Faces are Different Than Words: Evidence from Associative Priming Studies

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Abstract

Associative memory for familiar faces was investigated in two experiments. Pairs of familiar faces were presented for deep or shallow encoding; memory for these pairs was tested by presenting old-intact pairs, old-recombined pairs, and pairs consisting of one or two new faces. In Experiment 1, pairs consisted of two different individuals whereas in Experiment 2, pairs consisted of different views of the same individual. In both experiments, explicit recognition was best for old-intact pairs under deep encoding conditions. No associative priming effects were obtained in either experiment despite using a simultaneous familiarity-judgment task, similar to one that has produced associative priming effects with words (e.g., Goshen-Gottstein & Moscovitch, 1995a). It is proposed that the different associative priming effects obtained with the two types of stimuli may arise from differences in the modular perceptual representation systems for faces and words.

Introduction

Learning someone's name, the names of objects, which groups of people belong together or the context in which they are known all require forming arbitrary associations. To date, the majority of the theories concerned with associative memory have focussed on verbal associations. It is unclear whether these same processes apply to non-verbal associations as well. The two experiments presented here, using paradigms similar to those used with words, focus on associations between pairs of faces. Results similar to those obtained with words would suggest that the same associative processes apply across different classes of stimuli. Dissimilar results, on the other hand, would imply that the type of processes needed for forming new associations may be determined by the class of stimuli.

These two experiments investigate the associative process in terms of explicit and implicit memory (Graf & Schacter, 1985). Whether implicit memories can be formed for associative material has been a question of considerable debate in the literature. Using words as stimuli, some studies claim to have found convincing evidence for associative priming (e.g., Graf & Schacter, 1985; Schacter & Graf, 1986; Moscovitch, Winocur & McLachlan, 1986; McKoon & Ratcliff, 1979; Goshen-Gottstein & Moscovitch, 1995a, 1995b, 1995c) whereas other studies claim to have found no convincing evidence for associative priming (e.g., Carroll & Kirsner, 1982; Mayes & Gooding, 1989; Smith, MacLeod, Bain & Hoppe, 1989).

In the present set of experiments, we use a procedure, a simultaneous two-item task, that has produced reliable verbal associative priming effects in both normal and amnesic subjects (Goshen-Gottstein & Moscovitch, 1995a, 1995b, 1995c) and adapt it slightly for use with faces. In the original task, participants studied unrelated pairs of words such as *pause-weird* and *slope-plate*. At test, participants saw words in intact pairings (e.g., *pause-weird*), in recombined pairings (e.g., *pause-plate*) or new pairings (e.g., *soldier-apple*) and were asked to judge the lexical status (e.g., word or non-word) of the two words presented. Accordingly, some pairs were presented which consisted of one or two non-words. In this paradigm, repetition (or item) priming effects are measured by comparing reaction times to new pairs with reaction times to old or recombined pairs. Associative priming effects are measured by comparing reaction times to the recombined pairs with reaction times to the old pairs.

Theoretically, there is good reason to suppose that faces may give very different results from words in associative priming studies. First, theories of memory such as Schacter's (1990) and Moscovitch's (1992) contend that priming is mediated through modular perceptual representation systems which represent the form and structure of stimuli. Words are often combined into different pairs and sequences, both meaningful and non-meaningful, which create strong perceptual associations. The emphasis on *perceptual* association is important because Goshen-Gottstein and Moscovitch (1995a, 1995b, see also Light, La Voie & Kennison, 1995) concluded that two items *must* be perceived as a coherent perceptual gestalt in order for associative priming to occur. Faces, on the other hand, are not often combined into different combinations. It is thus likely that the modular perceptual representation system for faces would not possess the capability for creating strong perceptual associations (or gestalts) with other faces. Second, Farah (1991) contends that complex stimuli such as faces are recognized as single units whereas words are recognized by decomposition into multiple parts. It is very possible that these fundamental differences in how the two classes of stimuli are perceived and recognized may lead to differences in their ability to support associative priming.

Experiment 1

The aims of this experiment were two-fold: First, to demonstrate that explicit associative memory effects could be demonstrated with our famous face stimuli and encoding tasks (e.g., Winograd & Rivers-Bulkeley, 1977); and second, to investigate whether implicit memory for new associations could be demonstrated using pairs comprised of different famous individuals.

Methods

Sixty-four undergraduates participated in this experiment, half in the explicit memory task and half in the implicit memory task. Of these, half were instructed were to perform a deep encoding task (e.g., how likely are they to be friends?) and half were instructed to perform a shallow encoding task (e.g., how similar are the two skin tones?). Participants performed these encoding tasks with 36 pairs of familiar faces, each pair consisting of two different individuals. In all cases, encoding was incidental as participants were not informed that they would be tested later on their memory for these pairs. Of the 36 pairs presented, thirty pairs were critical pairs which in the test phase would form the Old-Old, Old-Recombined and Old-New pairs and three pairs were presented at both the beginning and end of the list to minimize primacy and recency effects.

The test phase differed for the explicit and implicit versions of the experiment. For the explicit version, participants were presented with 40 pairs of faces pairs which were presented in four kinds of pairings: Old-Old (same pairs as at study), Old-Recombined (same faces as at study but in new pairs), Old-New (faces from study paired with new faces not seen before) and New-New (faces not seen before). Participants were instructed to respond "Old" if both members of the pair were Old (the Old-Old and Old-Recombined pairs) and "New" if at least one member of the pair was New (the Old-New and New-New pairs).

For the implicit version, participants saw the 40 pairs of faces described above as well as 40 pairs containing unfamiliar faces to permit them to perform the familiarity judgment task. These pairs consisted of unfamiliar faces paired with old familiar faces, unfamiliar faces paired with new familiar faces and unfamiliar faces paired with other unfamiliar faces. Participants were instructed to respond "Familiar" if both members of the pair were Familiar (the Old-Old, Old-Recombined, Old-New, and New-New pairs) and "Unfamiliar" if at least one member of the pair was Unfamiliar (these consisted of Unfamiliar-Old, Unfamiliar-New and Unfamiliar-Unfamiliar pairs). This task is called a simultaneous familiarity-judgment task because participants are required to make a single response to two stimuli rather than responding to each stimulus individually. For both explicit and implicit versions of the task, participants were instructed to respond as quickly and accurately as possible.

Results and Discussion

Accuracy and reaction time means are presented below in Table 1 (Explicit) and Table 2 (Implicit).

Table 1: Explicit memory: Accuracy and reaction time means to judge whether associated pairs of faces in different conditions were "Old" or "New".

	Old-Old	Old-Recomb.	Old-New	New-New
ACCURACY (H-FA)[1]				
Deep	0.75	0.70	0.67	0.83
Shallow	0.63	0.55	0.50	0.74
REACTION TIME (in ms)[2]				
Deep	1342	1379	1435	1182
Shallow	1492	1590	1796	1457

Table 2: Implicit memory: Accuracy and reaction time means to judge whether associated pairs of faces in different conditions were "Familiar" or "Unfamiliar."

	Old-Old	Old-Recomb.	Old-New	New-New	Un-familiar
ACCURACY (H-FA)					
Deep	0.83	0.80	0.70	0.68	0.71
Shallow	0.80	0.80	0.64	0.70	0.69
REACTION TIME (in ms)					
Deep	963	953	1117	1168	1130
Shallow	1108	1073	1244	1275	1283

Accuracy data for the explicit task (Table 1) were entered into a 2 (Study Condition: Deep and Shallow) x 4 (Test Condition: Old-Old, Old-Recombined, Old-New and New-New) repeated measures ANOVA with Study Condition treated as a between-subjects factor and Test Condition treated as a within-subjects factor. Study Condition was significant (F (1,30) = 6.27, MSE = 0.122, $p < 0.02$), indicating that deep encoding led to more accurate responding than did shallow encoding. Test Condition was also significant (F (4,120) = 23.70, MSE = 0.0095, $p < 0.0001$). Post-hoc pairwise contrasts between the four Test Condi-

[1] In all tables, accuracy scores are Hits – FA.

[2] In all tables, reaction time outliers were removed by calculating the means in each condition for each subject and eliminating responses that were more than 2 standard deviations from these means; new means were then calculated.

tions, using the REGW multiple range q-test, confirmed that recognition accuracy in the explicit task was better for old-old pairs than for old-recombined pairs ($p<0.05$). This indicates an associative memory effect.

Reaction time data were analyzed in the same manner. Results of the ANOVA revealed a significant effect of Study Condition ($F\ (1,30) = 6.10$, $MSE = 482076$, $p < 0.02$) indicating that reaction times for pairs encoded deeply were faster than for pairs encoded shallowly. Test Condition was also significant ($F\ (4,120) = 11.01$, $MSE = 50593$, $p < 0.0001$). Unlike the accuracy data, post-hoc testing did not reveal significant differences between the old-old and old-recombined pairs but the difference between the old-old and new-new condition was significant ($p < 0.05$). Thus although two faces are recognized more accurately when they are in the same pair as opposed to a different pair, they are not necessarily recognized more quickly.

Accuracy data for the implicit task must be interpreted with caution due to the subjective nature of the familiarity-judgment task. That is, a score of "incorrect" may have been obtained because a participant was genuinely unfamiliar with a particular face. The overall error rates were 13% for the deep condition and 15% for the shallow condition. These data were not analyzed further but a breakdown of the accuracy rates across conditions appears in Table 2.

Reaction time data for the implicit task (Table 2), were analyzed in the same way as for the explicit task. Results of the ANOVA revealed a nonsignificant effect of Study Condition ($F\ (1,30) = 2.77$, $MSE = 450019$, $p > 0.1$) but a significant effect of Test Condition ($F\ (4,120) = 12.36$, $MSE = 27929$, $p < 0.0001$). Post-hoc tests revealed a large item priming effect between the reaction times to the new-new pairs and both old-old and old-recombined pairs ($p < 0.05$). No associative priming effect was observed, however, as reaction times to the old-old and old-recombined pairs did not differ.

These results occurred despite using a simultaneous familiarity-judgment task that has produced reliable associative priming effects with words (e.g., Goshen-Gottstein & Moscovitch, 1995a). Because reaction times in the implicit task were on average about 400 ms faster for each pair condition than in the explicit task, we were confident that our task was measuring *priming* rather than some form of conscious recollective process. On the basis on these results, we concluded that faces do not lend themselves to associative priming in the same manner that words do. One question we posed, however, was whether the face-processing system was incapable only of forming new associations between two *different* people. We hypothesized that the face-processing system instead may be adapted for forming associations between different views of the same individual. It is important, after all, to be able to integrate different views of the same individual into a single perceptual representation. This is the question we attempted to answer in Experiment 2.

Experiment 2

Methods

Sixty-four undergraduates participated in this experiment, half in the explicit condition and half in the implicit condition. The pairs of faces in this experiment all consisted of two different views of the same individual. For this reason, the encoding tasks had to be varied as the friendship-judgment task would not make sense with two different pictures of the same person. Thus, the deep encoding task became an honesty-judgment task (e.g., which picture looks the most honest?) and the shallow encoding task became a picture-shading task (e.g., which picture is the darkest in shading?).

The pairing conditions for the explicit task remained the same. Participants viewed 10 pairs in each condition (Old-Old, Old-Recombined, Old-New, and New-New) for a total of 40 pairs. As in Experiment 1, participants were instructed to respond "Old " if both member of the pair were old and "New" if at least one member of the pair was new. The Old-New condition became slightly more difficult, however, as participants were required to recognize which particular *picture* of an individual had been presented previously, rather than recognizing which individual had been presented previously.

For the implicit task, we changed the familiarity-judgment task to a person-identity task in which participants were required to judge whether the pair consisted of two pictures of the same person or of two different people. Participants viewed 10 pairs in each of the Old-Old, Old-Recombined and New-New conditions and 30 pairs in the Different condition (pairs consisting of two different individuals) for a total of 60 pairs. The faces making up the Different pairs were taken from 10 of the study pairs (the faces which made up the Old-New pairs in Experiment 1). These 20 faces were combined into 30 pairs. Participants were instructed to respond "Same" if both the pictures were of the same person and "Different" if the two pictures were of different people. As in Experiment 1, participants were asked to respond as quickly and as accurately as possible.

Results and Discussion

Accuracy and reaction time means are presented below in Table 3 (Explicit) and Table 4 (Implicit).

Data were analyzed in the same manner as Experiment 1. Data were entered into a 2 (Study Condition: Deep and Shallow) x 4 (Test Condition: Old-Old, Old-Recombined, Old-New and New-New) repeated measures ANOVA with Study Condition treated as a between-subjects factor and Test condition treated as a within-subjects factor. For the accuracy data in the explicit task (Table 3), significant effects were found for both Study Condition ($F\ (1,30) =$

14.17, MSE = 0.7813, $p < 0.001$) and Test Condition ($F_{(3,90)} = 49.89$, MSE = 0.5484, $p < 0.0001$). Thus, deep encoding led to more accurate responding than did shallow encoding. Post-hoc pairwise contrasts between the four Test Conditions, using the REGW multiple range q-test, confirmed that recognition accuracy was better for old-old pairs than for old-recombined pairs ($p < 0.05$), indicating an associative memory effect.

Table 3: Explicit memory: Accuracy and reaction time means to judge whether associated pairs of faces in different conditions were "Old" or "New".

	Old-Old	Old-Recomb	Old-New	New-New
ACCURACY (H-FA)				
Deep	0.75	0.67	0.58	0.84
Shallow	0.59	0.51	0.37	0.73
REACTION TIME (in ms)				
Deep	1360	1406	1785	1114
Shallow	1329	1394	1613	1028

Table 4: Implicit memory: Accuracy and reaction time means to judge whether associated pairs of faces in different conditions consisted of views of the "Same" or of "Different" individuals.

	Old-Old	Old-Recomb.	New-New	Different
ACCURACY (H-FA)				
Deep	0.98	0.94	0.96	0.96
Shallow	0.96	0.95	0.92	0.94
REACTION TIME (in ms)				
Deep	751	741	889	707
Shallow	749	751	904	667

For the reaction time data (Table 3), results of the ANOVA revealed a nonsignificant effect of Study Condition ($F_{(1,30)} = 0.61$, MSE = 179957, $p > 0.4$) but a significant effect of Test Condition ($F_{(1,30)} = 29.65$, MSE = 2118586, $p < 0.0001$). Thus, unlike Experiment 1, deep encoding did not lead to faster performance than shallow encoding. Post-hoc testing on Test Condition revealed that, similar to Experiment 1, reaction times to old-old pairs were not faster than reaction times to old-recombined pairs but were faster than reaction times to old-new pairs. Thus, like Experiment 1, the pairs of faces are recognized more accurately when in the same pair as opposed to a recombined pair, but not necessarily more quickly. It is not clear why deep encoding did not lead to faster reaction times than shallow encoding, as in Experiment 1, but differences in the encoding tasks may have been a factor. Judging which view of an individual is more honest may not elaborate the association as much as judging how likely two different people would be to be friends.

For the implicit task, a full analysis of the accuracy data could be performed due to the change in the task requirements. Judging "Same" versus "Different" is much more objective than judging "Familiar" versus "Unfamiliar" and has definite correct and incorrect responses. It also appears to be an easier task as overall accuracy rates were much higher for the implicit task in Experiment 2 compared with Experiment 1 (see Tables 2 and 4, respectively). Results of the ANOVA revealed no significant differences for either Study or Test Condition. This is desirable as any differences in reaction time cannot then be attributed to variations in task difficulty.

The reaction time data (Table 4) were analyzed in the same manner as in Experiment 1. Results of the ANOVA revealed a nonsignificant effect of Study Condition ($F_{(1,30)} = 0.01$, MSE = 545.6, $p > 0.9$) but a significant effect of Test Condition ($F_{(1,30)} = 71.21$, MSE = 255565, $p < 0.0001$). Similar to Experiment 1, post-hoc testing on Test Condition revealed a large item priming effect between the reaction times to the new-new pairs and both old-old and old-recombined pairs ($p < 0.05$) but no associative priming effect, as reaction times to the old-old pairs and old-recombined pairs did not differ significantly. Once again, reaction times in the implicit task were much faster than reaction times in the explicit task, suggesting that the person-identity task is measuring priming rather than some conscious recollective process.

Contrary to our hypothesis, it does not appear that pairs consisting of two views of the same individual support associative priming any more than pairs consisting of two pictures of different individuals. Thus, the inability to form perceptual associations is not restricted to new associations between faces which share no relation (e.g., Boris Yeltsin and Suzanne Sommers) but also applies to faces which share a direct relation (e.g., two different views of Harrison Ford).

Discussion

The results of these two experiments led us to conclude that the face-processing system does not lend itself to form perceptual associations in the same manner that the word-processing system does. This provides partial support for Farah's (1991) theory that faces and words are perceived and recognized in fundamentally different ways. Because words are recognized by decomposition into multiple parts, meaningless words like "housefrog" form a perceptual gestalt just as coherent as meaningful words like "houseboat." The individual letters that make up a word can be mixed and matched and no detriment is observed on recognition performance for the individual letters. Faces, on the other hand, do not share this property. As Tanaka and Farah (1993) have shown, recognition of the individual elements that make up a face (e.g., the nose, the eyes) is drastically reduced when these elements are taken out of the context of the whole face. Because faces do not share the "mix-and-match" property that words have, it is likely that two individual faces, side by side, would not form a coherent perceptual gestalt in the same way that "housefrog" does. For this reason, it is not likely that pairs of faces would support associative priming as Goshen-Gottstein and Moscovitch (1995a, 1995b) concluded that perceptual associations are a necessary condition in order to demonstrate associative priming.

It is possible, however, that these results apply only to familiar faces. With a familiar face, the different viewpoints are already represented and thus forming associations between them may be unnecessary. With unfamiliar faces, however, each new view is unique and it is important to be able to associate these various views into a single perceptual representation. We have been investigating this possibility in the lab and preliminary data seem to suggest that this is indeed the case.

It is important to note that our conclusions apply only to implicit memory for associations between faces and not to explicit memory. As our results showed, it is possible to form associations between unrelated or related faces and to recollect them as long as they are recollected with an explicit test of memory. Explicit memory is not restricted to modular perceptual representation systems but has access to higher-level central systems (see Moscovitch, 1992). Therefore, for explicit recollection, it does not matter that pairs of faces do not form a coherent perceptual gestalt; this only becomes important when one wishes to demonstrate implicit recollection. Further, the disparity between implicit and explicit recollection reveals that the inability to form associations is not an inherent property of face stimuli themselves, but rather a property of the way faces are represented in their perceptual representation system (e.g. Farah, 1991). Future research in this area could use stimuli that vary in the extent to which they are processed holistically or by parts to determine precisely what are the necessary and sufficient conditions to demonstrate associative priming.

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