Journal of Experimental Psychology: Applied
2005, Vol. 11, No. 3, 147–156

1076-898X/05/$12.00 DOI: 10.1037/1076-898X.11.3.147

Building Face Composites Can Harm Lineup Identification Performance

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Face composite programs permit eyewitnesses to build likenesses of target faces by selecting facial features and combining them into an intact face. Research has shown that these composites are generally poor likenesses of the target face. Two experiments tested the proposition that this composite-building process could harm the builder's memory for the face. In Experiment 1 ($n = 150$), the authors used 50 different faces and found that the building of a composite reduced the chances that the person could later identify the original face from a lineup when compared with no composite control conditions or with yoked composite–exposure control conditions. In Experiment 2 ($n = 200$), the authors found that this effect generalized to a simulated-crime video, but mistaken identifications from target-absent lineups were not inflated by composite building.

Keywords: eyewitness, composite faces, lineups

Eyewitness identification from live and photographic lineups is a staple type of evidence used against criminal suspects. Over the last 25–30 years, cognitive and social psychologists have conducted research questioning the accuracy of eyewitness identification evidence, examining the critical variables, and devising methods to improve eyewitness identification accuracy (e.g., see Cutler & Penrod, 1995; Wells, 1993). Over the last decade, forensic DNA testing has been used to exonerate people who were convicted of crimes they did not commit, and the vast majority of these cases involved mistaken eyewitness identification (Wells et al., 1998). The U.S. justice system has now started to incorporate better methods of eyewitness identification based on psychological research (see Wells et al., 2000).

When criminal investigators have both a crime suspect and an eyewitness to the crime, investigators place the suspect (or a photo of the suspect) in a lineup of persons (or photos of persons) for the purpose of seeing whether the eyewitness can identify the suspect as the culprit in question. Variables affecting the chances that the witness will accurately identify the culprit, identify an innocent person, or make no identification at all are highly complex. These variables include witness characteristics (e.g., Hosch & Platz, 1984), viewing conditions at the time of the crime (e.g., Lindsay, Wells, & Rumpel, 1981), disguises (e.g., Cutler, Penrod, & Martens, 1987), witness and culprit race (see Meissner & Brigham, 2001), retention interval (e.g., Krafka & Penrod, 1985), prelineup instructions given to the witness (see Steblay, 1997), characteristics of the lineup fillers that are used (e.g., Wells, Rydell, & Seelau, 1993), and whether the lineup contains the actual culprit (see Wells & Olson, 2002), among others.

Often, crime investigators have an eyewitness to a crime but have no particular suspect. In such cases, investigators will sometimes resort to the use of techniques to build a facial composite of the culprit. Police sketch artists, for example, were used in as many as 10% of law enforcement agencies in the mid-1980s (MacDonald, 1984), but these have tended to be replaced by other facial composite production systems. The Identi-Kit and the Photofit Kit, for example, use transparencies of facial features that are superimposed over each other to create facial likenesses. Hundreds of hairstyles and eyes, dozens of mouths, noses, and chins are available for the person to select when building the face. In more recent years, computerized versions of facial composite systems have been developed to run on PCs. One of the computerized systems in use in U.S. law enforcement agencies today is the FACES (Cote, 1998) program, which is what we used in the current research. All of these facial composite systems have in common the fact that the person must select individual facial features (e.g., hair, nose, eyes, chin, mouth, facial hair) and combine them to yield an emergent image of a face. This "particularistic" (feature-based) approach used by composite systems is different from the "holistic" manner in which people are presumed to perceive and store faces in memory (see Tanaka & Farah, 1993; Tanaka & Sengco, 1997; Wells & Hryciw, 1984).

Although the meaning of holistic face memory is not fully understood at a theoretical level, it seems reasonable to speculate that faces are not represented in memory in a manner that permits people to build facial composites that represent reasonable likenesses of the target face that they intended to build. Research has consistently shown that various facial composite systems yield hit rates on the original faces that are barely above chance levels of performance (e.g., Christie & Ellis, 1981; Ellis, Davies, & Shepherd, 1977; Ellis, Shepherd, & Davies, 1975; Gibling & Bennett, 1994; Green & Geiselman, 1989). Using a computerized facial composite system, for example, Kovera, Penrod, Pappas, and Thill (1997) found that composites of individuals who were well known to the composite builder were no better than chance in directing naïve participants to the correct person in a five-person lineup that included the target individual. There are too few controlled studies

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This research was supported by National Science Foundation Grant SES0211711 to Gary L. Wells.

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of sketch artists at this point to know whether they fare appreciably better than composite production systems in yielding likenesses of the intended target face. Such studies are made difficult by numerous factors, including the need to find and test representative samples of sketch artists (rather than one or two sketch artists). Accordingly, our discussion and conclusions in this article are restricted to facial composite systems and are not necessarily meant to generalize to sketch artists.

If composites tend to be poor likenesses of the target face that they were intended to depict, then might this have implications for the witness's memory for the face and his or her prospects for being able to identify that face later? Three published articles have included conditions that partially test this hypothesis. Davies, Ellis, and Shephard (1978) used a comparatively small sample (20 participants) and found evidence in the direction of recognition impairment from using the Photofit composite system, but the effect was not statistically significant. Lack of statistical significance is not surprising because a sample size of 20 would have less than 20% power to detect a medium size effect at $\alpha < .05$ in this type of experiment. Mauldin and Laughery (1981) found a significant increase in recognition accuracy following use of the Identi-Kit composite system, despite having a small sample size of 20 participants. However, Mauldin and Laughery's (1981) research also found an unusual result for verbal descriptions, namely an increase in later recognition accuracy, which goes against the standard verbal overshadowing effect (see Meissner & Brigham, 2001). There might be something unusual about their experiment, in which the target appeared in Position 125 in a 130-photograph set, which is very different from a standard lineup (Wells et al., 1998). In any case, as an outlier in the verbal overshadowing meta-analysis, we are reluctant to assume that Mauldin and Laughery's (1981) results for the composite portion of their experiment would necessarily represent our expectations for the composite effect. Finally, a study by Yu and Geiselman (1993) found that participants who used the Identi-Kit increased the reluctance of witnesses to make identifications when the target face was present (misses = 33% in control condition and 50% in Identi-Kit condition). Again, the experiment was somewhat underpowered, with only 20 participants in the Identi-Kit condition.

The sparse, underpowered, and inconsistent literature on the effects of composite production on later recognition stands in contrast to the import of the question. The decision to have an eyewitness build composite is a system variable. The effects of such a variable on identification accuracy could have an impact on policies used by law enforcement, especially in the current era in which law enforcement is increasingly taking direction from the eyewitness literature (Wells et al., 2000).

There are, of course, several possibilities for what might happen to recognition memory following the building of a composite. First, it is possible that building a composite face has no implications for the witness's memory; the witness's memory for the original face remains intact, and the composite face does not interfere or compete with that memory. Second, it is possible that building a composite face creates a second memory; there are now two memories of the face, the original memory and the composite memory, and they compete in any later memory task. Third, it is possible that the original memory is blended or averaged with the composite memory, yielding a new face that has some characteristics of the original face and some of the composite face. Fourth, it is possible that the original memory of the face is replaced with the composite face, yielding only one face in memory, namely that of the composite.

There are also hybrid possibilities for the effects of composites that involve more than one of these processes. For instance, the witness might end up with three faces in memory: the original face, the composite face, and a blend of the two. These ideas of two memories, replacement of the original memory, blended memories, and so forth are actually complex and have not been fully resolved in related literatures that involve suggested memories (e.g., see Loftus, Schooler, & Wagenaar, 1985; McCloskey & Zaragoza, 1985). Accordingly, the current experiments do not resolve the precise process. However, we can establish some things. First, we can establish whether building a composite harms the ability of a person to identify the original face from a lineup. Second, we can establish whether any such effect is due to a shift in confidence (or a decision-criterion shift) or whether it is the result of a reduced familiarity of the original face. Third, we can establish whether any such effect is due to mere exposure to a composite face or whether the composite-building process itself causes the effect. Finally, we can establish how the effect of building a composite operates in lineups in which the target face is not present and whether it leads to increased correct rejections or actually increases the chances that an innocent person will be identified.

It could be said that building a composite is similar to giving a verbal description of a face, except that a composite is visual and is more concrete and specific. Indeed, the primary reason that crime investigators use composites is because eyewitnesses' verbal descriptions of culprits are usually too few in number and too vague (see Sporer, 1996b; Wells et al., 1993) to lead to specific suspects. Note, however, that both verbal descriptions and composites share the characteristic of being feature-based productions for what is presumed to be holistic memorial representations of the face.

Research on verbal overshadowing could shed some light on what to expect from composite productions. The verbal overshadowing effect, originally discovered by Schooler and Engster-Schooler (1990), is generally described as a negative effect of verbalizing a face on later attempts to recognize that face. The verbal overshadowing effect has been replicated extensively in the literature (e.g., Dodson, Johnson, & Schooler, 1997; Fallshore & Schooler, 1995; Ryan & Schooler, 1998), although the effect size has been generally small ($r = .12$ on the basis of meta-analysis by Meissner & Brigham, 2001). Recent experiments suggest that the verbal overshadowing effect could sometimes be the result of a change in decision criterion rather than an alteration of the underlying memory trace (Clare & Lewandowsky, 2004). Clare and Lewandowsky reached this decision-criterion conclusion on the basis of two primary observations in their experiments. First, verbalization reduced choosing rates for both target-present (from 80.0% choosing in the control condition to 63.3% choosing in the verbalization condition) and target-absent lineups (from 77.3% choosing in the control condition to 48.0% choosing in the verbalization condition). Second, when forced to make a choice from a target-present lineup, there was no significant effect of the verbalization manipulation. We do not necessarily think that the verbal overshadowing effect is always a result of a shift in response criterion because Meissner and Brigham's meta-analysis shows evidence that recoding interference or transfer-inappropriate retrieval seems to occur at least part of the time. Nevertheless, in the current work, we wanted to be sure that we could distinguish between a criterion shift and some type of changed memory that might result from building a composite. In Experiment 1, therefore, we permitted a "not present" response even though the target face was present, but then we forced nonchoosers to make a choice. Also, in Experiment 2, we included target-absent lineups to see whether building a composite increased the rate of nonchoosing.

We also wanted to be able to distinguish between the composite-building process itself and mere exposure to a composite face of the target. When a witness builds a composite, the witness must sort among a large number of facial features and settle on those that seem to best represent his or her memory of the target face. The witness can place these features together into an image and then try out various features, replacing them at will, until she or he is satisfied that the product is the best that can be achieved. In the end, a whole face is examined by the witness. We included conditions in the current experiments in which a 2nd participant was exposed to the resulting composite produced by each participant. These participants (hereafter called *yoked composite–exposure participants*) were informed that this was a composite of the target that was built by another participant. It is possible that any detrimental effects in the composite-building conditions on later lineup identifications are the mere result of having viewed a final composite of the target, not the process of having built the composite.

We believe that the questions that we are asking in this research require stimulus sampling for all the reasons described recently by Wells and Windschitl (1999). Specifically, we need some assurances that the faces used in this research are not unique in some way that make them especially likely to show or not show any effects. Hence, we sampled 50 different faces for use in Experiment 1, we used each face equally often in each condition, and we built 50 different six-person lineups around each face. The target face photos and the test face photos were the same photos (as opposed to a different photo of the same person), which is not necessarily advisable for testing some hypotheses (e.g., see Bruce, 1982). However, this does not confound our test of the hypotheses of interest because this characteristic of our studied and tested stimuli was true in all conditions. This methodology prevented us from using realistic crime scenarios in Experiment 1 because this would have required us to develop 50 video or live crimes around each of the 50 targets. However, after we had established the generality of the effect across a broad sample of faces in Experiment 1, we used a video crime in Experiment 2.

We predicted that building face composites would have two different effects. First, we predicted that participants who built a face composite would show a criterion shift as evidenced by an increased reluctance to attempt identifications. This claim is evidenced by a reduced confidence on the part of the eyewitness that she or he knows what the target looks like. However, we also expected that building a composite would impair the memory of the witness. Hence, we expected that the composite-building participants would show a diminished likelihood of identifying the target when forced to make identifications. It was less clear what to predict for the yoked composite–exposure conditions. Unlike the composite-building conditions, participants in the yoked composite–exposure conditions were not exposed to isolated facial features, and although they viewed a final visual product of an intact face, that face was from another participant, thereby permitting them to possibly separate that image from their own memory. Also, the yoked control composite was externally provided information rather than self-generated, which could produce less internalization of the image (see Meissner, Brigham, & Kelley, 2001). Some previous research has shown that exposure to a misleading composite leads witnesses to identify someone later who resembles the composite (see Jenkins & Davies, 1985; $\phi = .45$), but those were conditions in which the misleading composite was constructed specifically to resemble one of the nontargets in an identification task. Hence, although we expected that the yoked composite–exposure participants would perhaps experience some reduction in their confidence in their ability to identify the target, it might not actually harm their ability to identify the target if forced to make identifications.

Experiment 1

Method

Participants and design. A total of 152 undergraduate students participated in exchange for extra credit in their psychology courses at Iowa State University. Participants were randomly assigned to one of three conditions: a control condition, a composite-building condition, or a yoked composite–exposure condition. Within each condition, participants were randomly assigned to view 1 of 50 target faces. A caveat to random assignment required that the composite-building condition always have $N + 1$ completed composites compared with the yoked composite–exposure condition so that there was always a composite from a composite-building participant to show to a subsequent yoked composite–exposure participant. Sessions involved either 1 or 2 participants per session, each being placed in a separate room with a computer.

Materials. The 50 target photos were of 29 White men and 21 White women ranging in age from 18 years to 27 years. For each of the 50 target photos, five filler photos were selected that matched each target photo on the characteristics of gender, race, approximate age appearance, hair color, hair length, and any facial hair. In some cases, filler photos were repeated if they fit appropriately in a lineup for more than one target. Because a given participant only viewed one lineup, this did not result in a participant seeing the same photo twice. A total of 212 filler photos were used for the 50 six-person lineups. All photos had similar backgrounds. Photos were high-quality color photographs from a straight-on pose showing the neck to the top of the head. No clothing clues were visible. Each photo was presented on a color computer screen with the image measuring 8 in. × 6.4 in. The composite program used was FACES: The Ultimate Composite Picture (Cote, 1998) by Interquest Incorporated (Saint Hubert, Quebec, Canada). FACES includes 361 hair selections, 63 head shapes, 42 forehead lines, 410 sets of eyebrows, 514 sets of eyes, 593 noses, 561 sets of lips, 416 jaw shapes, 145 moustaches, 152 beards, 33 goatees, 127 sets of eyeglasses, 70 eye lines, 147 smile lines, 50 mouth lines, and 40 chin lines. Within each feature category, a selection button permits the user to view only subsets of the feature that meet a particular description. For instance, eyes are subdivided into the following subsets: narrow, deep set, overhanging lids, heavy lids, average blue or green, almond shaped blue or green, average brown, almond shaped brown, and bulging. Noses are subdivided into the following subsets: narrow, average with round base, average with broad base, average pointed, hooked nostrils not showing, hooked nostrils showing, slightly flared nostrils, very flared nostrils, round (bulbous), average large, wide base with nostrils showing, and side base with nostrils not showing. In addition, controls permit the features to be moved up or down, closer or farther apart, and made to be larger or smaller. Features are displayed on the right side of the computer screen. When clicked with a mouse, the feature then appears on the left side of the screen in a position appropriate to that feature on a face. So, for example, clicking any head shape, hair, eyebrows, eyes, nose, lips, and chin yields a very realistic face. Clicking a different set of eyes then instantly replaces the eyes on that face with the new eyes. Participants were encouraged to start with a feature that they best remembered (e.g., eyes, hair). No time limit was set for completing their composites, but no participants took longer than 20 min. The program keeps track of all features that were attempted so that the operator can return easily to a previous feature. Details can then be added, such as the mouth lines, smile lines, facial hair, and so on. Distances between features and feature sizes on the face can be manipulated on the intact face on the left side of the screen. The product can then be saved electronically. The FACES program is user-friendly in the sense that no special knowledge is required of computers other than how to operate a mouse. A recent study found that the FACES program produced better likenesses of target faces (by about 5% in being able to name the correct person) than older composite programs, such as the Identi-Kit and Photofit Kit (Frowd, Carson, Ness, Patterson, & Hancock, 2005).

Procedure, Day 1. Participants signed up for an experiment on "perceptions of people" but otherwise were told nothing about the purpose of the study before signing up. Participants understood that they would have to return for a second session 48 hr later. On arrival at the lab, participants were told that they would be asked to view a face on a computer screen and make various judgments about the face. Participants were then escorted individually to a cubicle that had a computer screen, keyboard, and mouse. The experimenter then gave each participant a sheet of paper with 10 question items. The 10 items asked the participant to rate a face on the following traits: attractive, intelligent, warm, aggressive, kind, happy, foolish, humorous, studious, and likable. An 11-point scale for each item ranged from 0 (*not at all*) to 10 (*very*). The experimenter then presented the target face on the computer screen. Participants were given 3 min alone to complete their ratings while the face remained in view. This procedure, in which participants make trait judgments while viewing the face, has been shown to induce a more holistic type of encoding than do procedures in which participants make physical judgments about facial features (see Bower & Karlin, 1974; Sporer, 1996b). Compared with feature-encoding tasks, trait-encoding tasks have been shown to produce better full-face recognition performance but poorer composite production performance (Wells & Hryciw, 1984). The experimenter then returned and deleted the target's image from the screen. Participants in all conditions then were asked to provide a verbal description of the target face on a blank sheet of paper. After writing their descriptions, control participants were dismissed with instructions to return 48 hr later for additional questions. After writing their descriptions, composite-building condition participants were instructed on the use of the FACES (Cote, 1998) program and attempted to build the target face. Instruction took about 8 min. The participant was then left alone to use the composite program. The average participant took about 16 min to create a composite. The experimenter then saved the composite product on the computer, and the participant was dismissed at that point with instructions to return 48 hr later for additional questions. After writing their descriptions, participants in the yoked composite–exposure condition were told (correctly) that another participant had viewed the same face that they had just viewed and then had used a composite program to try to build that face. They were then shown the composite from their yoked participant and informed that this was the result of that participant's attempt. Participants in the yoked composite–exposure condition were dismissed at that point with instructions to return 48 hr later for additional questions.

Procedure, Day 2. Only 2 participants failed to show 48 hr later for their second appointment, and those two are totally excluded from this report. On their return, participants in all conditions were treated identically. Participants first filled out a questionnaire that took approximately 12 min and was totally unrelated to the current research. Then, participants were escorted back to their original cubicle. It was explained that we were interested in their ability to identify the photo of the person they had viewed and rated on various traits 48 hr earlier from a lineup of six photos. The experimenter strongly emphasized that the photo of the person that they had rated 48 hr earlier might or might not be among the six that they were going to view. "Hence," the experimenter explained, "the correct answer might be 'none of the above.'" In fact, the target was always in the lineup and appeared in a position determined randomly for each participant. The lineup arrays were displayed as two rows of three persons each, all six displayed simultaneously. After the identification decision was recorded, any participants who made no identification were then asked to go ahead and make an identification to wit "If you had to identify one of these photos as the one that you rated 48 hr ago, which photo would you pick?" (Readers should note that witnesses should never be forced to make identifications in actual criminal cases.) Participants then rated their confidence that their identification was correct on a scale ranging from 0% (*not at all confident*) to 100% (*positive*).

Results

Table 1 reports the percentages of participants who identified the target, a filler, or made no identification in each of the three conditions. The fourth column reports the percentages of participants who identified the target after the nonidentifying participants were forced to identify someone. Chi-square tests were performed to locate statistically significant differences between conditions in the rates of identification of the target, identification of fillers, and identifications of the target when forced to choose. Four orthogonal chi-square tests were conducted, so we used the p level of .05/4 or .0125 to hold the overall alpha level at .05. Effect sizes for the chi-square tests were expressed as phi, for which a medium size effect is .30. Power for this experiment on the chi-square tests was approximately 60% to detect a medium size effect at $p = .0125$.

The results showed significant evidence that identifications of the target were more likely in the control condition (84%) than in the two composite conditions combined (54%), $\chi^2(1, N = 150) = 13.02$, $p < .001$, $\phi = .29$. In addition, identifications of the target

Table 1
Percentages of Participants Identifying the Target, Identifying a Filler, Making No Identification, and Identifying the Target When Forced to Make an Identification by Condition in Experiment 1

Condition	Identification of target	Identification of filler	No identification	Identification of target under forced identification
Control	84	6	10	94
Composite building	10	30	58	30
Yoked composite–exposure	44	6	50	82

were more likely in the yoked composite condition (44%) than in the composite-building condition (10%), $\chi^2(1, N = 100) = 14.66$, $p < .005$, $\phi = .38$. Filler identifications were more likely for those in the composite-building condition (30%) than for the control and yoked composite conditions combined (6%), $\chi^2(1, N = 150) = 15.95$, $p < .001$, $\phi = .33$. Finally, when forced to make a choice, the likelihood of identifying the target was higher in the control and yoked-composite conditions combined (88%) than in the composite-building condition (30%), $\chi^2(1, N = 150) = 54.12$, $p < .001$, $\phi = .59$. We did not analyze rates of nonidentification decisions because those data are not independent of the rates of target and filler identifications (i.e., 100% minus target plus filler identification rates is equal to no identification rate).

Confidence results. Two orthogonal *t* tests were conducted comparing mean confidence, so the critical level of alpha was set at .05/2 or .025 to control for the number of comparisons. Participants' mean confidence in identifications was significantly higher for the control condition ($M = 78.3\%$) than for the combined composite-building and yoked composite–exposure conditions ($M = 50.6\%$), $t(149) = 2.84$, $p < .005$, $d = .56$. The composite-build and yoked composite–exposure conditions did not significantly differ, $t(99) = 1.12$, $p = .265$, $d = .22$. The point-biserial confidence-accuracy correlation was high for the control condition and for the composite-building condition ($r_{pb} = .59$ and .54, *p*s < .01, respectively) but low for the yoked composite–exposure condition ($r_{pb} = .12$, *ns*).

Goodness of composites. In an attempt to determine how similar the composites were to the actual faces, a separate sample of 10 participants each attempted to match one composite to one of the six lineups members that was used with that composite for each of the 50 composite/lineup combinations. Overall, the match rate was 24.6% (chance = 16.7%) and ranged between 0% and 84%. An important finding was that the point-biserial correlation across the 50 lineups between the match rate (a measure of the goodness of the composite) and the accuracy of identification for the composite-building condition participants was significant ($r_{pb} = .47$, $p < .01$).

Discussion

The results of this experiment provide evidence that building a face composite diminishes the prospects that a person will later be able to identify that face from a six-person lineup. Compared with a control condition, both those who built a composite face and those who merely observed the composite face that was built by another participant exhibited an increase in the tendency to make no identification attempt from the lineup at all. However, when forced to choose someone from the lineup, only the participants who built a composite face exhibited a significant decreased ability to identify the target face. Hence, although mere exposure to the face composite product of another participant reduced participants' confidence that they could identify the target and increased their reluctance to make identifications, mere exposure—unlike actually building a composite face—did not significantly affect the ability of participants to accurately identify the target when forced to make identifications.

The relation between eyewitness identification confidence and accuracy is not a constant but instead is influenced by numerous moderating variables (see Sporer, Penrod, Read, & Cutler, 1995). The confidence-accuracy correlations revealed a particularly interesting pattern of results. Participants in the control condition and participants in the composite-building condition exhibited strong (*r*s = .59 and .54) confidence-accuracy relation, but those in the yoked composite–exposure condition did not ($r = .12$). We propose that this pattern can be explained rather easily. Those who were exposed to the composite of another participant tended to lose confidence in their ability to identify the target from the lineup and yet, when they were forced to make a choice, were as accurate as the control-condition participants. Their modest level of confidence (56% confidence) but high accuracy when forced to choose (82% accuracy) suggests that the yoked-composite condition participants were not aware that they in fact knew the correct answer. Those who built a composite also expressed low confidence that they could identify the target from the lineup (46% confidence) but, unlike their yoked composite–exposure controls, were in fact inaccurate when forced to make a choice (30% accuracy). Hence, the participants who built a composite seemed aware that they in fact did not know the correct answer.

Our goal in this experiment was to determine whether building a face composite impairs performance for a later identification task. We believe that we have established that it does cause such impairment, at least under the conditions in which we operationalized this experiment. Our yoked composite–exposure control condition helps rule out interpretations that are based merely on exposure to a completed composite face. Nevertheless, we do not know the precise mechanisms that are producing the effect. We strongly suspect that the impairment results from the process of having to break the face down into individual facial features to perform the composite-building task. There is a consensus in the extant literature on face processing that faces induce holistic, Gestalt-like processing and representation that reduces the accessibility of information about individual facial features (see review by Maurer, Le Grand, & Mondloch, 2002). It seems to us that forcing people to try to recreate a holistic memory by recognizing and assembling individual parts is an unnatural act that can reconfigure the memory representation.

There are, of course, other levels of explanation for the results that we could not test in this experiment. For instance, the performance difference between the yoked composite–exposure control condition (which did not show memory impairment) and the composite-building condition (which did show impairment) could have been due to the differential "investment" that they had in the composite. Those who were merely exposed to a composite of another participant had no personal investment in that product, no particular reason to believe that it was a serious attempt by the other participant, and so forth. However, yoked composite–exposure did have a significant effect on participants' willingness to make an identification attempt and on their confidence. Hence, mere exposure to a composite face did have effects, and so participants clearly did not dismiss the composite as something that was uninformative about the identity of the target.

We have learned from related literatures on misinformation effects that it is almost impossible to determine the fate of the original memory, such as whether the original memory has been altered by postevent information or whether a second memory has been formed that competes with the original memory at the time of test (e.g., see Loftus et al., 1985; Loftus & Loftus, 1980; McCloskey & Zaragoza, 1985). It is worth noting, however, that our experiment used a version of the so-called "modified test" proposed by McCloskey and Zaragoza that helps rule out the two-memory hypothesis. McCloskey and Zaragoza noted that misinformation experiments typically include the misinformation item as a test alternative. Such tests could simply prove that the participants have two memories, one for the original item and one for the misinformation item. The modified test, on the other hand, is one in which the original item remains an option among filler items, but the misinformation item is not one of the options. McCloskey and Zaragoza's modified test was used in this experiment because it included the original item (target-present lineups) but not the misinformation item (e.g., the composite or a face that was designed to resemble the composite). If participants in the composite-building conditions had two memories (one of the original face and one of the composite), then they still should have been able to identify the original face. The fact that they could not identify the original face when the composite face was not an option suggests that the original memory was actually impaired.

An applied perspective was one of the primary driving factors in this research, and the applied implications of this experiment are fairly clear. The decision by crime investigators to build a composite face is usually based on the issue of whether there is a suspect in the case. If there is a suspect, or a defined set of possible suspects, then investigators will usually follow those leads, check alibis, and perhaps conduct a lineup for the eyewitness. Composites tend to be reserved for cases in which there are few or no leads and the idea is that the composite might help develop a pool of possible suspects from the general population. The results of this experiment, however, suggest that the decision to develop a composite comes at a potential cost. The cost can occur later when a suspect emerges in the investigation, and the eyewitness is then shown a lineup containing that suspect. Given the usual cautionary instructions (the actual culprit might or might not be present in this lineup), participants who either built a composite or simply viewed the composite of another participant were significantly less likely to identify the actual target than were those who did not build a composite or view the composite of another participant ($\phi = .29$). If forced to choose someone, those who built a composite were one third as likely to be able to pick out the target ($\phi = .59$). There might be other costs and benefits to the decision to have an eyewitness build a composite of a culprit, but the diminishment of the eyewitness's later ability to pick the culprit out of a lineup is a serious consideration that must be brought into the decision process.

Experiment 2

The applied implications of this work beg for a further test of the effect of composite building, namely, what happens if the witness views a lineup that does not contain the actual target? Extensive writings and experiments in the eyewitness identification literature explain the importance of including target-absent lineups in eyewitness identification research designs (e.g., see recent treatment in Wells & Olson's, 2002, study). Because a proper lineup contains only one suspect (who might or might not be the culprit), eyewitness-identification researchers do not count identifications of fillers in a target-present lineup as mistaken identifications of innocent suspects. A mistaken identification of an innocent suspect, therefore, can only occur when the culprit is not in the lineup (see Wells & Turtle, 1986). Furthermore, identification patterns with target-absent lineups are not fully predictable from identification patterns with target-present lineups. A primary purpose of Experiment 2, therefore, was to find out whether the building of a composite would increase mistaken identification rates in target-absent lineups. The results of Experiment 1 suggest that this is likely to happen because building composites increased the rate of filler identifications in target-present lineups. Hence, we predicted that building a composite would reduce accurate identification rates for target-present lineups (as in Experiment 1) but also would increase mistaken identifications for target-absent lineups. Although we expected composite building to increase mistaken identifications for target-absent lineups, we also expected the increase to be limited by the tendency of composite building to make participants less confident in their ability to make identifications.

Another reason for conducting the second experiment was to increase the ecological validity of the materials. Experiment 1 used still photos for encoding and still photos for the lineup. The target photo for the lineups in Experiment 1 was the same photo that was used for encoding. This circumstance creates a great advantage in overall performance because the participant need only recognize the specific photo of the target rather than a different photo of that person. This is perhaps the reason that the overall performance of the control-condition participants was so high (94% able to pick out the target photo when forced to make a pick). In actual criminal cases involving eyewitnesses, however, the witnessed event is more dynamic, and the photo of the target used in a target-present lineup is not an exact duplication of what the witness viewed. In an actual criminal case, the lineup photo of the target in a target-present lineup is the same person who committed the criminal act but not an exact duplicate of what the witness originally saw (e.g., not the same expression on the face, not the same pose, photo not taken on the same day as the crime). Accordingly, in Experiment 2 we used a video crime, and the photo of the culprit was taken on a different day, wearing different clothing, and with a different background than that shown in the video. We did not include a yoked composite–exposure condition in Experiment 2.

Method

Participants and design. A total of 200 undergraduate students participated in exchange for extra credit in their psychology courses at Iowa State University. Participants were randomly assigned to one of four conditions of a 2 (target-present or target-absent lineup) × 2 (composite building vs. control) factorial design. Sessions involved either 1 or 2 participants per session, each being placed in a separate room with a computer.

Materials. The witnessed event was a video that lasted 65 s and showed a man on a rooftop placing an object down an airshaft. His face was in full view for 21 s. The man was approximately 20–22 years old with short, dark hair, no facial hair or glasses, and no other distinguishing characteristics. Hereafter, he is called the *rooftop bomber* or *target*. Seven high-quality color photographs were used to create the photo lineups. One photo was of the rooftop bomber, and the other six photos were of other men who were approximately 20–22 years old with short, dark hair, no facial hair or glasses, and no other distinguishing characteristics. The target-absent lineup included all six of the nontarget photos and was always in the same order. Target-present lineups were created by replacing each member of the target-absent lineup with the target 8 times for Positions 3–6 and 9 times for Positions 1–2 in each target-absent condition. (Because there were 50 participants and six potential positions for the target, two positions were occupied one extra time. However, this was equally true for both the control condition and the composite condition.) This replacement scheme means that there was no a priori innocent suspect for the target-absent lineups; hence, the unbiased estimate of the chances that an innocent suspect would be identified is one sixth of the total rate of identifications of someone from the target-absent lineup.

Procedure, Day 1. Participants signed up for an experiment on "perceptions of people" but otherwise were told nothing about the purpose of the study before signing up. Participants understood that they would have to return for a second session 48 hr later. On arrival at the lab, participants were told that they would be asked to watch a short video and to pay close attention because they would be asked questions about the video later. Participants were then escorted individually to a cubicle that had a computer screen, keyboard, and mouse. The video was then played for the participant on the computer screen. After the video ended, the experimenter returned and informed participants that the person on the roof in the video had planted a bomb down the air shaft of the building. Participants in all conditions then were asked to provide a verbal description of the rooftop bomber's face on a blank sheet of paper. After writing their descriptions, control participants were dismissed with instructions to return 48 hr later for additional questions. After writing their descriptions, composite-building condition participants were instructed on the use of the FACES (Cote, 1998) program and followed the same procedure that was used in Experiment 1.

Procedure, Day 2. Only 3 participants failed to show 48 hr later for their second appointment, and those 3 are totally excluded from this report. On their return, it was explained to all participants that we were interested in their ability to identify the bomber on the roof that they had viewed 48 hr earlier. The experimenter strongly emphasized that the photo of the person that they had viewed 48 hr earlier might or might not be among the six that they were going to view. "Hence," the experimenter explained, "the correct answer might be 'none of the above.'" The lineup arrays were displayed as two rows of three persons each, all six displayed simultaneously. After the identification decision was recorded, any participants who made no identification were then asked to go ahead and make an identification: "If you had to identify one of these photos as the one that you viewed in the video 48 hr ago, which photo would you pick?" Participants then rated their confidence that their identification was correct on a scale from 0% (*not at all confident*) to 100% (*positive*).

Results

Four orthogonal chi-square tests were conducted, so we used the p level of .05/4 or .0125 to hold the overall alpha level at .05. Effect sizes for the chi-square tests were expressed as phi, for which a medium size effect is .30. Power for this experiment on the chi-square tests was approximately 65% to detect a medium size effect at $\alpha = .0125$.

Target-present lineups. Table 2 reports the percentages of participants who identified the target, a filler, or made no identification for the target-present lineups for both the control and composite-building conditions. The fourth column reports the percentages of participants who identified the target after the non-identifying participants were forced to identify someone. Three orthogonal chi-square tests were performed in the target-present conditions to locate statistically significant differences between the two conditions in the rates of identification of the target, identification of fillers, and identifications of the target when forced to choose. Rates of nonidentification were not analyzed because those results would not be orthogonal to the three tests that were performed. The results replicated those of Experiment 1. Building a composite significantly reduced identifications of the target relative to the control, $\chi^2(1, N = 100) = 18.54$, $p < .001$, $\phi = .43$. Building a composite also significantly increased the rate of filler identifications, $\chi^2(1, N = 100) = 6.06$, $p = .014$, $\phi = .25$, and significantly reduced the rate of identifications of the target when participants were forced to make an identification, $\chi^2(1, N = 100) = 32.67$, $p < .001$, $\phi = .57$.

Target-absent lineups. Correct rejection rates did not significantly differ between the control condition (80%) and the composite-building condition (74%), $\chi^2(1, N = 100) = 0.51$, $p = .475$, $\phi = .07$. No chi-square test was conducted on rates of identification from the target-absent lineups because this is statistically identical to the test of correct rejections (i.e., 100% minus the correct rejection percentage is equal to the identification percentage).

Confidence results. As in Experiment 1, participants' mean confidence in identifications was significantly higher for the control condition ($M = 72.8\%$) than for the composite-building condition ($M = 53.5\%$) within the target-present conditions, $t(99) = 4.33$, $p < .001$, $d = .87$. Unlike Experiment 1, however, the point-biserial confidence-accuracy correlation was low for both the control condition ($r_{pb} = .17$, *ns*) and for the composite-building condition ($r_{pb} = .12$, *ns*). There was no significant confidence difference between the control ($M = 46.7\%$) and composite-building ($M = 43.1\%$) conditions within the target-absent conditions $t(99) = 1.03$, $p = .30$, $d = .21$. Because confidence was measured only after forcing identifications (i.e., confidence in nonidentifications was not measured), no confidence-accuracy correlation could be calculated in the target-absent conditions.

Discussion

Using different materials, we replicated the deleterious effects that composite building has on rates of identifying the target from a target-present lineup. Participants who built a composite were less likely to attempt identifications and, when forced to make a

Table 2
Percentages of Participants Identifying the Target, Identifying a Filler, Making No Identification, and Identifying the Target When Forced to Make an Identification by Condition in Experiment 2

Condition	Identification of target	Identification of filler	No identification	Identification of target under forced identification
Control	60	4	36	88
Composite building	18	20	62	32

selection, were far less likely to make accurate selections. This increases our confidence that the effects observed in Experiment 1 might generalize to actual witnesses who observe dynamic events and attempt identifications from photo lineups that include the culprit but do not use an exact replica of the face as it was seen originally.

An interesting finding was that we discovered no significant effects of composite building on the rates of correct rejections (and hence on mistaken identification rates) for the target-absent lineups. Although we had expected that there would be more mistaken identifications from the composite-building conditions on the basis of their greater rate of filler identifications in Experiment 1, in retrospect, the failure to find a significant increase in mistaken identifications makes sense. Even if composite building alters memory for the original face, there is no reason to think the altered memory systematically resembles the members of the target-absent lineup any more than the original face resembles members of the target-absent lineup. Accordingly, there is no reason to believe that control-condition participants (whose memory of the target is not altered) would find a match to the original face at a rate significantly lower than would those whose memory was altered, as long as the target face is not in the array.

General Discussion

We began this work with the goal of seeing whether having a person build a composite of a face has a negative effect on the person's memory for the face. Mindful of the need for stimulus sampling, we used 50 separate faces in Experiment 1 to make sure that our conclusions could be generalized across a broad sample of faces. In addition, we wanted to separate any effects of mere exposure to the composite face products from the process of actually being the one who built the composite face, so we yoked each participant who built a composite to another participant who was then exposed to the composite product. Furthermore, we wanted to separate any effects of a criterion shift (specifically, an increased reluctance to attempt an identification) from an actual change to or confusion of the original memory. Hence, participants were first given the option of making no identification, but then all participants were forced to make a lineup choice. The results clearly supported the hypothesis that building a composite significantly lowered accuracy for identifying the original face. When forced to make a choice from a lineup that included the original target face, accurate identifications of the face were significantly reduced for those who built a composite face. Those who were exposed to a composite produced by another participant were also significantly affected, but the effect was limited to a criterion shift in which these yoked participants were more reluctant to attempt identifications but, when forced to make a choice, showed no significantly reduced ability to accurately identify the original target.

Our second experiment showed that the results can be generalized to more dynamic witnessing events in which the lineup photos at test are not duplicates of the exact stimulus face that was encoded, a condition that applies to virtually all actual lineup situations. In addition, our second experiment shows that, other things being equal, the building of a composite did not significantly inflate mistaken identification rates for target-absent lineups. The latter observation, however, needs to be associated with two important caveats. First, despite the fairly large sample sizes (100 participants per condition), power for detecting medium size effects ranged from .60 to .65 for the Bonferroni-corrected alpha levels that we used. Although all of the medium or greater effect sizes were significant, some of the small effects might have been significant with an appreciably higher sample size. Second, although we found no significant increase in mistaken identification rates for target-absent lineups as a function of composites, this research did not test a particular set of conditions that might be especially likely to inflate mistaken identifications in actual cases. Specifically, the primary purpose of having eyewitnesses build composites in actual cases is to narrow the pool of potential suspects and perhaps receive tips regarding the identity of the culprit. This is why, for instance, composites are often published in newspapers or broadcast on TV news programs. If an innocent person then becomes a suspect because of resemblance to the composite built by the eyewitness, and thus ends up being placed in a lineup, then the innocent suspect could very well match the "new" memory of the eyewitness and be at high risk of mistaken identification. (This concern applies equally regardless of whether we assume the composite changes the witness's memory or simply creates a second memory.) We did not test this potentially dangerous path. However, Sporer (1996a) tested precisely this hypothesis and found support for it. Hence, had we selected an innocent suspect for the absent lineup on the basis of similarity to the composite, we might have found a significant increase in the rate of mistaken identifications.

One of the recommendations for selecting lineup fillers is that they should be matched to the description that the eyewitness gave of the perpetrator as long as the suspect (innocent or guilty) matches that description (see Wells et al., 1993). In cases in which a composite exists and the composite resembles the suspect, the composite should be considered the eyewitness's description for purposes of selecting fillers. We did not use the composite to select lineup fillers in this work because the composite was not used to select the suspect (see previous paragraph). As a result, had we selected fillers to resemble the composite, we might have skewed our results toward the fillers for witnesses who built composites, and this would have constituted an alternative explanation for our results.

The legal system has taken a great deal of direction from the eyewitness identification literature in recent years and the impact of this lab-based psychological science has been remarkable (see Wells et al., 2000). We find it interesting, however, that almost all of psychology's research-based recommendations to the legal system have emphasized law enforcement practices that contribute to mistaken identification and how to reduce mistaken identifications by altering those practices (see Wells et al., 1998). The current work carries a somewhat different flavor. Although still emphasizing how law enforcement practices might be contributing to an eyewitness identification problem, the problem here concerns how certain practices could contribute to the loss of accurate identifications rather than the enhancement of mistaken identifications.

Our interpretation of the effects observed here is similar to an interpretation of verbal overshadowing that was given by Schooler and Engster-Schooler (1990) and by Meissner and Brigham (2001). These researchers suggested that verbal overshadowing results from the verbal description task, causing participants to recall incorrect details, which then confuse the original memory.

Schooler and Engster-Schooler (1990) termed this process *recoding interference*. Consistent with this is the observation from Meissner and Brigham's (2001) meta-analysis that instructions that require more elaborate and detailed descriptions (e.g., describe the eyebrows, the chin) produce a greater decrement in later recognition performance than do instructions requiring only free recall (describe what you can remember). In the case of a composite, the detail required to complete the composite is even more detailed than most any verbal description, and the result is very specific. One cannot decide, for instance, to leave off the eyebrows or not insert a chin. Hence, the chances of participants inserting features that they do not recall is high with the composite production task. In fact, we know of no studies that have examined the test–retest reliability of composites. It is possible that the same witness doing a composite two or more times might select different features each time.

We are not yet prepared to argue that the use of composites should be significantly curtailed in criminal investigations. On the one hand, we know that composites usually produce results that poorly resemble the actual face that they were meant to depict (e.g., Christie & Ellis, 1981; Ellis et al., 1975, 1977; Gibling & Bennett, 1994; Green & Geiselman, 1989; Kovera et al., 1997) and that composites can apparently impair the witness's ability to identify the original face (current research). On the other hand, we do not know how often composites somehow manage to help crime investigators eliminate potential suspects or narrow the search of possible suspects. Furthermore, in multiple witness crimes, it might be possible to use one witness to build a composite and save the other witnesses for any later lineup identification attempts. Furthermore, we cannot be certain that the effects we observed here are applicable to sketch artists. Like computer and transparency-based face composite systems, the sketch artist process is somewhat feature-based rather than holistic. Unlike computer and transparency-based face composite systems, however, the sketch-artist process does not require the witness to examine isolated facial features and select among them. Hence, we reserve judgment on the sketch-artist process until we more fully understand the processes leading to the effects that we observed here.

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Received November 18, 2004
Revision received April 11, 2005
Accepted April 11, 2005 ■