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Local and global processing biases fail to influence face, object, and word recognition

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Three studies investigated whether encouraging people to use either global or local processing using the Navon task (Navon, 1977) influenced recognition memory for upright and inverted pictures of faces, objects, and words. Contrary to the striking results of Macrae and Lewis (2002), no effect of such cross-task processing biases were found. In particular, encouraging global processing did not improve the recognition of upright faces, whilst encouraging local processing failed to improve the recognition of words. These results suggest that using the Navon task to manipulate people's processing strategy typically does not have a large, consistent effect on recognition memory. Instead, prior performance of an unrelated task may only influence subsequent recognition memory under restricted circumstances. Therefore, the cross-task processing bias effect does not provide researchers with a powerful, reliable tool with which to investigate the relative importance of local versus global, configural processing of visual stimuli.

There is an extensive literature on the use of compound, Navon stimuli to study global and local processing (Navon, 1977; Figure 1 shows typical stimuli). Much of this research has investigated whether there is global precedence such that processing starts first at a higher, more global level of organization and only later at lower, more local levels of the hierarchy[1] (Kimchi, 1992; Navon, 2003). This issue of global precedence was not,

[1] In this paper, the terms global, configural, and holistic are used interchangeably, as are the terms local, featural, and parts based. These terms can be given distinct definitions (e.g., Maurer, le Grand, & Mondloch, 2002), but this precision was not necessary here. It was assumed that the global Navon task encouraged global, configural, holistic processing, which would most benefit face recognition, whereas the local Navon task encouraged local, featural, parts-based processing, which would most benefit word recognition.

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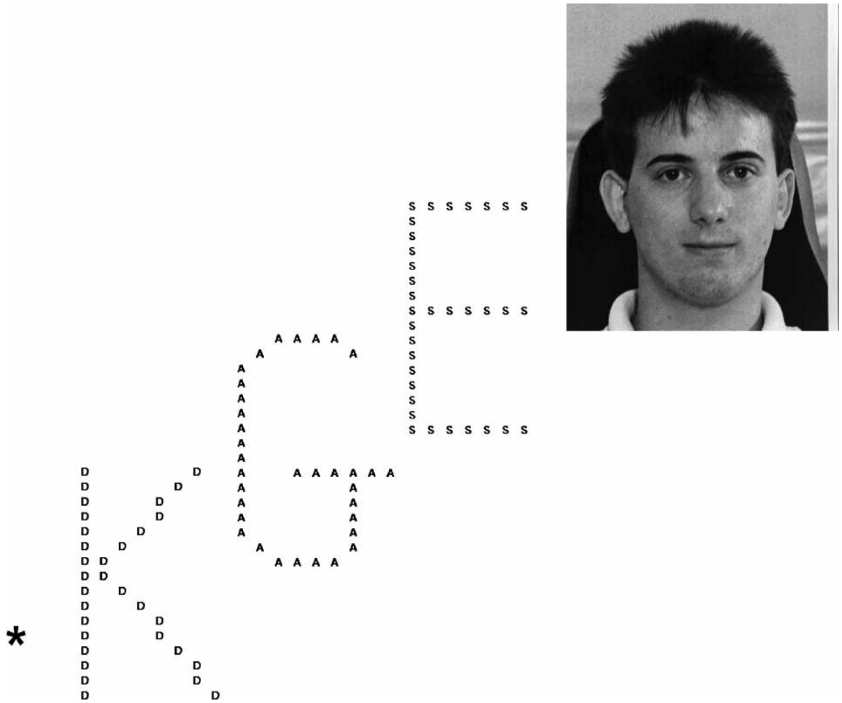

Figure 1. Examples of the stimuli presented in Experiments 1, 2, and 3. All test trials began with the presentation of a fixation cross. The local and global groups then saw three successive Navon stimuli comprising large letters made up of small letters. Here, the correct response was D, A, S for the local group and K, G, E for the global group. Finally, a picture of a face or a word or an object was presented for the old/new recognition decision. For the control groups, a blank screen was shown instead of the Navon stimuli whilst the participant performed mental arithmetic. In Experiment 3, two stimuli (faces, words, or objects) were presented side by side for the old/new recognition decision.

though, investigated in the present research. Instead, the present studies probed whether people can be induced to adopt a generalized global or local processing strategy such that performing one task (e.g., reporting the global level of a Navon letter) influences the preferred level of processing on a subsequent, unrelated task (e.g., deciding if a face had been seen earlier in the study).

Research requiring only Navon stimuli to be identified has found that processing can be biased towards a given (global or local) level in various ways, for instance by using explicit cueing and by varying the ratio of global:local targets within a block (e.g., Hübner, 2000). The bias manipulation most relevant to the present studies is that of varying the level of processing required for the trials immediately preceding a critical test trial. This produces the level-specific priming effect: Detection of a target at the global level of a Navon stimulus is improved if the preceding trial also presented a target at the global level of a Navon stimulus, and vice versa for the detection of local targets (Filoteo, Friedrich, & Stricker, 2001; Lamb & Yund, 1996; Shedden, Marsman, Paul, & Nelson, 2003). Robertson (1996) reported that these level-specific priming effects were relatively abstract: They occurred whether or not there were changes to the identity or shape or contrast or location of the target from the first to the second trial, and whether there was an overall global or local advantage for target detection (i.e., irrespective of whether there was a global precedence effect; see also Hübner, 2000; Lamb & Yund, 1996; Robertson, Egly, Lamb & Kerth, 1993; Ward, 1982).

Level-specific priming effects can extend beyond one trial. Robertson (1996) found that the level of the two preceding trials influenced performance, so, local-local-local targets, for example, were detected faster than global-local-local targets, whilst Lamb, London, Pond, and Whitt (1998) and Hübner (2000) found greatest level-repetition priming when target level (global or local) was constant across a whole block of trials. However, these studies did not test whether level-specific priming effects on the Navon task could influence a subsequent, very different task (such as old/new face recognition). Such cross-task processing biases were investigated by Macrae and Lewis (2002) and in the present experiments. In order to introduce the theoretical background to Macrae and Lewis's study, I will first review the verbal overshadowing effect that motivated their research.

Many studies have reported a verbal overshadowing effect such that asking people to describe a face impairs their subsequent recognition memory for that face (Schooler & Engstler-Schooler, 1990; for a review, see Meissner & Brigham, 2001). A plausible explanation of the verbal overshadowing effect is that it results from a generalized shift towards using a local processing strategy. Any such bias to local processing would impair face recognition because accurate face recognition requires global or configural processing (Bartlett & Searcy, 1993; Diamond & Carey, 1986; Kimchi, 1992; Leder & Bruce, 1998, 2000; Maurer et al., 2002; McKone, 2004; Tanaka & Farah, 1993; Tanaka, Kiefer, & Bukach, 2004; Tanaka & Sengco, 1997; Young, Hellawell, & Hay, 1987). When people verbally describe a face, they may be encouraged to use a local processing strategy because many local facial features (e.g., eye colour, or the presence of a beard or a dimple) are simple to list verbally, whereas global, configural information cannot easily be described.

The local processing bias account of the verbal overshadowing effect is consistent with a variety of findings that have been reported in the literature. For example, it predicts that verbal overshadowing should still occur if the face that is described is different from the to-be-recognized face. This prediction has been confirmed (Brown & Lloyd-Jones, 2003; Dodson, Johnson, & Schooler, 1997; but see Lyle & Johnson, 2004); indeed verbal overshadowing can occur even if a nonface stimulus is described (Westerman & Larsen, 1997; but see Brown & Lloyd-Jones, 2003). Numerous studies have found that global, configural processing of inverted faces is ineffective and that, instead, people largely rely on a less effective local processing strategy for such stimuli (e.g., Farah, Tanaka, & Drain, 1995; McKone, 2004; Tanaka & Farah, 1991). Hence, for inverted faces, no disadvantage would be expected for a local processing bias. Confirming this prediction, verbal overshadowing was not observed when people had to recognize inverted faces (Fallshore & Schooler, 1995). Fallshore and Schooler (1995) also found an effect of verbalization only for own-race faces, not for other-race faces. This may be due to a greater reliance on global, configural processing when people are shown stimuli that they are perceptually expert at recognizing, such as faces from their own race (Diamond & Carey, 1986; Rhodes, Brake, Taylor, & Tan, 1989; Tanaka et al., 2004). By this account, own race faces should be most vulnerable to the disruptive effect of verbalization. A further result that is consistent with the processing bias account was reported by Halberstadt (2005). He replicated the verbal overshadowing effect for whole face recognition but found that verbalization improved the recognition of individual face features, whether presented in isolation or within a face. The recognition of individual features would be expected to benefit from increased local compared to global, configural processing, and the processing bias account proposes that more local processing occurs following verbalization. Finally, Finger (2002) found that doing mazes or listening to music after verbalization eliminated verbal overshadowing because, she argued, these tasks encouraged a shift from verbal to perceptual processing that benefited subsequent face recognition.

Macrae and Lewis (2002) provided further support for this local processing bias account of the verbal overshadowing effect. They used the Navon task (Navon, 1977; see Figure 1) rather than verbalization to manipulate preferred level of processing. In their study, all participants were first shown a 30 s video of a simulated robbery. They then spent 10 min reporting either the global letter or the local letter in the Navon task for the global and local groups respectively, or they read aloud from a novel in the control group. Finally, people were asked to select the face of the male robber that they had seen in the video from seven similar, unfamiliar faces. Accuracy was 83% for the global processing group, 60% for the control group, and 30% for the local processing group. Thus, encouraging the adoption of either a global or a local processing strategy in an unrelated Navon task had a large impact on people's subsequent face recognition.

Perfect (2003) replicated Macrae and Lewis's (2002) study but had participants do first the global and then the local version of the Navon task (each for 5 min) or vice versa. This equated the overall difficulty of the filler Navon task across the global and local groups. The control group read a magazine for 10 min. Perfect reported that the processing bias encouraged in the second half of the Navon task determined performance. Recognition accuracy was 80% for the local-to-global group, 70% for the control group, and 43% for the global-to-local group.

Together, the studies of Macrae and Lewis (2002) and Perfect (2003) suggest that it is not verbalization per se that causes the verbal overshadowing effect. Instead, verbalization may disrupt subsequent face recognition because it encourages participants to use an ineffective local processing strategy. Hence, other tasks that similarly encourage this strategy (such as the local Navon task) also disrupt subsequent recognition memory. Note that the processing bias effects reported by Macrae and Lewis (2002) and Perfect (2003) cannot simply be explained as a shift in recognition criteria between the local and global conditions (Clare & Lewandowsky, 2004) because both of these studies used a forced-choice task.

The most striking aspect of their findings was the size of the processing bias effect. After just a few minutes of a simple intervention, the global group recognized faces 53% more accurately than the local group in Macrae and Lewis's (2002) study and 37% better in Perfect's (2003) study (see Figure 2). This contrasts to the verbal overshadowing effect which is often not significant and is rarely strong (Meissner & Brigham, 2001).

The cross-task processing bias results reported by Macrae and Lewis (2002) and Perfect (2003) suggest that, first, face recognition is highly sensitive to variation in processing strategy and, second, that the preferred processing strategy can easily be switched from global to local or vice versa by having participants do an unrelated Navon task for a few minutes (although alternative explanations were not ruled out by their findings, see Weston & Perfect, 2005). Clearly, this result has important practical implications for situations such as eyewitnesses trying to identify criminals from police line-ups. In addition, if it could be replicated in a more standard, laboratory-based task, it could provide a powerful means of investigating the role of processing strategy in the recognition of faces and other stimuli. The present studies focussed on this latter aim by attempting to replicate and extend the findings of Macrae and Lewis, and Perfect using a wider range of stimuli presented in a different paradigm. First, multiple trials of recognition memory were tested. Second, the stimuli included words and objects in addition to faces. Third, inverted as well as upright stimuli were tested, and views that were identical as well as different to the study views.

EXPERIMENT 1

The cross-task processing bias effect potentially provides an important methodological tool with which to examine the nature of processing involved

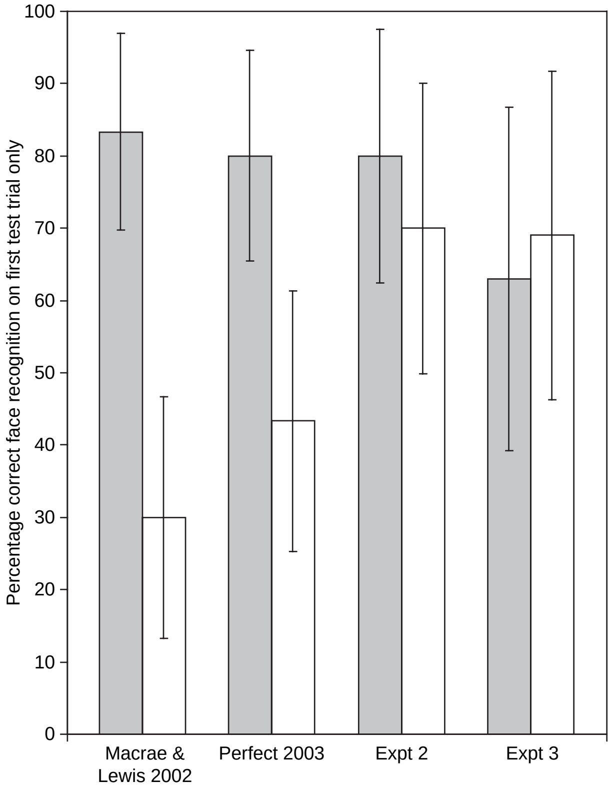

Figure 2. Results for the test trial immediately following a block of the Navon task performed at either the global level (grey bars) or the local level (white bars) for eight alternative forced-choice face recognition in Macrae and Lewis (2002), Perfect (2003), and Experiment 3, and for two alternative forced-choice face recognition in Experiment 2, along with 95% confidence intervals (Loftus & Masson, 1994; Masson & Loftus, 2003).

in recognizing different visual stimuli. It is of particular interest because the current techniques that are used to manipulate global versus local processing levels (stimulus inversion or misalignment and comparing part to whole stimulus recognition, e.g., Diamond & Carey, 1986; Tanaka & Farah, 1993; Young et al., 1987) all result in major changes to the test stimulus itself. In contrast, cross-task processing biases could, if effective, be used to vary the preferred level of processing without visually altering the test stimulus. Experiment 1 investigated whether the processing bias manipulation could be used to test hypotheses about differences in the processing of faces, objects, and words.

Farah and colleagues (1991; Farah, Wilson, Drain, & Tanaka, 1995 Drain, & Tanaka, 1998; but see Humphreys & Rumiati, 1998) have suggested that global, holistic information is extremely important for identifying faces, moderately important for identifying objects and relatively unimportant for identifying words. Conversely, they proposed that local, parts-based information is relatively unimportant for identifying faces, moderately important for identifying objects, and extremely important for identifying words. Global information is essential to allow different faces (which have the same parts in the same spatial configuration) to be discriminated, whilst a parts-based decomposition of faces will not usually aid recognition. In contrast, local, parts-based information is usually sufficient to distinguish different categories of objects at the basic level and words with different spelling.

Farah and colleagues' hypotheses lead to the following predictions. For faces, a global processing bias should improve recognition memory, whereas a local processing bias should disrupt recognition memory relative to a neutral, control condition, replicating the results of Macrae and Lewis (2002) and Perfect (2003). However, the opposite pattern should occur for words: A global processing bias should disrupt recognition memory, whilst a local processing bias should improve recognition memory relative to a neutral, control condition. Performance for objects should fall between that of faces and words.

These predictions apply to stimuli shown at their usual, upright orientation in the plane. However if stimuli are inverted, people may not be able to use global, configural information (Bartlett & Searcy, 1993; Carey & Diamond, 1977; Diamond & Carey, 1986; Rhodes, Brake, & Atkinson, 1993). Instead they may be forced to rely on local, featural information. People with a global processing bias should therefore be worse for inverted stimuli to the extent that identification of those stimuli relies on global, configural processing. Thus, for the global group, the deleterious effect of inversion should maximally disrupt face recognition because recognition memory for upright faces is assumed to be more reliant on global, configural information than recognition memory for upright objects or, especially, upright words. In contrast, inversion should have little or no influence on performance of the local group since inversion should not disrupt local processing.

In Experiment 1, participants first studied a series of sixty pictures of upright faces, objects, and words. They then did one of three processing bias tasks. The global group did the global Navon task, the local group did the local Navon task, and the control group did mental arithmetic. Finally, all participants completed an old/new recognition memory test. They were shown an upright or an inverted picture of a face, an object, or a word and had to decide if they had seen that picture at study, irrespective of orientation.

To try to maintain the processing bias for each group throughout the recognition task, each recognition memory trial was preceded by three Navon trials for the global and local groups, or one mental arithmetic trial for the control group. This should increase level-specific priming of processing level since multiple processing bias trials at the same level preceded the critical test trial (Hübner, 2000; Lamb et al., 1998; Robertson, 1996). This latter measure was unnecessary in the studies of Macrae and Lewis (2002) and Perfect (2003) since they tested only one recognition memory trial, which was preceded by a block of Navon stimuli that had to be processed at a fixed (either global or local) level.

Method

Participants. Sixty undergraduate students from the University of Liverpool took part in the study for course credit.

Materials and apparatus. Forty greyscale photographs of frontal views of faces were taken from the Nottingham Scans in the Psychological Image Collection at Stirling (PICS) database (http://pics.psych.stir.ac.uk). Half were men and half were women, and the neck, hair, and some background was also visible. For objects, 40 greyscale photographs of diverse scenes of buildings such as office blocks, castles, temples, and lighthouses were taken from a commercial CD. For words, 40 names were selected. These comprised 20 male and 20 female names of four to nine letters, e.g., Mark, Charlotte. Each of these 120 stimuli could be presented upright or inverted. There were also 44 Navon stimuli comprising a global uppercase letter made up of between 24 and 49 local uppercase letters placed within a 9×16 matrix (see Figure 1). The global letter always had a different identity to its component local letters.

Stimuli were presented using a Macintosh PowerPC G4 computer running the Psyscope version 1.2.5 experimental presentation software. All stimuli were displayed centrally on the computer monitor. The face, object, and word stimuli were presented within an area 13 cm wide $\times$ 14 cm high. The Navon stimuli were presented within an area 7 cm wide $\times$ 10 cm high. The viewing distance was approximately 50 cm.

Design. Twenty participants were assigned to each of three groups: a global, local, and control group. All participants completed a study block, then a processing bias block, then a recognition memory block. In the study block, participants saw 20 faces, 20 objects, and 20 words. All stimuli were shown upright. In the processing bias block, and prior to each recognition memory trial, the global group did the global Navon task, the local group did the local Navon task, and the control group did a mental arithmetic task.

In the recognition memory block, participants saw 40 faces, 40 objects, and 40 words, with half of each type of stimulus being shown upright and half inverted. For each stimulus type, half of the upright stimuli and half of the inverted stimuli were old (i.e., were shown in the study block), and the remaining stimuli were new. The assignment of stimuli to the old upright, old inverted, new upright, and new inverted conditions was fully counter-balanced across four equal subgroups of five participants within each of the three groups.

Procedure. All participants did 60 trials in the study block. They saw a fixation cross for 500 ms then, after 100 ms, a face, object, or word was shown for 1500 ms. There was an intertrial interval of 750 ms. Participants were instructed to look carefully at each word, face, and object, and to try to remember it.

Participants then did one of three processing bias tasks. The global and local groups did 44 trials of a Navon task. Here, a fixation cross was shown for 500 ms then, after 100 ms, a Navon stimulus was shown until participants made a speeded response by verbally reporting the identity of either the large, global letter (for the global group) or the small, constituent letters (for the local group). The experimenter coded the accuracy of their response and then there was an intertrial interval of 750 ms. The control group did around 20 trials of a mental arithmetic task. The experimenter said two numbers and participants verbally reported their sum.

Finally, all participants did 120 trials in the recognition memory block. They were shown 40 faces, 40 objects, and 40 words, with 10 stimuli of each type being upright old items, upright new items, inverted old items, and inverted new items. For each stimulus, they had to report whether it was old (shown to them in the study block) or new (they had never seen it before), ignoring stimulus orientation. Before each picture was presented, the global group did three trials of the global Navon task, the local group did three trials of the local Navon task, and the control group did one mental arithmetic trial. For the global and local groups, each Navon stimulus was presented for 500 ms, with a blank 100 ms interstimulus interval, and participants made speeded, verbal responses as each letter appeared. The experimenter then coded the accuracy of people's responses to the three Navon stimuli or to the single mental arithmetic question. There was a 100 ms interval and then the face, object, or word was presented until participants made an unspeeded response by pressing the "o" key for old items and the "n" key for new items. There was an intertrial interval of 750 ms. All trials in the study were presented in a different random order for each participant. The study lasted around 15 min.

Results

Analyses of variance (ANOVAs) were conducted on the d' measure of discrimination for a one-interval recognition task (Macmillan & Creelman, 2005; see Figure 3). Mean percentage correct responses are given in Table 1. Here and in Experiments 2 and 3, the results for the F-value in the by-participants and by-items analyses are reported using subscripts F_p and F_i respectively. One participant was replaced whose overall performance was at chance (51% errors). There were two within-participants factors: stimulus (face, object, or word) and orientation (upright or inverted), and two between-participants factors: group (global, local, or control) and stimulus set (the counterbalancing factor of which set of items were assigned to each of the four experimental conditions in the recognition memory block—old/new and upright/inverted). Main effects and interactions involving the stimulus set factor are not reported here as they were not of theoretical interest. Unless specified otherwise, all differences noted were significant ($p < .05$) in both by-participants and by-items post hoc Newman-Keuls analyses.

The main effect of stimulus was significant, $F_p(2, 96) = 44.873$, $p = .00$, $F_i(2, 108) = 45.731$, $p = .00$, with better discrimination of words (1.91) than of either objects (1.16) or faces (0.97). Orientation was also significant, $F_p(1, 48) = 73.986$, $p = .00$, $F_i(1, 108) = 42.332$, $p = .00$, with upright stimuli (1.55) being discriminated better than inverted stimuli (1.14). These two effects interacted, $F_p(2, 96) = 12.614$, $p = .00$, $F_i(2, 108) = 13.640$, $p = .00$. There was no orientation effect for words (1.91 for both upright and inverted words), but there was for objects (1.40 upright; 0.92 inverted; only significant for participants) and, especially, for faces (1.35 upright; 0.59 inverted). This result confirms the prediction that only the recognition of stimuli that benefit from global processing (faces and, to a lesser extent, objects) would be disrupted by misorientation in the plane.

The main effect of group was not significant, $F_p(2, 48) = 0.617$, $p = .5$, $F_i(2, 216) = 1.748$, $p = .18$. Overall discrimination was similar for the global group (1.38), the local group (1.27), and the control group (1.39). The Stimulus × Group interaction was significant, but only for items, $F_p(4, 96) = 1.865$, $p = .12$, $F_i(4, 216) = 3.933$, $p = .00$. Furthermore, there was no significant difference between the three groups for faces, or for words, or for objects. Instead, the interaction for items occurred because, although words were discriminated better than objects for all three groups, this difference was not significant for the global group, whereas it was for the local and control groups. Most important, the three-way interaction of Stimulus × Group × Orientation was not significant, $F_p(4, 96) = 1.769$, $p = .14$, $F_i(4, 216) = 1.611$, $p = .17$ (see Figure 3).

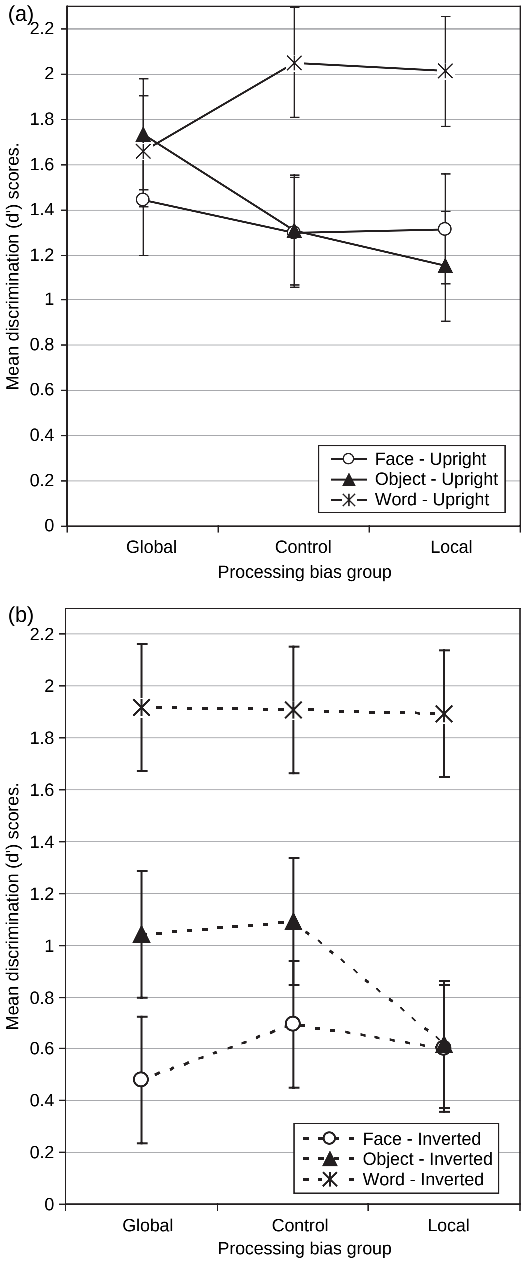

Figure 3. Mean discrimination (d') scores for the global, control, and local groups for (a) upright and (b) inverted versions of face, word, and object stimuli in Experiment 1, along with 95% confidence intervals based on the error term for the Stimulus × Group × Orientation interaction in the by-participants ANOVA (Loftus & Masson, 1994; Masson & Loftus, 2003).

TABLE 1
Mean percentage correct responses on target present (old) and target absent (new) trials in Experiments 1 and 2 (in which either an old or a new stimuli was shown on each trial) and mean percentage correct responses on same view and different view trials in Experiment 3 (in which two upright stimuli were shown on every trial: one old and one new)

	Stimulus type for the control (C), global (G), then local (L) groups separately		
	Faces—CGL	*Objects—CGL*	*Words—CGL*
Experiment 1			
Upright, old	73 72 67	59 69 54	84 77 79
Upright, new	71 77 78	85 88 84	82 78 86
Inverted, old	64 67 79	60 64 52	78 74 76
Inverted, new	58 50 42	76 72 69	85 89 86
Experiment 2			
Upright, old	75 75 78	67 67 62	78 77 78
Upright, new	76 72 62	84 76 84	81 80 78
Experiment 3			
Same view	82 77 84	69 70 63	84 88 80
Different view	73 71 75	60 63 56	81 88 77

Discussion

There was a strong interaction between the effects of stimulus type (faces, objects, or words) and orientation (upright or inverted). As predicted, misorientation strongly disrupted the recognition of faces, moderately disrupted the recognition of objects, and it did not disrupt the recognition of words. Consistent with previous research, these inversion effects indicate that global, configural processing plays an important role in face recognition, a more minor role in object recognition, and little or no role in word recognition.

However, critically, this interaction was similar across all three groups. There was no significant support for the predictions that, first, there would be superior recognition of upright faces by the global group, second, that there would be superior recognition of words by the local group, and third, that the disruptive effect of misorientation on faces (and, to a lesser extent, objects) would be greatest for the global group. Nevertheless, there were trends in support of these predictions (see Figure 3), so Experiment 2 was conducted to reexamine whether processing bias effects could be obtained using the cross-task manipulation.

One reason for the lack of difference between the local, control, and global groups in Experiment 1 may have been that effects of the processing bias task dissipate rapidly once people start the recognition memory task. In the studies reported by Macrae and Lewis (2002) and Perfect (2003), each participant was tested with just one recognition memory trial. Weston and Perfect (2005) investigated Macrae and Lewis's (2002) cross-task processing bias task in a laboratory-based study. They tested recognition of nonmatching face halves that were presented within a composite comprising aligned or misaligned top and bottom face halves. A global, configural processing bias was expected to disrupt performance for aligned faces in this task, since it would encourage people to process the two half faces together, as a whole (Young et al., 1987). Supporting this prediction, Weston and Perfect found that, on the first four trials, the recognition of aligned face halves (and, to a lesser extent misaligned faces) was significantly slower following 3 min doing the global compared to the local Navon task. However, they found no effect of processing bias in later trials or, as in Experiment 1, on accuracy. Furthermore, the verbal overshadowing effect has often been reported to attenuate or be eliminated after the first trial (Fallshore & Schooler, 1995; Melcher & Schooler, 1996, 2004; though not in Schooler & Engstler-Schooler, 1990; see Meissner & Brigham, 2001; whilst Brown & Lloyd-Jones, 2003, only found verbal overshadowing effects in the second half of their study).

In Experiment 1, three Navon trials preceded each recognition memory trial to try to maintain people's global or local processing bias. Nevertheless, it may be that the first few recognition memory trials show the strongest processing bias effects. This possibility could not be tested in Experiment 1 since each participant received a different, random order of recognition memory trials, and so stimulus type and orientation on the initial trials varied across participants. In Experiment 2, everybody was shown the same four faces on the first four recognition memory trials. Second, in Experiment 1, there were a relatively large number of conditions (six) with just 10 old items per condition. In order to increase the power to detect any effects of processing bias, only upright stimuli were presented in Experiment 2, halving the number of conditions tested.

EXPERIMENT 2

As in Experiment 1, Experiment 2 examined whether processing biases induced by performing the global or local version of the Navon test influenced the recognition of faces, objects, and words relative to a control group. A simplified design was adopted in Experiment 2 in which only upright stimuli were presented. Recognition accuracy was predicted to be superior for the global group with faces and for the local group with words. The initial four recognition memory trials of the study were identical for all participants. These trials only showed faces, two of which were old and two were new. Even if cross-task processing biases quickly dissipate, face recognition should still be better for the global group than the local group on these initial trials. Note, too, that if processing biases quickly fade and cannot be maintained by ongoing Navon trials interspersed throughout the test period then this would severely limit their usefulness in laboratory-based tasks since these typically present many trials.

Method

Participants. Sixty undergraduate students from the University of Liverpool took part in the study for course credit. None had participated in Experiment 1.

Materials, design, and procedure. This was identical to Experiment 1 except for three points. First, no inverted stimuli were presented, so in the recognition memory block all 40 faces, objects, and words were shown upright. As a result, there were only two subgroups of 10 participants within each group. These subgroups counterbalanced which stimuli were assigned to be old or new. Second, the mental arithmetic task required subtraction of one number from another rather than addition. Third, the first four recognition memory trials showed the same sequence of four female faces to all participants. These were old, new, new, and old for half the participants and new, old, old, and new for the remaining participants.

Results

ANOVAs were conducted on the d' measure of discrimination for a one-interval recognition task (Macmillan & Creelman, 2005; see Figure 4). Mean percentage correct responses are given in Table 1. No participants were replaced. There was one within-participants factor: stimulus (face, object, or word), and two between-participants factors: group (global, local, or control) and stimulus set (the counterbalancing factor of which items were old and new in the recognition memory block). Main effects and interactions involving the stimulus set factor are not reported here as they were not of theoretical interest. All differences noted were significant ($p < .05$) in both by-participants and by-items post hoc Newman-Keuls analyses.

The main effect of stimulus was significant, $F_p(2, 108) = 10.110$, $p = .00$, $F_i(2, 114) = 6.556$, $p = .00$. As in Experiment 1, words (1.81) were discriminated better than either objects (1.43) or faces (1.36). The main effect of group was not significant for participants and was only marginally significant for items, $F_p(2, 54) = 1.088$, $p = .34$, $F_i(2, 228) = 2.895$, $p = .06$. Overall discrimination was similar for the global group (1.47) and the local group (1.47), with a trend for improved discrimination for the control group (1.67). Most importantly, the interaction of Stimulus × Group was not

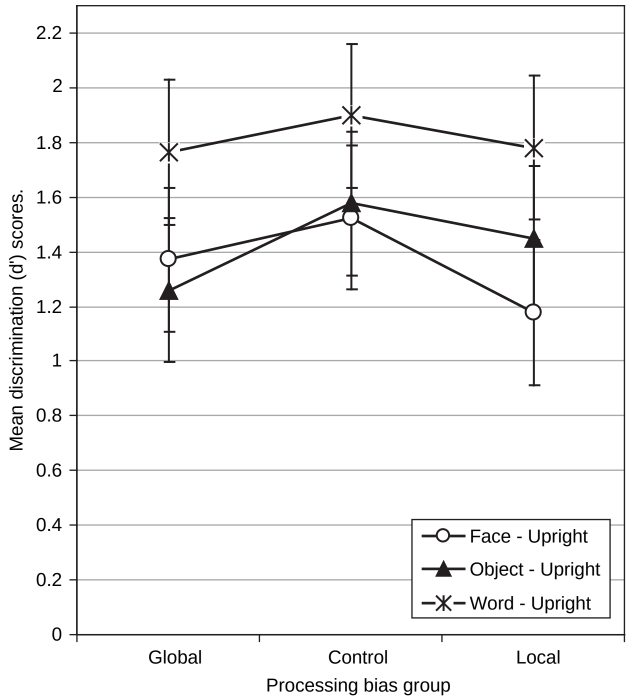

Figure 4. Mean discrimination (*d*') scores for the global, control, and local groups for upright face, word, and object stimuli in Experiment 2, along with 95% confidence intervals based on the error term for the Stimulus × Group interaction in the by-participants ANOVA (Loftus & Masson, 1994; Masson & Loftus, 2003).

significant, $F_p(4, 108) = 0.601$, $p = .66$, $F_i(4, 228) = 0.932$, $p = .45$ (see Figure 4). Replicating Experiment 1, there was no support for the predictions about a processing bias effect: there was no advantage for the global group for face recognition, and there was no advantage for the local group for word recognition.

Analysis of the first four recognition memory trials. Furthermore, there was also no support for the prediction that the global group would show improved discrimination of the faces shown on the first four recognition memory trials. For these trials, there was no significant effect of group, $F_i(2, 9) = 0.380$, $p = .69$, with discrimination as measured by d' being no greater for the global group (1.79) than the local group (1.81) or the control group (2.17). Likewise, for the face shown on the first recognition memory trial only, accuracy was similar for the global group (80% correct), the control group (80%), and the local group (70%) (see Figure 2).

Discussion

The results for Experiment 2 replicated those of Experiment 1. No evidence was found to support the prediction that the global group was better at detecting old faces (and worse at detecting old words) than the local group. Thus, neither Experiment 1 nor Experiment 2 replicated the advantage for the global group for face recognition reported by Macrae and Lewis (2002) and Perfect (2003). Instead, in both studies performance was similar across the global, local, and control groups. Furthermore, in Experiment 2, the global group did not reveal superior face recognition even for analyses restricted to only the first few recognition trials.

EXPERIMENT 3

Neither Experiment 1 nor 2 revealed any cross-task processing biases overall or, in Experiment 2, on the initial few trials. In a final attempt to elicit a processing bias effect, Experiment 3 eliminated several differences between the methodology of Experiments 1 and 2 here and the studies conducted by Macrae and Lewis (2002) and Perfect (2003).

First, Macrae and Lewis (2002) and Perfect (2003) presented the recognition memory stimulus in a different format to the study stimulus. In their studies, a 30 s video was shown at study, and the test stimulus was an eight alternative forced-choice line-up of photographs of faces. In contrast, in Experiments 1 and 2 here, the study and test stimuli were identical pictures. In Experiment 3, half of the test stimuli were identical to the study stimuli and half presented a different view to the study stimuli. This change might be important if a global processing bias is beneficial because it encourages people to ignore detailed information which changes across different views. Unfamiliar face recognition can be good if identical stimuli are presented at encoding and test, but performance is typically poor after viewpoint, lighting, and other changes (Hancock, Bruce, & Burton, 2000). If a global processing bias encourages people to use more view-invariant information, this could improve people's ability to generalize across views at test (as tested by Macrae & Lewis and Perfect), whilst the recognition of identical stimuli (as tested in Experiments 1 and 2 here) may not benefit.

Second, in Macrae and Lewis (2002) and Perfect's (2003) experiments, the old, study item was always present at test together with seven distractor faces in a forced-choice identification task. In contrast, in Experiments 1 and 2 here, a single item was presented at test, and old items only appeared on half of the test trials. In Experiment 3, two stimuli (one old and one new) were shown on every trial in a two alternative forced-choice task. Both stimuli came from the same category (faces, objects, or words) and showed the same type of view.

Third, participants in Macrae and Lewis's (2002) study did 10 min of the Navon task. In contrast, in Experiments 1 and 2 here the processing bias block lasted less than 5 min. This may not have been sufficient to bias people's processing. There is little evidence to support this suggestion. Perfect (2003) demonstrated that 5 min doing the Navon task produced a significant global processing benefit, and Weston and Perfect (2005) found significant processing bias effects after just 3 min of the Navon task. Nevertheless, to eliminate this possible explanation, the number of Navon trials was increased in Experiment 3 so that the processing bias block lasted an average of 7 min.

Fourth, as discussed above, any processing bias effect may rapidly dissipate once the processing bias block ends. If so, then the effect may have dissipated during the short time taken to read the recognition memory block instructions. This could explain why no processing bias effects were found in Experiment 2, even on the first few recognition memory trials. To test this possibility, in Experiment 3 the first recognition memory trial immediately followed the final trial of the processing bias task. This trial preceded the instructions for the main recognition memory task and was an eight alternative forced-choice identification. This trial was intended to closely replicate the single recognition trial tested by Macrae and Lewis (2002) and Perfect (2003). Photographs of eight male faces were shown on a single card, and the old face was a different view of the last face presented at study.

Method

Participants. Forty-eight undergraduate students from the University of Liverpool took part in the study for course credit. None had participated in Experiments 1 or 2.

Materials, design, and procedure. The study was identical to Experiment 2 except for the following points. At study, each stimulus was shown for 2000 ms (rather than 1500 ms). Forty new face, object, and word stimuli were used. Words were recognized much better than faces or objects in Experiments 1 and 2. To try to reduce this difference, words that were harder to discriminate were used in Experiment 3. All were male names; half began with the letter J and half with the letter C. These words were capitalized and written in bold, lowercase, italicized Mistral font at study, and were written in both this font and in bold, uppercase Desdemona font at test. The photographs of buildings presented in Experiments 1 and 2 may not have been perceived as parts-based objects but rather as scenes, since each building was depicted within its background. In Experiment 3, shaded pictures of views of unfamiliar objects against a black background were presented instead. Each study object was paired with a visually similar morphed shape from which it had to be discriminated on test trials. This ensured that the object recognition task was difficult and that participants could not use basic level names to support accurate performance. These stimuli were a subset of those depicted in Figure 1 of Lawson, Bülthoff, and Dumbell (2003). Objects were depicted from a view rotated 30° from an experimentally defined frontal view during study and from both this view and a view rotated 60° from the frontal view at test. For faces, greyscale photographs of men were taken from the PICS database (http://pics.psych.stir.ac.uk). Faces were depicted from a three-quarters view during study and from both this view and a frontal view at test. Nine additional face stimuli were taken from the PICS database for use in the first recognition memory trial. These faces comprised frontal views of eight men and a three-quarters view of one of these men. The same male face was always shown from a three-quarters view on the final study trial. The frontal view of this man and the other seven men were shown on the first recognition memory trial.

For the processing bias task, the local and global group did 264 trials of the Navon task and the control group did between 55 and 80 trials of subtraction (average 71 trials). For all groups, the processing bias task took 6–9 min (average 7 min) to complete. For the Navon tasks, the fixation cross was shown for 250 ms (not 500 ms) and the intertrial interval was 500 ms (not 750 ms).

The first recognition memory trial immediately followed the processing bias task, and so preceded the instructions for the main recognition memory task. Pictures of the frontal view of eight male faces were arranged on two rows on an A4-sized piece of card. People indicated which face showed the last person that they had seen during study. The correct response was the top right face.

During the main recognition memory test, two faces or two objects or two words were shown on every trial. Both stimuli were shown in the same format: Depicted from the same view for faces and objects, and written in the same script with the same initial letter for words. The two stimuli appeared to the left and right of fixation, and the location of the old item was counterbalanced across all conditions. Participants made an unspeeded response by pressing the "z" key if they thought that the old item was on the left and the "m" key if they thought it was on the right. There were two recognition memory trials for each study stimulus. On same view trials, the stimulus was shown as it had been seen at study (three-quarter views for faces, 30° views for objects, and lowercase Mistral font for words). On different view trials, faces were shown from profile views, objects from 60° views, and words in the uppercase Desdemona font. For a given participant, same view trials were shown in the first half of the recognition memory block for half of the study items and in the second half for the remaining items, and vice versa for the different view trials. The assignment of items to the first or second half of the recognition memory block was counterbalanced across participants. The study lasted around 35 minutes.

Results

ANOVAs were conducted on the d' measure of discrimination for a two alternative forced-choice recognition task (Macmillan & Creelman, 2005; see Figure 5). Mean percentage correct responses are given in Table 1. No participants were replaced. There were two within-participants factors: stimulus (face, object, or word) and view (same or different view shown at test relative to study), and two between-participants factors: group (global, local, or control) and stimulus set (the counterbalancing factor of which items were old or new in the recognition memory block). Main effects and interactions involving the stimulus set factor are not reported here as they were not of theoretical interest. Unless specified otherwise, all differences noted were significant ($p < .05$) in both by-participants and by-items post hoc Newman-Keuls analyses.

The main effect of stimulus was significant, $F_p(2, 84) = 46.215$, $p = .00$, $F_i(2,90) = 27.707$, $p = .00$. Words (1.39) were discriminated better than faces (1.13; only significant for participants), which in turn were discriminated better than objects (0.56). The main effect of group was not significant for participants and was only marginally significant for items, $F_p(2, 42) = 1.180$, $p = .32$, $F_i(2,180) = 2.819$, $p = .06$. Overall discrimination was similar for the global group (1.10), the control group (1.03), and the local group (0.94). The interaction of Stimulus × Group was significant, $F_p(4,84) = 2.510$, $p = .05$, $F_i(4, 180) = 3.775$, $p = .01$. However, crucially, there was no significant difference across the three groups for faces, words, or objects, and there were not even trends to support the predictions that a global processing bias would aid face discrimination and that a local processing bias would aid word discrimination.

There was also no evidence for a processing bias effect that was restricted to different view trials (see Figure 5b). There was a clear effect of view, $F_p(1,42) = 30.852$, $p = .00$, $F_i(1, 90) = 26.438$, $p = .00$. Discrimination was better on same view trials (1.15) than on different view trials (0.90). However, the three-way interaction of Stimulus × Group × View was not significant, $F_p(4,84) = 0.065$, $p = .99$, $F_i(4, 180) = 0.027$, $p = .99$ (see Figure 5). In particular, there was no indication that there was a global group advantage for face recognition or a local group advantage for word recognition for different view trials. Indeed, as for same view trials, any

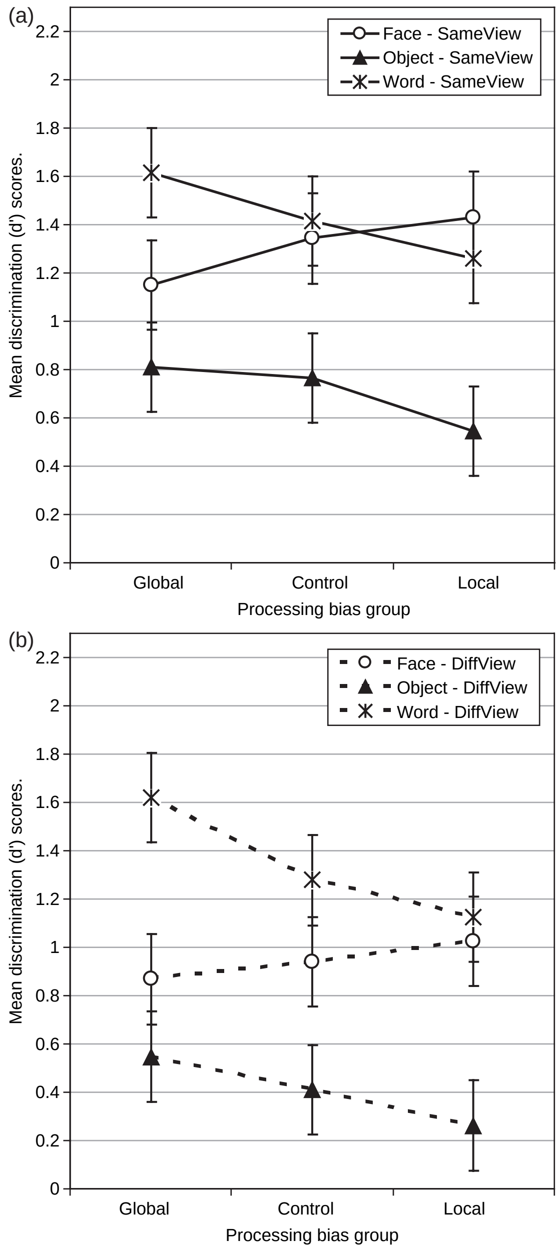

Figure 5. Mean discrimination (d') scores for the global, control, and local groups for (a) same view and (b) different view versions of face, word, and object stimuli in Experiment 3, along with 95% confidence intervals based on the error term for the Stimulus × Group × View interaction in the by-participants ANOVA (Loftus & Masson, 1994; Masson & Loftus, 2003).

trend on different view trials was in the opposite direction to these predictions (compare Figure 5a and 5b).

The interaction of Group × View was not significant, $F_p(2,42) = 0.642$, $p = .53$, $F_i(2, 180) = 0.749$, $p = .47$, but there was a significant interaction of Stimulus × View, $F_p(2,84) = 3.626$, $p = .03$, $F_i(2, 90) = 3.436$, $p = .04$. Same views were discriminated significantly better than different views for faces (1.31 compared to 0.94) and objects (0.71 compared to 0.41), but not for words (1.43 compared to 1.34). Stimulus format at study was not counterbalanced so the relatively weak same view benefit for words was likely to simply be an artefact due to the word font presented on same view trials (Mistral) being harder to read than the font used on different view trials (Desdemona).

Analysis of the initial recognition memory trial. There was no support for the prediction that the global group would show improved discrimination of the face shown on the first recognition memory trial. There was no significant effect of group for this trial, $\chi^2(2, N = 48) = 3.56$, $p = .17$. Discrimination was no better for the global group (63% correct) than the local group (69%) or the control group (38%) (see Figure 2). The trend towards worse performance for the control group could have been due to the greater difficulty of the subtraction control task relative to the local and global Navon tasks. The studies reported by Macrae and Lewis (2002) and Perfect (2003) had effect sizes of 0.37 and 0.54 respectively for the global versus local group comparison. For $\alpha = .05$, they had power of 0.87 to detect an effect size of 0.4 between the global and local groups. Experiment 3 was primarily designed as a multiple-trial study and so tested fewer participants than these studies. Nevertheless, for $\alpha = .05$ it still had power of 0.67 to detect the same effect size.

Analyses across all three studies. The studies reported here were designed to test recognition accuracy so participants were not encouraged to produce speeded responses, and the tasks were difficult to ensure that reasonably high error rates were produced. Nevertheless, given the lack of evidence for processing bias effects reported so far, RTs were analysed across both participants, and items for all three studies to investigate whether processing biases might have influenced the speed rather than the accuracy of recognition. Weston and Perfect (2005) reported significant processing bias effects on speed but not accuracy. Similar results could have occurred in the present studies. ANOVAs were conducted on median RTs since responses were relatively slow and variable. To increase the data available, all responses (not just correct responses) were analysed. These analyses failed to support the predictions of the processing bias account. In no study were both faces recognized faster by the global group and words recognized faster by the local group. Furthermore, only in Experiment 2 was there significant support for either of these predictions, and here the faster responses to faces by the global group is best accounted for by an overall RT advantage for this group rather than a stimulus-specific effect.

In addition, percentage correct responses on target present (old stimulus) and target absent (new stimulus) trials (in Experiments 1 and 2) and target on left and target on right trials (in Experiment 3) were analysed across both participants and items. The target was always present in Macrae and Lewis (2002) and Perfect (2003), and it was possible that processing bias effects could be limited to only target present trials. No evidence was found to support this proposal. In particular, there was no indication of a global processing benefit for old faces or of a local processing bias for old words.

Discussion

Despite making several changes to increase the similarity of Experiment 3 to studies in which significant cross-task processing bias effects have been reported (Macrae & Lewis, 2002; Perfect, 2003; Weston & Perfect, 2005), no evidence was found to support the predictions of the processing bias account. The view change manipulation influenced performance in Experiment 3: different view stimuli were recognized less accurately (see Figure 5). However, the pattern of results on different view trials failed to support the processing bias account, and instead was similar to the results for same view trials. In Experiment 3 there was no significant advantage for face recognition for the global group, whether on overall accuracy, or for different view trials only, or for the first recognition trial only, or for median RTs. Neither was there a significant advantage for word recognition for the local group in any of these cases.

GENERAL DISCUSSION

The three studies reported here were designed to replicate and extend Macrae and Lewis's (2002) cross-task processing bias manipulation using a multiple-trial, laboratory-based task. These studies tested whether there would be a global processing advantage for recognizing stimuli such as upright faces (which are assumed to rely more on global, configural processing) and a local processing advantage for recognizing stimuli such as words (which are assumed to depend more on local, featural processing). These predictions were not confirmed. Together, these results suggest that level-specific priming effects do not extend to influencing a very different task.

These three studies attempted to alter the preferred level of processing on a recognition memory task by manipulating the processing level required to do a preceding and unrelated Navon task. It has been suggested that the verbal overshadowing effect reviewed in the introduction provides a means of manipulating processing level indirectly. However, the verbal overshadowing effect has not always been observed and even when it is detected it is often small (Meissner & Brigham, 2001; see also Brand, 2004). Many studies testing face recognition have either failed to find verbal overshadowing or have even reported the converse, a verbal facilitation effect (e.g., Clare & Lewandowsky, 2004; Itoh, 2005; Lyle & Johnson, 2004). In contrast, the results reported by Macrae and Lewis (2002) and Perfect (2003) were intriguing because of the strength of the processing bias effect that they found (see Figure 2). After just a few minutes doing the Navon task, unfamiliar face recognition by the global group was 53% (Macrae & Lewis, 2002) and 37% (Perfect, 2003) more accurate compared to the local group. Furthermore, both studies used a forced choice task so the results cannot simply be due to shifts in recognition criteria (Clare & Lewandowsky, 2004). However, the three studies reported here failed to find any such large scale effects of processing bias for the recognition memory of faces, objects, and words.

The present results are, instead, consistent with those of Brand (2004), who attempted to effect a shift towards either local or global processing. Across five studies he used local versus global Navon tasks, featural versus configural face judgement tasks, small versus large letter identification tasks, and word naming versus colour naming Stroop tasks to bias processing level. In all five studies, people were shown a single static face for 2 s, did a filler task for 5 min, the processing bias task for 5 min, and finally a six alternative forced-choice face recognition task. Despite having over 70 people in each local and global group, the global group was significantly more accurate in only one study, and even then the difference in accuracy was just 14% (it was 8%, 6%, 4%, and –1% in the other studies). Taken together with the present results, this suggests that the processing bias effect is, at best, weak and difficult to replicate. As such, it does not provide an effective or powerful means to probe global, configural processing effects.

The present results are also consistent with those reported by Large and McMullen (2006). They reported weak and unreliable effects of global versus local processing biases on basic level object recognition (with, at most, a 15 ms benefit for global priming) and more reliable but still very small effects on subordinate level object recognition (with, at most, a 30 ms benefit for local priming).

The present studies did not directly replicate those of Macrae and Lewis (2002) and Perfect (2003), and it is possible that there remain important methodological differences to these earlier studies. For example, both these studies showed a 30 s video at study rather than a series of static pictures of faces, objects, and words. It may be necessary to see multiple views or moving views of the recognition target at study to demonstrate strong processing bias effects. Knight and Johnston (1997) reported that upright (but not inverted) moving faces were recognized more accurately than static faces. They suggested that this pattern of results could be explained if the benefit of motion was due to improved global, configural information that was destroyed by inverting the faces. However, these results were only obtained for faces shown in negative that looked unnatural and were difficult to recognize. No benefit of motion was obtained for normal, positive faces, and only famous faces were tested. A recent review concluded that there was only mixed evidence that face or body motion information aids unfamiliar face recognition (O'Toole, Roark, & Abdi, 2002; but see also Knappmeyer, Thornton, & Bülthoff, 2003; Lander & Bruce, 2003). Also, in their meta-analysis of verbal overshadowing studies, Meissner and Brigham (2001) found no difference between studies showing videos or live actors at study versus studies presenting static photographs. In the present studies, both Macrae and Lewis, and Perfect presented static pictures of faces at test. Even if motion sometimes benefits unfamiliar face recognition, it seems unlikely that the advantage of global, configural processing is eliminated when matching stored representations of moving stimuli to static stimuli. In sum, although it is possible that global, configural processing is more important when moving faces are presented at study, this seems unlikely to explain why no processing bias effects were found here.

Another difference to note between the earlier studies and those reported here was the nature of the processing bias task for the control group. A mental arithmetic task was used in the present studies. This required only verbal, not visual inputs, and a verbal output. In contrast, the control group in Macrae and Lewis (2002) and Perfect (2003) read from a magazine or a novel. Reading seems a surprising choice as a control task since it requires a visual input and it should encourage local processing. In any case, the control groups here performed similarly to the local and global groups, so there is no reason to indicate that the choice of control task could explain the lack of processing bias effects in the present studies. The number of stimuli presented at encoding and the presentation duration at encoding also differed between the present studies and those of Macrae and Lewis, and Perfect. Again, it is possible that these differences influence processing biases, though there seems no reason to suggest that they are important factors.

A more interesting factor is the size of the Navon stimuli. One alternative account of the processing bias effect is that presenting the Navon stimuli encourages people to attend to a relatively large or small area in the global and local tasks respectively, rather than encouraging processing at different, hierarchical levels of structure (Lamb & Robertson, 1988). If so, then improved performance would be predicted for Navon stimuli similar in size to the recognition test stimuli. An alternative account is that the different sizes of the global and local Navon letters might encourage people to prioritize the processing of low or high spatial frequencies respectively (Lamb & Yund, 1993; Shulman & Wilson, 1987), with the former strategy being more effective for the global, configural processing of faces (Goffaux, Gauthier, & Rossion, 2003; Goffaux, Hault, Michel, Vuong, & Rossion, 2005). Global versus local organization is orthogonal to coarse versus fine spatial frequencies (see Figure 3 of Morrison & Schyns, 2001; see also Oliva & Schyns, 1997), so either or both effects could produce a processing bias effect. The size of the Navon stimuli was not specified in the studies of Macrae and Lewis (2002) or Perfect (2003). However, the global Navon letters shown in the present studies were similar in size to the target faces, words, and objects, whilst the local Navon letters were much smaller (see Figure 1). Therefore, on the attentional cueing account outlined above, there should have been a global processing benefit for all three types of stimuli. On the spatial frequency account, there should at least have been a global group advantage for face recognition. Furthermore, any such effects should have been particularly strong in the present studies because each recognition memory trial was immediately preceded by three Navon trials, so throughout the recognition phase the global group were encouraged to attend at the optimal scale and to process lower spatial frequencies. Thus, all three accounts (preferential processing of global versus local levels of stimulus organization, or of lower versus higher spatial frequencies, or of larger versus smaller spatial areas) predict better face recognition for the global group. It is important to emphasize that the present null results do not provide evidence for or against these accounts. Rather, they suggest that biasing processing on one task has little effect on the nature of processing of a subsequent, different task. Thus, cross-task processing bias effects do not provide a powerful tool with which to investigate the complex interactions between effects of visual attention, spatial frequency, and hierarchical processing levels.

Within-task processing bias effects have been reliably reported for the Navon task. Level-specific priming effects occur across successive Navon trials, regardless of whether global or local precedence effects are operating (Filoteo et al., 2001; Hübner, 2000; Lamb & Yund, 1996; Lamb et al., 1998; Robertson, 1996; Robertson et al., 1993; Shedden et al., 2003; Ward, 1982). Here, when the same task is tested on successive trials (e.g., the target appears at the global level in both trials), performance improves relative to when a target appears at different levels on each trial. However, in the present studies, the level of processing required on preceding Navon trials did not influence performance on the subsequent, unrelated recognition memory trial (but see Large & McMullen, 2006). Hübner (2000) suggested that problems in task-switching between levels could underlie the level-specific priming effect. Similarly, in the present studies, the difficulty of switching from the Navon task to the recognition memory task might have eliminated any effect of the processing level required for the Navon task, even though the task switch was always predictable (Rogers & Monsell, 1995).

In summary, it is possible that one of the factors discussed above is critical to determining whether a cross-task processing bias effect is observed. However, there appears to be no strong empirical or theoretical reason to support this suggestion. The draw of investigating the processing bias effect reported by Macrae and Lewis (2002) was that they reported large effects which have been replicated (Perfect, 2003, 2004) and which did not visually alter the target stimulus. There have also been recent reports of processing bias effects in web-based and laboratory-based tasks (Brand, 2004; Burton & Megreya, 2006; Large & McMullen, 2006; Weston & Perfect, 2005). However, Brand (2004) found a significant effect in just one of his five studies, Large and McMullen (2006) found only very small effects (maximum 30 ms on reaction times and 3% on errors), Weston and Perfect (2005) found an effect only on the first few trials and only for reaction times, not on accuracy, whilst Burton and Megreya (2006) reported significant effects only for hits, not on misses, false alarms, or false positives. These results together with those reported in the present studies suggest that cross-task processing bias effects are typically weak and unreliable. Where significant processing bias effects have been reported using a different methodology to that of Macrae and Lewis, the difference between global and local group performance has been far less dramatic than in Macrae and Lewis's original report.

Given that null results are less likely to be published than significant effects (Greenwald, 1975; Rosenthal, 1979), the extant literature may overestimate the size of the processing bias effect. Related to this point, if a study produces a null result, researchers understandably often conduct additional analyses to try to detect an effect. From the examples given above, this includes analysing the first trial only, or analysing the first and second half of trials separately, or analysing hits alone rather than d', and analysing speed as well as accuracy of responses. When a new effect has been reported, such exploratory analyses may be useful in pinning down the nature of the effect. However, the results of studies that test for the presence of an effect in many different ways must be interpreted with caution, since this strategy increases the likelihood of producing statistically significant results even if no effect actually exists (Maxwell, 2004).

The present studies investigated whether cross-task processing bias effects provide a useful means to investigate global, configural versus local processing of visual stimuli. Three experiments found no evidence that substantial processing bias effects carry over to an unrelated task. These findings fail to replicate the very large bias effects reported by Macrae and Lewis (2002) and Perfect (2003). Instead, the present results suggest that any processing bias effects are neither strong nor reliable.

An important implication of these findings is that, rather than requiring people to name the small, component letters in Navon stimuli, alternative, well-established techniques such as inverting stimuli (e.g., Diamond & Carey, 1986; and replicated once again in Experiment 1 here), misaligning stimuli (e.g., Young et al., 1987), and comparing part to whole recognition (e.g., Tanaka & Farah, 1993) provide much more effective and reliable techniques with which to disrupt or discourage global, configural processing. These methods, in combination with others such as the use of spatial frequency hybrid stimuli (which combine multiple stimuli specified at different spatial scales) to test biases in processing different spatial frequencies (e.g., Oliva & Schyns, 1997; Ozgen, Payne, Sowden, & Schyns, 2006; Ozgen, Sowden, Schyns, & Daoutis, 2005; Schyns & Oliva, 1994, 1999) and attentional cueing to spatial extent to test biases in processing different sizes of stimuli (e.g., Lamb & Yund, 2000; Large & McMullen, 2006; Robertson et al., 1993), provide diverse and effective methods to investigate hierarchical, spatial frequency and spatial extent processing biases on visual recognition. The cross-task processing bias manipulation would have provided a valuable addition to this set of techniques because, as in level-specific priming in the Navon task (e.g., Robertson, 1996) and spatial-frequency-specific priming of the identification of hybrid stimuli (e.g., Oliva & Schyns, 1997; Ozgen et al., 2005Ozgen et al., 2006), the cross-task processing bias manipulation does not visually alter the test stimulus. Unfortunately, the present results indicate that this technique is not a powerful tool for research in a laboratory setting.

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