make a no-identification decision.

Stimuli

The stimuli were developed especially for this study using the faces of 140 inmates from Florida's Department-of-Corrections website. The selected inmates were 24 years old, had short, brown hair, brown eyes, neutral expressions, and were wearing the Department of

Corrections' uniform. Inmates were looking directly towards the camera. The photos showed only inmates' head and neck and were taken against a uniform grey background. None of the inmates wore glasses and we removed all facial hair, bruises, scars, blemishes, moles, or other identifiers using Adobe Photoshop CS2. We randomly selected 60 faces and digitally added a distinctive feature to each face using Photoshop. Figure 1 illustrates each distinctive feature type (a bruise, a tattoo, a piercing, facial hair, a scar or a mole).

Prior to conducting the experiments, 30 independent judges rated the distinctiveness, attractiveness and degree of emotional arousal elicited by the 200 faces (80 faces always in non-distinctive form, plus 60 faces in both distinctive and non-distinctive forms). We measured distinctiveness and attractiveness on 9-point Likert scales where 1 indicated '*not at all'* and 9 indicated '*very'*. To measure emotional arousal we used the Self-Assessment Manikin scale (Bradley & Lang, 1994).

Of the 80 faces that never appeared with distinctive features, we excluded 4 outliers on the distinctiveness scale. Of the 60 faces used in both forms we excluded 6 outliers on the distinctiveness scale. We also excluded 2 for which there was no difference in distinctiveness before versus after the addition of the distinctive feature. There were no such outliers on the other scales.

Experiment 1

Method

Participants. We recruited 110 students (M = 25.5 years, SD = 6.3, 45% female) from the University of Warwick and they participated voluntarily or received £2. Participants were presented with both lineup techniques in a within-participants design.

Procedure. In the study phase, participants were informed that they would view 32 faces drawn randomly from the stimulus set, and would subsequently be tested on their memory of these faces. Participants were asked to view each face carefully. Of these 32 study faces, 6 randomly selected faces had distinctive features (one of each type) and appeared as targets in the test phase. The remaining 26 faces of the study phase appeared without distinctive features and were not seen again. The 32 study faces were presented in random order. Each face stimulus was displayed in the centre of the screen for 2 s.

In the test phase, which followed a 5-minute anagram-solving filler task, participants completed a lineup-identification task. Participants viewed a series of six 6-person lineups and were required to indicate, for each lineup, which *one* lineup member they saw in the study phase by clicking on it with the mouse; they did not have the option of not responding. They were instructed that a person previously seen might have a different appearance at test and that their task was to recognize the person previously seen, not the exact photograph. Three of the lineups applied replication (Figure 2a) and three applied concealment (Figure 2b). The five fillers for each lineup were new, unseen faces randomly drawn from the stimulus set. Lineups were displayed in two rows of three photos each (Figure 2). The placement of the target in each lineup was random for each participant. The six lineups were presented in a random order for each participant. There was no time limit for their decision and no feedback was provided. The duration of the experiment was approximately 10 minutes.

Results

Figure 3 shows the proportion of correct and incorrect selections under replication versus under concealment. Participants were significantly more likely to correctly select the suspect when distinctive features were replicated across foils rather than concealed on the target, $t(109) = 5.32$, $p < .001$, $p_{rep} = .99$, $r = .45$.

Experiment 2

Experiment 2 replicated Experiment 1 and extended the design to include TA lineups. The design was a 2 (lineup technique: replication, concealment) x 2 (target presence: present, absent) within-participants design. In TA lineups all six foils are, on average, equally familiar under replication and under concealment (because none of them matches exactly any of the exemplars), so the HS model predicts no difference in identification accuracy between the two conditions.

Method

Participants. Eighty-five psychology students (M = 20 years, SD = 3.0, 74% female) participated for course credit.

Procedure. The procedure was identical to Experiment 1, with two modifications. First, in the test phase, participants viewed 12 lineups instead of 6; half were TP and half were TA. Second, if participants recognised none of the faces in the lineup, they were instructed to click on a "none" button below the lineup. TP and TA lineups were randomly intermixed.

Results

Figure 4 shows the proportion of correct and incorrect responses under replication and under concealment. In TP lineups, participants were more accurate at identifying the suspect when distinctive features were replicated across foils rather than concealed, $t(84) = 5.02$, $p < .001$, $p_{rep} = .99$, $r = .48$, replicating the results of Experiment 1. Also, the proportion of errors that were foil identifications (rather than no-identifications) was higher under replication, $t(84) = 2.74$, $p < .01$, $p_{rep} = .97$, $r = .29$. In TA lineups, accuracy did not differ between concealment and replication: A similar proportion of participants incorrectly selected an innocent foil.

In sum, our results suggest that replication is better for constructing lineups because replication increased the probability of selecting the target when they were present without increasing the probability of selecting an innocent foil when the target was absent. The only drawback was that, when the target in TP lineups was *not* identified, replication rendered participants less willing to make a no-identification decision than did concealment. However, in absolute terms, incorrect foil selections were equally likely for both techniques.

Discussion

Our results support the HS model of recognition memory. Other standard global-familiarity models (e.g., Valentine & Ferrara, 1991) cannot account for our data. Under these models, in TP lineups the target:foil familiarity ratio is the same for concealment and replication lineups. Therefore, global-familiarity models predict no difference in identification performance under replication and concealment. This is not supported by our results.

Global-familiarity models also predict increased false identifications in TA lineups under concealment: since faces without distinctive features resemble many other faces without distinctive features from the study phase, the overall familiarity evoked under concealment is higher; hence participants must have an increased tendency to choose someone from the lineup and to make more false identifications. Under replication, the opposite must be true. However, our data revealed no difference in choice rates between replication and concealment in TA lineups.

In Experiment 2, the improvement when distinctive features were replicated rather than concealed came from a reduction in incorrect no-identifications. It could be argued that this increase in hits resulted from an increased tendency to select someone from a replication lineup rather than a concealment lineup. Such a mechanism though, would also predict more false identifications in both TP and TA lineups. However in Experiment 2, choice rates were equal under replication and concealment in both TP and TA lineups.

Our finding that replication (when the suspect remains unchanged between study and test) is better than concealment (when the suspect is altered between study and test) is consistent with the changed-appearance literature. Lineup-identification studies, for instance, show that disguises (Cutler, Penrod, & Martens, 1987a, 1987b; Cutler, Penrod, O'Rourke, & Martens, 1986), changes in hair style or facial hair, and the addition or removal of glasses (Read, 1995), result in poorer identification performance. Likewise, recognition-memory studies show that disguises, changes in pose and facial expression, presence or absence of glasses, wigs or beards (Patterson & Baddeley, 1977), changes in visual angle (Bruce, 1982), and the effect of aging (Read, Vokey, & Hammersley, 1990) increase false identification rates (see also Shapiro & Penrod, 1986).

This paper focused on the cases where eyewitnesses report a culprit's distinctive feature. For the cases in which a distinctive feature is not reported, Wells and colleagues (1998) argue for "propitious heterogeneity" (Luus & Wells, 1991; Wells et al., 1998) in the lineup, that is, no replication of the suspect's distinctive feature. However, we have reasons to believe that replication should still be applied. People are able to encode information without concurrent awareness of what is being encoded (Shanks & St. John, 1994). So, although eyewitnesses may not verbalize the presence of a distinctive feature, they may be able to remember it should they see it on the culprit at the time of the lineup. For reasons of fairness then, everyone in the lineup should have the distinctive feature.

We have used a mathematical model of the effect of distinctive features on recognition memory to make predictions for real-world lineups. We predicted that replicating a distinctive feature across foils is better than concealing it on the suspect, because replication amplifies the difference in the familiarity of the target and the foils whereas concealment attenuates this difference. Two experiments confirmed this prediction. Police officers should be aware of this theoretical and empirical result when constructing lineups for suspects with distinctive features, and should replicate rather than conceal these features.

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Figure Captions

Figure 1. Faces used in Experiments 1 and 2 before (top) and after (bottom) the digital addition of a distinctive feature (from left to right, a bruise, a mole, a piercing, a moustache, a scar, and a tattoo).

Figure 2. Examples of a replication lineup (a) and a concealment lineup (b) presented in Experiments 1 and 2.

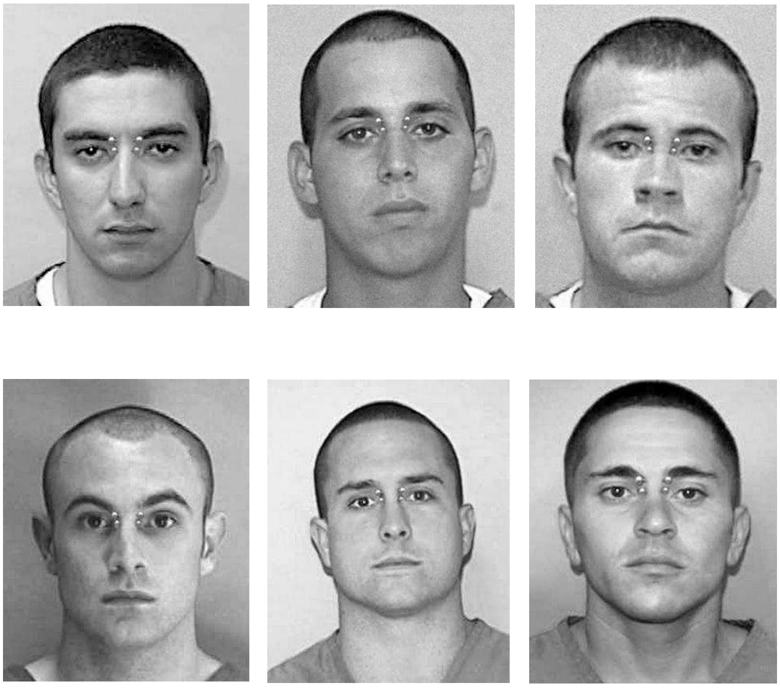
Figure 3. Mean proportion of correct responses and errors for replication and concealment. Error bars represent the standard error of the mean.

Figure 4. Mean proportion of correct responses and errors in replication and concealment lineups for target-present (top) and target-absent (bottom) lineups. Error bars represent the standard error of the mean.

Figure 1

Figure 2

(a)



(b)

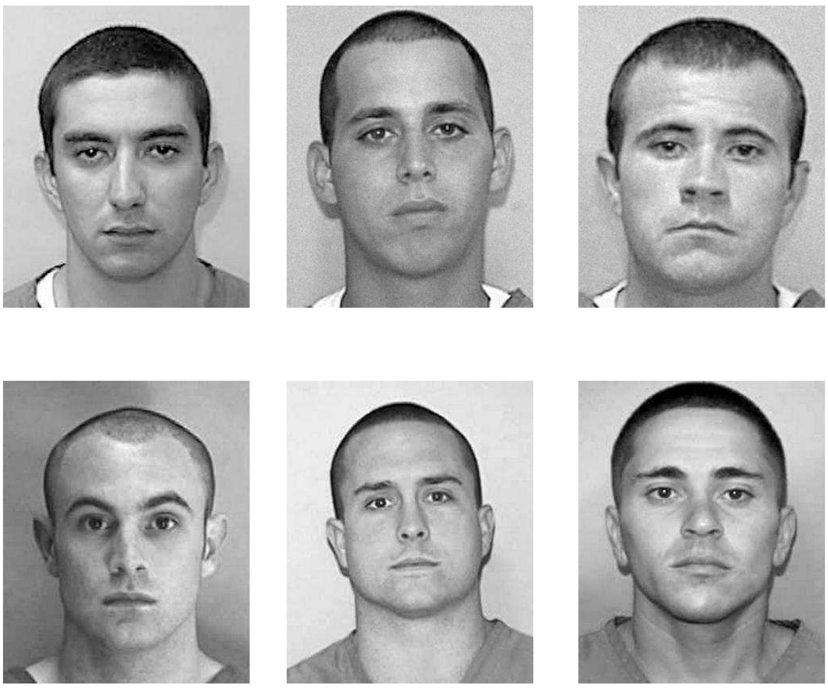
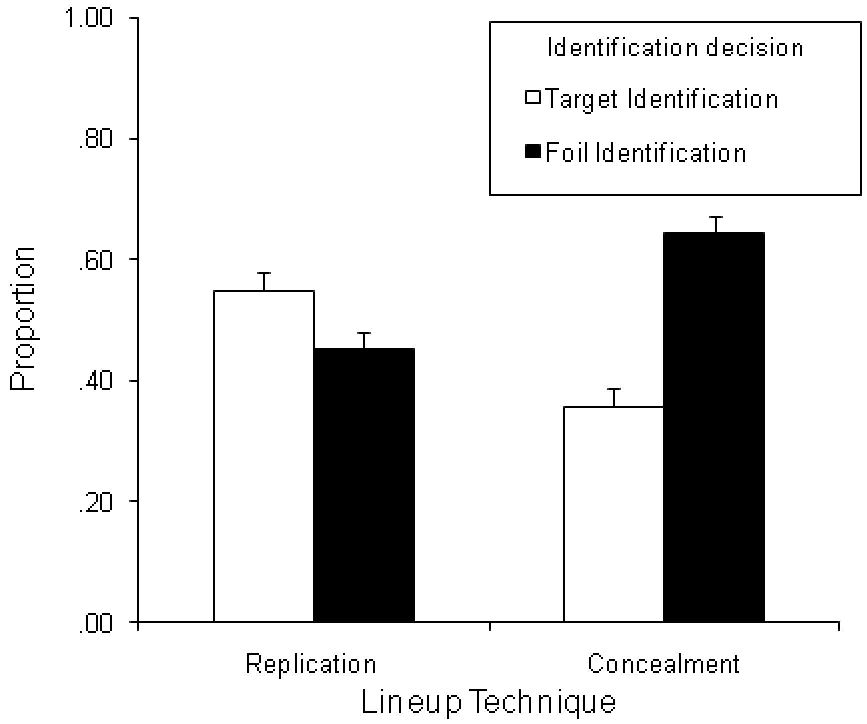


Figure 3


1.00
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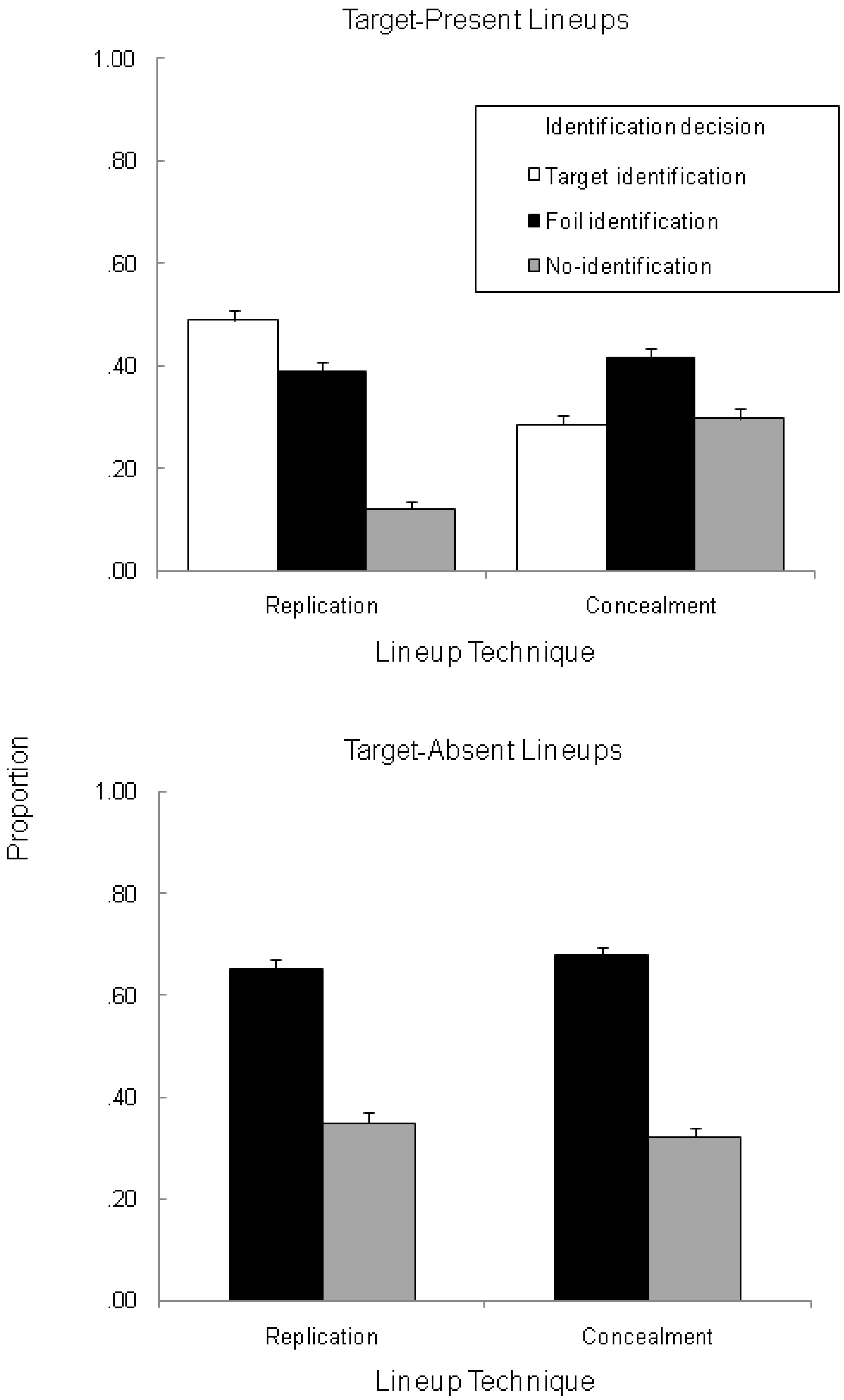
Proportion
Identification decision
Target Identification
Foil Identification
Replication
Concealment
Lineup Technique

Figure 4


Target-Present Lineups
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Identification decision
Target identification
Foil identification
No-identification
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