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TABLE 1
Mean Recognition as a Function of Presentation Method, Test-view, and Post-exposure Task

	Massed		Distributed	
Post-exposure task	Same view	Different view	Same view	Different view
Image targets	5.71	3.73	5.65	3.92
Image initial face	5.00	3.59	5.31	3.17
Letter-search	3.73	3.73	4.54	3.13

sures were also computed based on hit and false-alarm scores. The discrimination results were similar to the hit results and are not reported here.

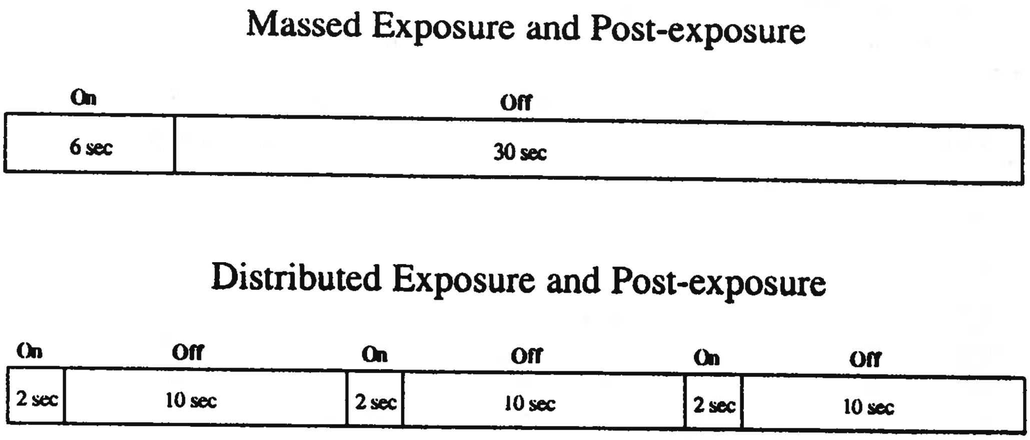
Recognition of the non-target, initial face was also analyzed. Only a significant main effect of picture view was shown, $F(1, 84) = 32.72, p < .001$. Recognition of the initial face was higher when presented in the same view ($M = 5.10$) than in a different view at test ($M = 3.08$).

DISCUSSION

This experiment showed that distributed exposure and post-exposure target imaging facilitated subsequent recognition, but these effects primarily occurred when the same facial view as given at both study and test. Recognition was generally quite poor when the target was presented in a different view from study to test. However, the data suggest that when a different view is combined with distributed presentation and target imaging, performance is enhanced relative to the other two post-exposure tasks.

Imaging the target faces facilitated recognition compared to the irrelevant, letter-search activity, and thus supports research showing that imaging a face following exposure benefits recognition (Graefe & Watkins, 1980; Sporer, 1988). The other control task, non-target imaging, showed intermediate performance that did not differ from the other two tasks. The failure to find lower performance than the other two tasks fails to support the findings of earlier research suggesting that similar tasks will

FIGURE 1
Representation of Massed and Distributed Exposure (On) and Post-exposure (Off) Timing for One of Six Targets Presented at Study



Procedure

Participants were randomly assigned to one of the six groups. All participants first viewed one of two depictions of an initial, non-target face for 2 s, given the prior instruction that their memory of this face would be tested later.

A sequence of six faces was shown at study. Participants in the massed presentation conditions were shown a sequence of six target faces for 6 s each, with 30 s off time between exposures (the post-exposure periods). Participants in the distributed presentation conditions were shown each target three times for 2 s, with a 10 s off time between exposures. Thus, the total on time and off time in the massed and distributed presentation conditions was identical. The duration of the entire presentation/post-exposure phase was held constant at 216 s; the total time was 36 s (6 s for each target) and the total off time was 180 s (30 s for each target). Figure 1 shows a graphic representation of the massed and distributed exposure and post-exposure times for one of six targets presented at study.

Participants in the image-target conditions were told to try to image the most recently seen face during the post-exposure periods. Participants in the image initial non-target conditions were told to image the initially presented face during the post-exposure periods. Participants in the letter-search conditions performed an unrelated letter-search task during the post-exposure periods in which they quickly looked for and circled specific letters on sheets containing a large array of letters.

Following the target-presentation/post-exposure phase, participants were given a recognition test. The test consisted of a sequence of 80 faces that contained the target faces embedded in a set of foil faces. Targets were placed in random positions in the latter half of the recognition test sequence. Half of the targets were in the same view at test as seen at study and half were in a different view. The recognition test also

& Simmonds, 1979), it has generally been found to apply to most memory tasks (Rea & Modigliani, 1988), and has been considered by some to be an established principle of learning (e.g., Landauer & Ross, 1977; Rea & Modigliani, 1988; Woodworth, 1938).

Research on massed versus distributed learning has mainly focused on verbal memory and motor skills. No research has used more complex, pictorial stimuli, such as faces. This fact prompted one purpose of the current study: Does face recognition benefit from distributed presentations compared to massed presentations? If so, this finding might be useful in the forensic situations cited earlier.

A second purpose of the study was to determine whether covert facial imaging (or rehearsal) between presentations facilitates later recognition of the faces. Previous research suggests that such visual rehearsal is beneficial (Graefe & Watkins, 1980; Sporer, 1988). However, the evidence is not conclusive, because some research has failed to find a positive effect of post-exposure imaging of faces (e.g., Schooler & Engstler-Schooler, 1990). Indeed, even in research showing a positive effect of imaging faces, only a small effect has been found (e.g., Graefe & Watkins, 1980). The present study re-examines the effectiveness of post-exposure imaging of faces.

One difficulty in measuring the effect of imaging concerns the selection of the appropriate control condition. In this study, target imaging is compared to two non-target control tasks: (a) imaging an earlier-presented face, and (b) performing an irrelevant perceptual speed (letter-search) task. These two control tasks represent a "within domain" (facial imaging) and an "out of domain" (no facial imaging) task. Thus, a subsidiary question is addressed: Does a control task with greater similarity to the primary target-study activity (non-target imaging) produce more interference compared to a control task with less similarity (letter-search activity)? According to some research (e.g., Allport, Antonis, & Reynolds, 1972; Friedman & Polson, 1981), we might expect two tasks that require similar processing resources to produce greater interference than two tasks that require different processing resources. Thus, the performance of participants imaging the non-target face was expected to be worse than participants performing the letter-search task.

A third purpose of the present study involves examination of the effect of study versus test view. In most face memory research, the same pictures are used in both study and test conditions. However, a large body of research shows that when the stimulus face is changed at test, recognition performance is severely degraded (Bruce, 1988). For example, inversion and lateral reversal of the face pictures (McKelvie, 1983) and change of expression and pose (Kottoor, 1989; Wogalter & Laughery, 1987) dramatically lowers recognition performance. However, these kinds of alterations differ considerably from events that a witness is likely to encounter. It is not unusual for a witness to be involved in a task of trying to recognize the assailant who has undergone multiple changes in appearance (e.g., aging & hair style) since the face was first viewed (Bruce, 1988). In the current research, some of the target faces were shown in the same view at study and test, while others were changed at test. The change involved using another picture taken of the same person separated by approximately 1 year. While we would expect recognition to be better for the same view