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Form-Specific Repetition Priming for Unfamiliar Faces

Douglas Martin[1], Susan A. Cairns[2], Elizabeth Orme[1], Lisa M. DeBruine[2],

Benedict C. Jones[2] and C. Neil Macrae[2]

University of Aberdeen

Word count: 4846

Address Correspondence To:

Douglas Martin
Division of Psychology
Northumbria University
Northumberland Building
Newcastle upon Tyne, NE1 8ST
UK

Email: doug.martin@northumbria.ac.uk

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[1] Northumbria University
[2] University of Aberdeen

Abstract

It has frequently been demonstrated that repeated presentation of a stimulus can result in facilitated processing of the item, an effect termed repetition priming. Questions remain, however, regarding the boundary conditions of this effect, particularly for faces. For example, is repetition priming for unfamiliar faces dependent on the presentation of identical stimuli at study and test? This question was explored in three experiments in which the pose (i.e., frontal vs. ¾) and perceptual distance from the original facial identity (i.e., 100%, 75%, 50% or 25% of original person) were manipulated between the testing phases of a standard repetition-priming paradigm. The results revealed that priming did not persist following any change to a face between study and test, thereby suggesting that repetition priming for unfamiliar faces is form-specific. The theoretical implications of this finding are considered.

Form-Specific Repetition Priming for Unfamiliar Faces

Repetition priming (RP) is the term commonly used to describe facilitated processing of a stimulus as a consequence of prior exposure to the item (A. W. Ellis, Flude, Young, & Burton, 1996). RP has been demonstrated using a wide range of stimulus materials and is a highly replicable phenomenon (see Schacter, 1994, for a review). While the general processing advantage associated with RP — speeded reaction time or increased response accuracy to primed stimuli — is consistent across a variety of task conditions, there is evidence to suggest that not all forms of RP are functionally equivalent (Schacter, 1994). In particular, differences have been noted between RP effects that have a specific perceptual basis (i.e., form-specific priming; Marsolek, Kosslyn, & Squire, 1992) and those that are more abstract in character (i.e., abstract-form priming; Marsolek, 1995). Given recent demonstrations of RP for unfamiliar faces (Goshen-Gottstein & Ganel, 2000; Henson et al., 2003; Martin, Nind, & Macrae, in press; Quinn & Macrae, 2005), the current investigation explored whether RP for novel faces is form-specific — that is, is dependent on viewing identical stimuli at both study and test.

Until relatively recently, unfamiliar faces were considered to be unsuitable for the generation of RP effects. Unlike familiar faces, novel faces do not have associated semantic knowledge in memory, the activation of which has been taken to underpin the emergence of person-based RP (Burton, Bruce, & Johnson, 1990). The compatibility of familiar faces for RP, and the lack of a comparable effect for unfamiliar faces, is encapsulated in the influential Interactivity Activation and Competition (IAC) model of person recognition (Burton et al., 1990). According to this model, based on the perceptual information available the cognitive system stores structural representations of faces (based on pictorial codes) within Face Recognition Units (FRUs). When a face is encountered and matches an item in this store, it is recognized as being familiar. Any positive identification of a face by a FRU leads to subsequent activation of a related Person Identity Node (PIN), a representation that contains semantic information specific to the recognized person (e.g., occupation, nationality). It is believed that when one is exposed to a face on multiple occasions there is a strengthening of the associations between FRUs and PINs, which in turn increases the accessibility of stored knowledge and promotes response facilitation to occur. Importantly, because it is the product of a strengthened association between structural representations and semantic knowledge, the IAC model predicts that whenever a familiar face is perceived, irrespective of whether it is the same image of the person or not, RP should emerge. In other words, RP for familiar faces is independent of the perceptual inputs to the system (Burton, Kelly, & Bruce, 1998).

But what about RP for unfamiliar faces? In an important article, Goshen-Gottstein and Ganel (2000) challenged the widespread assumption that unfamiliar faces are unsuitable for the generation of RP effects. Their reasoning was quite straightforward. If faces are processed as perceptual wholes during initial encoding, structural representations will be created, the reactivation of which should support RP. Goshen-Gottstein and Ganel (2000) suggested that repeated failure to demonstrate RP with unfamiliar faces may have arisen because one of the commonly used experimental tasks (i.e., sex categorization) does not require participants to process faces in a holistic manner. Specifically, by focusing on the dominant categorical cue of hairstyle (Brebner, Martin, & Macrae, in press; Brown & Perrett, 1993; Macrae & Martin, 2007; Martin & Macrae, 2007), participants can complete sex-classification tasks without processing internal facial features, a strategy that undermines the formation of structural representations of encountered faces. To remedy this situation, Goshen-Gottstein and Ganel removed hair cues from their stimuli, a manipulation that was sufficient to prompt the emergence of RP (see also Henson et al., 2003; Martin et al., in press; Quinn & Macrae, 2005).

One of the key theoretical assertions arising from demonstrations of RP for unfamiliar faces is that stored structural representations can be formed following a single, brief perceptual encounter with a 2-D image and that these representations are reactivated when the stimulus is encountered on a subsequent occasion (Goshen-Gottstein & Ganel, 2000). As such, this interpretation firmly aligns RP with a memory-systems account of priming. According to this viewpoint, following the detection of an object, perceivers retain a pre-semantic perceptual record, or engram (Kirsner &

Dunn, 1985) of the stimulus in one of a number of domain-specific perceptual representation systems (PRS; Tulving & Schacter, 1990). Every time an object (including a person) is perceived, an engram specific to that processing encounter is created but that is functionally independent from other information that may be related to the stimulus. Thus, when the sex of an unfamiliar face is probed twice, access to an existing perceptual representation facilitates processing of the stimulus on the second occasion (Kirsner & Dunn, 1985). Importantly, it is believed that the structural representations that support such priming are hyper-specific in visual form and as a result require an identical image be encountered before reactivation occurs (Schacter, 1994).

The apparent perceptual specificity of some modes of priming is supported by research examining the processes that support multiple forms of implicit recognition and memory (e.g., Marsolek, 1999; Marsolek et al., 1992). For example, using word-stem completion tasks, Marsolek and colleagues (1992) have demonstrated that when the letter case of primed words changes between study and test, significantly less priming is observed than when the case remains constant during both phases of the experiment. Indeed, such is the dependence of priming on the basic visual properties of encountered stimuli, it has been suggested that there are multiple subsystems that support form-specific (i.e., view dependent) and abstract-form (i.e., view invariant) visual recognition. It is proposed that a form-specific subsystem supports recognition of individual exemplars, such that the holistic structural representations that are created during encoding are reactivated when the identical stimulus is encountered again (Marsolek et al., 1992). In addition, it is believed that an abstract-form subsystem allows categorical recognition of a stimulus to occur following the identification of isolated features that are diagnostic of specific category membership (Marsolek, 1995).

So is RP for unfamiliar faces form specific (Schacter, 1994)? Elsewhere there is evidence to suggest that exemplars from non-facial categories are processed in a whole-based manner in a form-specific processing subsystem (Burgrund & Marsolek, 2000; Marsolek, Schacter, & Nicholas, 1996). But is the same true of novel faces? By manipulating the visual form of unfamiliar faces between study and test in a standard RP paradigm (i.e., alternating between frontal or ¾ views of faces), we explored this possibility in our first experiment.

Experiment 1

Method

Participants and Design

Forty undergraduates (27 female) from the University of Aberdeen completed the experiment in return for course credit. The experiment had a 2 (Face View: same or different) X 2 (Item Status: repeated or new) mixed design with repeated measures on the second factor.

Procedure and Stimulus Materials

Participants arrived at the laboratory individually, were seated at a Viglen PC and asked to place their chin on a chin rest to ensure that their eyes were a standard distance (i.e., 57 cm) from the fixation cross on the monitor during testing. Participants were then randomly assigned to either the same-view or different-view condition and informed that the current experiment explored person categorization. It was explained that a series of faces would appear in the center of the screen and the task was simply to indicate, as quickly and accurately as possible, whether each face was male or female. The stimuli were 96 greyscale digital headshots (each face subtended a visual angle of 5˚ vertically and 4.3˚ horizontally) of 48 unfamiliar people (24 men and 24 women) displaying neutral facial expressions, with each person depicted in both a frontal and a ¾-profile pose (see Figure 1, top panel). Images were digitally cropped, using a standardized oval mask in Adobe Photoshop (version 8.0), to remove all traces of hair (Goshen-Gottstein & Ganel, 2000).

Each trial entailed the appearance of a central fixation cross, which remained on screen for 500ms. This was then replaced by the presentation of a facial prime, which appeared on screen for a further 1000ms. The inter-trial interval was 1500ms and participants were instructed to make a response, using a key press, while the face remained on the screen. The experiment comprised two blocks (i.e., study and test), with 24 trials in the study phase and 48 trials (i.e., 24 old faces, 24 new faces) in the test phase. There was an interval of approximately 3 minutes between the study and test phases. The order of trial presentation was randomized and the computer measured the accuracy and latency of each response.

For all participants, the study phase consisted of the presentation of 24 faces (12 male and 12 female), half of which were displayed in frontal-pose and half of which were displayed in ¾-pose. For participants in the same-view condition, the test phase consisted of the presentation of 48 faces, 24 of which were identical to those shown in the study phase (i.e., same identity and same pose), while 24 were novel unfamiliar faces (12 male and 12 female, half in frontal-pose and half in ¾-pose). For participants in the different-view condition, the test phase consisted of the presentation of 48 faces, 24 of which had the same identity as the study phase but the alternate view (i.e., identities viewed in ¾-pose at study were viewed in frontal-pose at test and identities viewed in frontal-pose at study were viewed in ¾-pose at test) and 24 of which were entirely novel faces (12 male and 12 female, half in frontal-pose and half in ¾-pose). The response key mappings and the identity, pose and old/new status of facial images were all counterbalanced across conditions and participants. On completion of the task, participants were debriefed and dismissed.

Results and Discussion

The dependent measure of interest was the median time taken by participants to classify the sex of faces during the test phase. Trials on which errors were committed (3%) were excluded from the analysis (see Table 1 for error rates). A 2 (Face View: same or different) X 2 (Item Status: repeated or new) mixed design analysis of variance (ANOVA) was undertaken on the data. The only significant effect to emerge in the analysis was a Face View X Item Status interaction [$F(1,38) = 4.48$, $p < .05$, see Figure 2]. Simple main effects analyses revealed that participants responded more quickly to repeated than new faces in the same-view condition [$F(1,19) = 6.31$, $p < .05$; respective *M*s: 553ms vs. 569ms]. No such effect emerged in the different-view condition [$F(1,22) < 1$, *ns*; respective *M*s: 566ms vs. 560ms].

The results of Experiment 1 revealed that RP only emerged when the target faces were identical at study and test. What this suggests is that RP for unfamiliar targets may be supported by a form-specific processing subsystem that is sensitive to perceptual transformations in a face (Marsolek, 1999; Marsolek et al., 1992). It is worth noting, however, that an alternative explanation can be offered for the observed pattern of effects. Recent research suggests that rapid stimulus-response learning can occur when a target is paired with an identical response at both study and test (Dobbins, Schnyer, Verfaellie, & Schacter, 2004; Schnyer, Dobbins, Nicholls, Schacter, & Verfaillie, 2006; Schnyer et al., 2007). Thus, if participants learn a particular response to a target face (e.g., female) during the study phase of a task, then this association can be used guide behavior in the subsequent test phase if participants are once again required to report the sex of the target. In other words, stimulus-response learning can give rise to putative RP effects of the sort reported in Experiment 1. Importantly, however, there is also evidence to suggest that rapid stimulus-response learning is exemplar specific, such that even when targets are very similar to the original to-be-judged stimuli they do not elicit response facilitation (Schnyer et al., 2007).

To examine if the results reported in Experiment 1 were indicative of form-specific RP or hyper-specific stimulus-response learning (Schnyer et al., 2007), in our second experiment we required participants to make different judgments to the faces during the study and test phases of the task. Specifically, participants were required to make intelligence judgments at study and sex judgments at test (see also Goshen-Gottstein & Ganel, 2000). If RP for unfamiliar faces is form-specific, then one would expect the results to replicate those observed in Experiment 1. If, however, the effects reported in Experiment 1 are indicative of rapid stimulus-response learning, response facilitation to repeated rather than novel faces should be eliminated following a change in the judgment task between study and test (Schnyer et al., 2007).

Experiment 2

Method

Participants and Design

Twenty-eight undergraduates (18 female) from Northumbria University completed the experiment. The experiment had a single factor (Target: same-view or different-view or new-face) repeated-measures design.

Procedure and Stimulus Materials

The stimuli were identical to Experiment 1, but there were two important modifications to the experimental procedure. First, participants were required to make an intelligence judgment at study and a sex judgment at test (Goshen-Gottstein & Ganel, 2000). Second, a repeated measures design was employed. The experiment comprised two blocks (i.e., study and test), with 32 trials in the study phase and 48 trials (i.e., 16 same-view old faces, 16 different-view old faces and 16 new faces) in the test phase. The study phase consisted of the presentation of 32 faces (16 male and 16 female), half of which were displayed in frontal-pose and half of which were displayed in ¾-pose. Each trial entailed the presentation of a face for 5000ms. Participants were required to rate the apparent intelligence of the depicted individual (i.e., “high intelligence” or “low intelligence”) and indicate their response via a key press. As in Experiment 1, the test phase required participants to make sex classifications and comprised the presentation of 48 faces, 16 of which were identical to those shown in the encoding phase (i.e., same identity and same pose), 16 of which were of the same identity but viewed from a different angle than as seen in the study phase (i.e., same identity and different pose), and 16 of which were novel unfamiliar faces (8 male and 8 female, half in frontal-pose and half in ¾-pose). The response key mappings and the identity, pose and old/new status of facial images were all counterbalanced across conditions and participants.

Results and Discussion

The dependent measure of interest was the median time taken by participants to classify the sex of faces during the test phase. Trials on which errors were committed (6%) were excluded from the analysis (see Table 1 for error rates). Four participants were excluded from the analysis because of excessive error rates on the task (> 10% error rate). A single factor (Target: same-view or different-view or new-face) repeated measures ANOVA was undertaken on the data. This yielded an effect of Target on participants' responses [$F(2, 46) = 5.51$, $p < .01$, see Figure 3]. Post-hoc analyses revealed that participants responded more quickly to targets in the same-view condition than in the different-view [$F(1, 23) = 8.08$, $p < .01$; respective *M*s: 625ms vs. 670ms] and new-face conditions [$F(1, 23) = 11.85$, $p < .01$; respective *M*s: 625ms vs. 675ms]. There was no difference in response latency between the different-view and new-face conditions [$F(1,22) < 1$, *ns*; respective *M*s: 670ms vs. 675ms].

The results of Experiment 2 are not compatible with a rapid stimulus-response learning account of response facilitation (Schnyer et al., 2007). Despite making different judgments on faces at study and test, RP emerged when the faces were identical across the two phases of the task (see also Goshen-Gottstein & Ganel, 2000). When, however, the viewpoint of the faces differed between study and test, RP was not observed. Taken together, the results of Experiments 1 and 2 suggest that RP for unfamiliar faces is supported by a form-specific processing subsystem (Marsolek, 1999; Marsolek et al., 1992). Changing the orientation of an unfamiliar face between study and test is sufficient to eliminate RP. But just how pervasive is this effect? Would other changes to a face similarly eliminate the emergence of RP? Recent evidence suggests even very subtle physical changes to a face are sufficient to affect activation of brain areas associated with the structural encoding of faces (e.g., inferior occipital gyrus, fusiform area; see Rotshtein, Henson, Treves, Driver, & Dolan, 2005). It appears that whether faces, and particularly unfamiliar faces, are judged to have the same or different identity is subject to an abrupt categorical transition as a consequence of relatively minor structural changes (Beale & Keil, 1995). Using morphed stimuli (i.e., 100% original, 75% original, 50% original, and 25% original), our third experiment therefore explored whether RP can survive quite subtle perceptual alterations to a face.

Experiment 3

Method

Participants and Design

Twenty-four undergraduates (14 female) from the University of Aberdeen completed the experiment in return for course credit. The experiment had a single factor (Face Morph: 100% - original, 75% - original, 50% - original, 25% - original) repeated measures design.

Procedure and Stimulus Materials

The general procedure for Experiment 3 was identical to Experiment 1, however the materials (i.e., facial images) differed in a number of important ways. The stimuli for Experiment 3 were created using 320 greyscale digital headshots (256 X 256 pixels) of unfamiliar people (160 men and 160 women) displaying neutral pose and depicted in a frontal view (see Figure 1, bottom panel). Of these 320 images, 160 were used as either targets or distracters during the experiment and 160 were used as ‘base’ faces for creating digitally altered versions of the target and distracter stimuli. Using digital morphing software (Psychomorph; see Krupp, De Bruine & Barclay, 2008) each target and distracter face was combined with base faces to create three additional morphed versions of each facial image (i.e., version 1 = 75% original face & 25% base face; version 2 = 50% original face & 50 % base face; version 3 = 25% original face & 75% base face). Therefore, including the original unaltered facial images, there were four possible versions of each target and distracter face. As in Experiment 1, images were digitally cropped to remove the hair.

The stimuli at study comprised 80 unfamiliar faces (40 male and 40 female). The stimuli at test comprised 160 facial images, 80 of which were repeated versions of identities presented during the study phase and 80 of which were entirely new (previously unseen identities) faces. Of the 160 facial images shown at test, 40 images (20 repeated and 20 new) were unaltered face images and 120 images (60 repeated and 60 new) were morphed versions, with equal numbers from the 75%, 50%, and 25% morph categories (i.e., 40 faces per condition).

To delineate the boundary of identity-based processing with the current stimuli, pre-testing was conducted to examine whether the morphed stimuli could be recognized as having the same identity as the original facial images. Participants (*N* = 20, 12 female) reported if two sequentially presented faces were of the same person or were of different people. Participants were initially presented with an original face for 200ms, followed by a stimulus from one of the morphed categories or a new item (i.e., 100% original, 75% original, 50% original, 25% original, or new) until a response was made. The results revealed above chance performance in three of the morph conditions (100% = .95, 75% = .91, 50% = .59, all *t*'s (19) > 2.6, *p* < .05). When less than 50% of the original face was represented in the morph, identity matching was not possible (25% = .15, new = .07). Thus, explicit identity-matching was possible when greater than 50% of the original face was represented in the morph. In addition, a single factor (Morph Category: 100%, 75%, 50%, 25%, new) repeated measures ANOVA was conducted to compare matching performance across the Face Morph categories. The results revealed a main effect of Morph Category [*F*(4, 76) = 455.51, *p* < .001]. Bonferroni corrected t-tests revealed significant differences between all of the category levels [all *t*'s (19) > 5.0, *p* < .001], except 100% and 75% [*t* (19) = 1.97, *p* = .633].

Results

The dependent measure of interest was the median time taken by participants to classify the target items by sex during the test phase. Trials on which errors were committed (5%) were excluded from the analysis (see Table 1 for error rates). In addition, two participants were excluded from the analysis because of excessive error rates on the task (> 10% error rate). A 4 (Face Morph: 100% - original, 75% - original, 50% - original, 25% - original) X 2 (Item Status: repeated or new) repeated measures ANOVA was undertaken on the data. The only significant effect to emerge in the analysis was a Face Morph X Item Status interaction [*F*(1, 63) = 2.93, *p* < .05, see Figure 4]. Simple main effects analyses revealed that participants responded more quickly to repeated than new faces in the 100% - original condition [*F*(1, 21) = 9.37, *p* < .01; respective *M*s: 551ms vs. 575ms]. No such effect emerged in any of the other Face Morph conditions [all *F*s < 1, *ns*; 75% = *M*s: 561ms vs. 552ms, 50% = *M*s: 564ms vs. 556ms, 25% = *M*s: 564ms vs. 571ms; see Figure 4].

These results demonstrate that RP for unfamiliar faces does not persist following a perceptual change in facial identity, even if the alteration is so modest that explicit matching is not significantly decreased from that for identical images (i.e., 25% distance from original). Together with the results of Experiments 1 and 2, these findings lend support to the view that RP for unfamiliar faces is form specific (Marsolek, 1999; Marsolek, et al., 1992).

General Discussion

There is considerable evidence to suggest that the brain is sensitive to the repetition of a stimulus, even though one may be consciously unaware that the item has been encountered before (e.g., A.W. Ellis et al., 1996). Research examining the underlying bases of such RP effects has identified two processing systems that support distinct forms of implicit memory, an abstract-form subsystem that is viewpoint invariant with respect to stimulus inputs and a form-specific subsystem that is highly sensitive to structural visual form (Marsolek, 1999; Marsolek et al., 1992). Using unfamiliar faces as the stimuli of interest, the current findings provide further evidence for the operation of a form-specific processing subsystem during priming. First, unfamiliar face RP effects were eliminated when the orientation of target faces was changed between study and test (i.e., from frontal to ¾ pose or vice-versa). Second, a subtle perceptual alteration to an unfamiliar face (i.e., 25% reduction in identity-specific information producing only a 4% decrease in explicit matching) was also sufficient to abolish RP, even though pre-testing revealed that identity matching was possible for faces containing as little as 50% of the original perceptual information. This suggests that different mechanisms support RP and identity discrimination.

The current findings provide additional support for the assertion that a single, brief exposure to an unfamiliar face is sufficient to create an abstract structural record, a prerequisite for RP to occur within the PRS account of priming (Goshen-Gottstein & Ganel, 2000; Martin et al., in press; Tulving & Schacter, 1990). Importantly, the results also provide the first direct evidence of the hyper-specific nature of the structural representations that are formed for unfamiliar faces. It seems that unlike previous demonstrations of viewpoint-invariant and even cross-domain RP using familiar faces (Burton et al., 1998), unfamiliar face RP requires an identical stimulus to be presented at study and test. One possible explanation for this disparity in view dependence between unfamiliar and familiar faces is simply that because they are formed following a single processing encounter, abstract records associated with unfamiliar faces are weaker than those for familiar faces as these are formed following multiple exposures from a variety of viewpoints (Goshen-Gottstein & Ganel, 2000). Thus, at a basic perceptual level, relative experience of a face may determine whether it is perceived as representing the same individual following a relatively minor structural transformation. As previous research has shown variability in the magnitude of face RP effects as a function of task context and presentation duration at study (Goshen-Gottstein & Ganel, 2000; Henson et al., 2003; Quinn & Macrae, 2005), one useful task for future research will be to establish if repeated experience with unfamiliar faces is sufficient to trigger view-invariant RP, as this may elucidate the possibility of perceptually driven but not form-specific response facilitation.

Is it possible that the current findings may be amenable to an interpretation based on the operation of rapid stimulus-response learning (Dobbins et al., 2004; Schnyer et al., 2006; 2007)? According to this viewpoint, a direct association can be formed between a stimulus and a particular response, such that when the object is encountered on a subsequent occasion the response is automatically triggered (i.e., the original processing operations need not be implemented). While rapid stimulus-response learning could potentially account for the facilitation effects observed in Experiments 1 and 3, it is less able to accommodate the results of Experiment 2. Priming attributed to rapid stimulus-response learning is not only reliant on identical perceptual inputs at study and test, but also the judgment that is undertaken on the stimuli (Dobbins et al., 2004; Schnyer et al., 2007; but see Horner & Henson, 2008). Thus, in Experiment 2, one would have expected RP to be eliminated (or at the very least dramatically attenuated) as a consequence of changing the judgment task between study and test. Instead, as has been demonstrated elsewhere (Goshen-Gottstein & Ganel, 2000), response facilitation persisted.

These apparent discrepancies in no way detract from the emerging behavioral and neuroimaging evidence which suggests that stimulus-response learning can play a prominent role in the generation of putative RP effects (Dobbins et al., 2004; Horner & Henson, 2008; Schnyer et al., 2006, 2007). Rather, they corroborate the observation that, depending on the prevailing task requirements, there are multiple routes through which response facilitation can emerge. It would appear that the nature of any given RP effect reflects both the inherent properties of the stimuli of interest and the judgments that are undertaken on these items (Schnyer et al., 2007). Thus, under varying circumstances, RP may be driven by response learning (Dobbins et al., 2004; Schnyer et al., 2006, 2007), semantically rich abstract representations (Bowers, 2000; Marsolek 1999; Ellis et al., 1996), or, as demonstrated herein, form-specific perceptual representations (Goshen-Gottstein & Ganel, 2000; Marsolek, 1999; Martin et al., in press). In this way, tasks and classes of stimuli with differing properties may produce similar behavioral effects (i.e., response facilitation) via divergent processing routes (Schnyer et al., 2007).

The current findings further underscore the distinction between perceptual and conceptual priming within multiple memory-systems accounts of implicit cognition (Schacter, 1994; Tulving & Schacter, 1990). It has been suggested that different modes of implicit memory may be supported by functionally distinct and neuroanatomically lateralized processing subsystems, with an advantage for form-specific processing in the right hemisphere (RH) and a corresponding advantage for abstract-form recognition in the left hemisphere (LH; Marsolek, 1995, 1999; Marsolek et al., 1992). Using a divided-visual-field RP paradigm, Marsolek (1999) has demonstrated that when conceptually similar but perceptually diverse exemplars are presented to the RH between study and test (e.g., an image of an acoustic guitar is presented at study and an image of an electric guitar is presented at test), the degree of facilitation observed is considerably less than when identical items are used during both phases of the experiment (e.g., an image of an acoustic guitar is presented at both study and test). This form-specific sensitivity is not apparent when categorical exemplars presented to the LH differ between study and test. When considered in conjunction with the recent demonstration of a RH locus for RP for unfamiliar faces (Martin et al, in press), there is reason to suspect that the effects reported herein (i.e., form-specific RP) may be underpinned by a right lateralized form-specific subsystem.

Given the evidence that unfamiliar face RP is form-specific, it is important to consider the underlying neural architecture that may support such response facilitation. One possibility is that the neurons involved in making fine-grained within-group contrasts (Dubois et al., 1999; Haxby Hoffman, & Gobbini, 2000; Henson et al., 2003), such as face discrimination, are very narrowly tuned and consequently are highly sensitive to subtle changes in visual-form inputs (Gilaie-Dotan & Malach, 2007). This viewpoint is supported by recent neuroimaging research which indicates that areas of the brain commonly associated with face perception, notably the right Fusiform Face Area (FFA), are sensitive to differences between facial images which are below the threshold of exemplar-identity change (i.e., < 50 % distance from original face image; Gilaie-Dotan & Malach, 2007). A useful task for future research will be to uncover whether such neuronal sensitivity explains the hyper-specific nature of unfamiliar face RP and other examples of form-specific priming.

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Acknowledgements

The authors thank Jochen Musch and Chad Marsolek for their help and advice on this research. CNM was supported by a Royal Society-Wolfson Fellowship.

Figure 1. Examples of Frontal and ¾ Pose Face Images (top panel); Examples of Morphed Facial Stimuli (bottom panel).

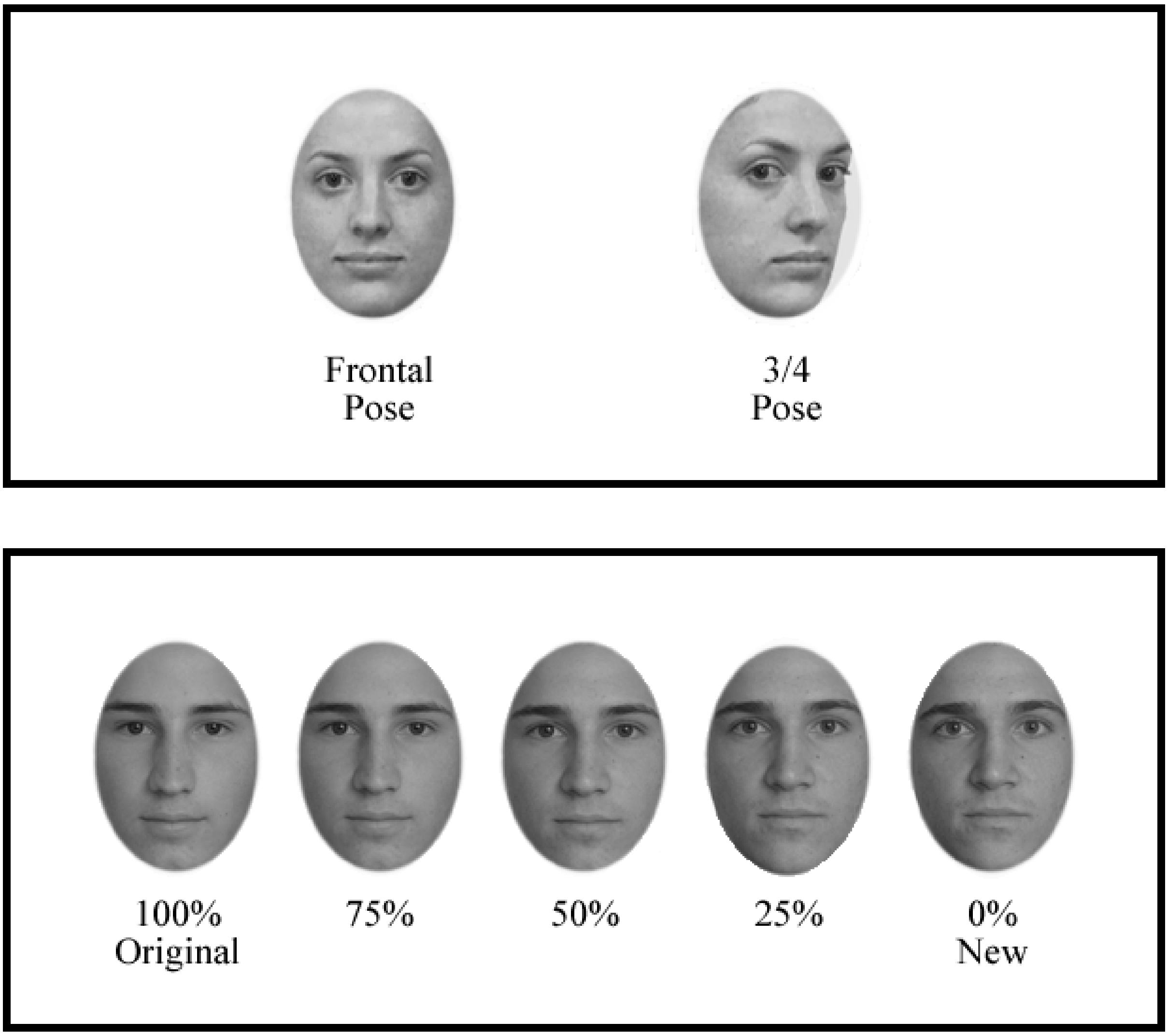


Figure 2. Task Performance as a Function of Face View and Item Status (Expt 1)

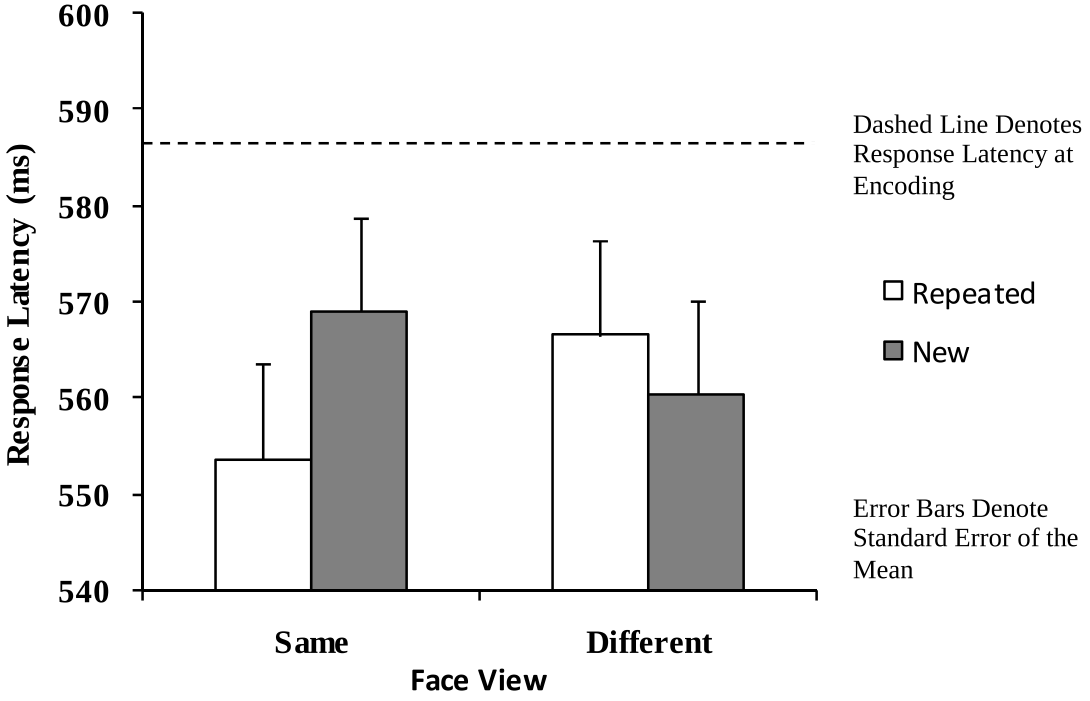
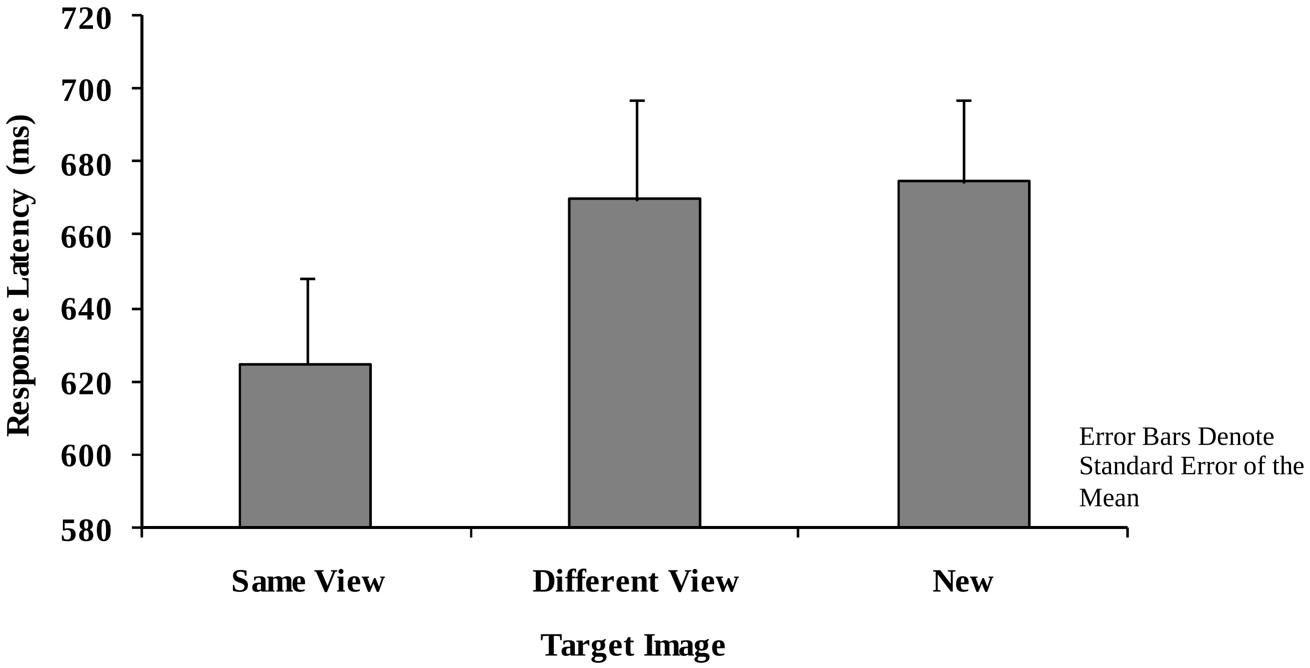


Figure 3. Task Performance as a Function of Target Image (Expt 2)



Error Bars Denote Standard Error of the Mean

Figure 4. Task Performance as a Function of Face Morph and Item Status (Expt 3)

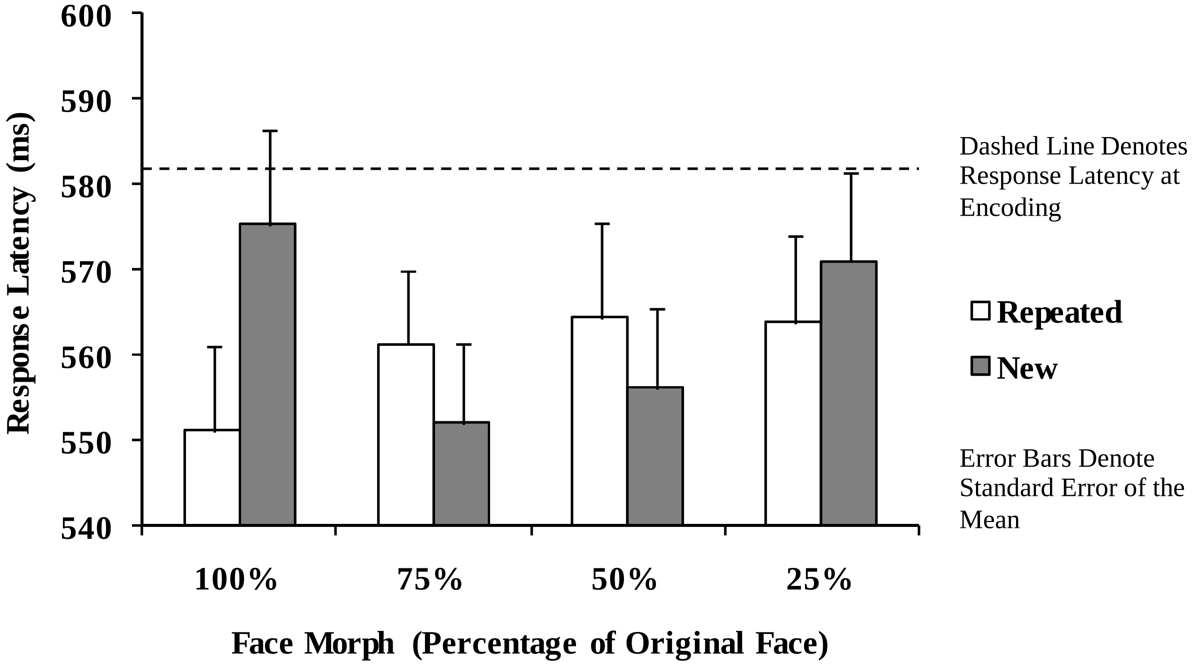


Table 1. Mean Percentage Errors (Expts 1, 2 & 3)

	Face View Condition				
	Expt 1 (Sex classification at study)				
	Baseline	**Same View**	**Different View**		
Repeated	**-**	**3.4**	**2.4**		
New	**7.4**	**2.5**	**4.3**		
	Expt 2 (Intelligence judgment at study)				
		Same View	**Different View**		
Repeated		**6.4**	**6.6**		
New		**5.9**	**5.9**		
	Expt 3 (Sex classification at study)				
	Baseline	**100%**	**75%**	**50%**	**25%**
Repeated	**-**	**4.3**	**2.5**	**4.6**	**5.5**
New	**7.6**	**4.6**	**5**	**5.2**	**4.3**