FACIAL RECOGNITION: EFFECTS OF CHANGING ACCESSORIES[1]

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A facial recongition study examined effects of accessories changes between initial exposure to a target person and that person's appearance in a recognition task. Three accessories were manipulated; glasses and beards (present or absent) and hair style (long or short). Changes in both directions had marked negative effects upon recognition, with hit rates dropping as much as 42 percent. The various accessories had differential effects; glasses producing the smallest decrement and beards the largest. False positive errors were also increased by accessory changes. The results have implications for criminal identification systems.

INTRODUCTION

Two earlier papers (Laughery, Alexander and Lane, 1971; Laughery, Fessler, Lenorovitz and Yoblick, 1974) reported a series of experiments exploring the effects of several task variables on facial recognition. The paradigm in these studies simulated a situation in which a witness who has seen a criminal attempts to identify that person's picture in a set of alternatives. Two variables strongly affected recognition: the more decoys (or distractors) preceding the target, the poorer the performance; and the more similar the decoys were to the target, the poorer the performance.

The results of these experiments were related to the design of criminal identification systems. An important set of task variables in such a system that have not been explored to date, however, concerns differences between the target's appearance in the initial exposure and his appearance in the recognition task. In all of the earlier studies the target's appearance was basically the same in the two instances. In the real-world of criminal identification there are frequently changes in appearance. The study reported here explored one class of changes; namely, differences in accessories. Accessories refer to parts of the facial stimulus that are not permanent and are relatively easy to modify. Examples would be beards, moustaches, glasses, hair styles and cosmetics. This experiment dealt specifically with three of these; glasses, beards and hair styles.

METHOD

Subjects. The Ss were 480 undergraduate students enrolled in introductory psychology at the University of Houston. Class credit was given for participation in the study.

Task. The task in this experiment was essentially the same as that reported in Laughery, Alexander and Lane (1971) and Laughery, Fessler, Lenorovitz and Yoblick (1974). Ss first viewed four sequentially presented slides of the target person in different candid positions. The Ss task was to indicate, using a 6-point scale (definitely yes, probably yes, possibly yes, possibly no, probably no, definitely no), whether each picture in a subsequent, sequentially presented test series of slides was or was not the target. The slides were projected so as to be approximately life size on the screen. The target's picture appeared only once in the test series.

Design. The design of the experiment was a 3 x 4 x 4 factorial with all factors manipulated as between-S variables. The conditions of the first variable, accessory, were beard, hair style and glasses. The second variable was the view-search accessory relationship. More specifically, this variable refers to an accessory change between the target's appearance in the initial exposure and his appearance in the search series. The levels of this variable were defined by the accessory being same or different and the actual condition of the accessory. In the case of the beard and glasses accessories, the change related to the presence or absence of the accessory. For hair style the change was long versus short hair. Perhaps the four levels of this view-search variable are better understood by noting the specific view-search relationships. If we think of "with" as referring to the presence of the accessory (or long hair), and "without" as the absence of the accessory (or short hair), then the four conditions of same or different for each of the three accessories were with-with, with-without, without-with, and without-without.

The third variable, target, consisted of four different people, all white males, whose pictures were used as targets.

A total of 10 Ss were run in each of the 48 experimental conditions.

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Materials. The people recruited to be target persons were all clean shaven and had a long hair style. A make-up artist prepared the targets for the different accessory conditions. A short wig was used to effect the hairstyle change. The beards were full and included a moustache. The glasses, of course, were simply put on or off. In this manner a full set of photographs, including candid and posed, were taken for each target with each accessory condition. Ten separate targets were made up and their photographs taken. From these 10 four were selected for the study. The selection criteria were concerned primarily with how natural the makeup appeared. Figure 1 shows one of the targets used in the study with the different accessory conditions.

In this experiment the accessories were manipulated independently; that is, no interactions were considered. Putting it another way, in manipulating the presence or absence of an accessory, only 1 accessory was changed. For example, when the target appeared with a beard, he did not wear glasses and appeared with a short hair style. Similarly, when the target appeared with a long hair style, he was clean-shaven and did not wear glasses.

The test series consisted of 74 decoys and the target, all appearing in front, bust views. The decoys were all white males ranging in age from 18 to 28. Half of the decoys in the test series consisted of decoys without glasses, without beards and with short hair. The appearance of the remaining decoys depended upon the accessory condition. If the condition concerned beards, then the remaining 37 slides contained pictures of men with beards. Similarly, if the condition concerned hair or glasses, the remaining pictures contained long hair or glasses respectively.

The order of the decoys was random with the constraint that no more than 4 consecutive decoys were of the same type with respect to presence or absence of the accessory. The physical parameters of all slides were constant (sharpness, scale, lighting, etc.).

The candid position slides showed the target person in positions ranging from left to right side, full length, and bust views. The candid positions were selected from a larger set of photographs of the target with an effort to select those which seemed least posed.

Apparatus. The apparatus consisted of a Kodak Carousel AV 900 projector with a 4 to 6 in., F3.5 Zoom Ektamar Lens and a Da-Lite projection screen.

Procedure. The Ss in each of the 48 experimental conditions were run as a group. Five Ss were seated at each of two long tables, one behind the other, in a normal size classroom. The screen was located at the front center of the room at a height slightly above the seated Ss. The tables were 7.0 and 12.0 feet from the screen. The projector was located at the rear center of the room. The room was darkened to insure good vision of the slides, but with sufficient light to read and mark the answer sheet.

The instructions were presented in two parts. The first part made clear that the Ss would later be looking for a picture of a person whom they were about to see. Following the presentation of the 4 candid photographs of the target for 10 seconds each, the Ss were given the second part of the instructions. This part included details about the use of the answer sheet and a statement that the target might appear in the test series several times, only once, or not at all. In fact, the target appeared just once, in position 69. Presentation of the second part of the instructions required 4 minutes and the test series followed immediately.

During the search sequence, each slide was projected on the screen for seven seconds with two seconds between slides - during which the Ss recorded their responses on answer sheets.

Any S who knew the target person was given credit for participation and excused from the experiment. The Ss were asked to indicate on their answer sheets if they knew any of the decoys. There was a negligible number of responses indicating any S knew a decoy face.

RESULTS

The Yes and No responses to the target picture in the test series are referred to as hits and misses. Similarly, the Yes and No responses to the decoys are referred to as false alarms and correct rejections. For a given S the hit-miss (H-M) score could be a single value from 1 to 6. A score of 6 indicates that the S responded definitely yes when the target appeared, 5 was probably yes, and so on, with a score of 1 indicating a response of definitely no. Two false alarm-correct rejection (FA-CR) scores were computed for each S. One considered responses to decoys with all accessories absent; the other considered responses to decoys with the accessory present.

Two analyses were carried out on the results. The first was an analysis of variance on the H-M scores. The mean H-M scores for the 12 treatment conditions (collapsed across targets) are displayed in Table 1. The view-search factor had a significant effect, $F(3,432) = 30.31$, $p < .01$, with performance better in the unchanged conditions than in the changed conditions. A significant view-search by accessory interaction $F(3,432) = 2.76$, $p < .025$, reflects differential view-search effects depending on which accessory was changed. The order of

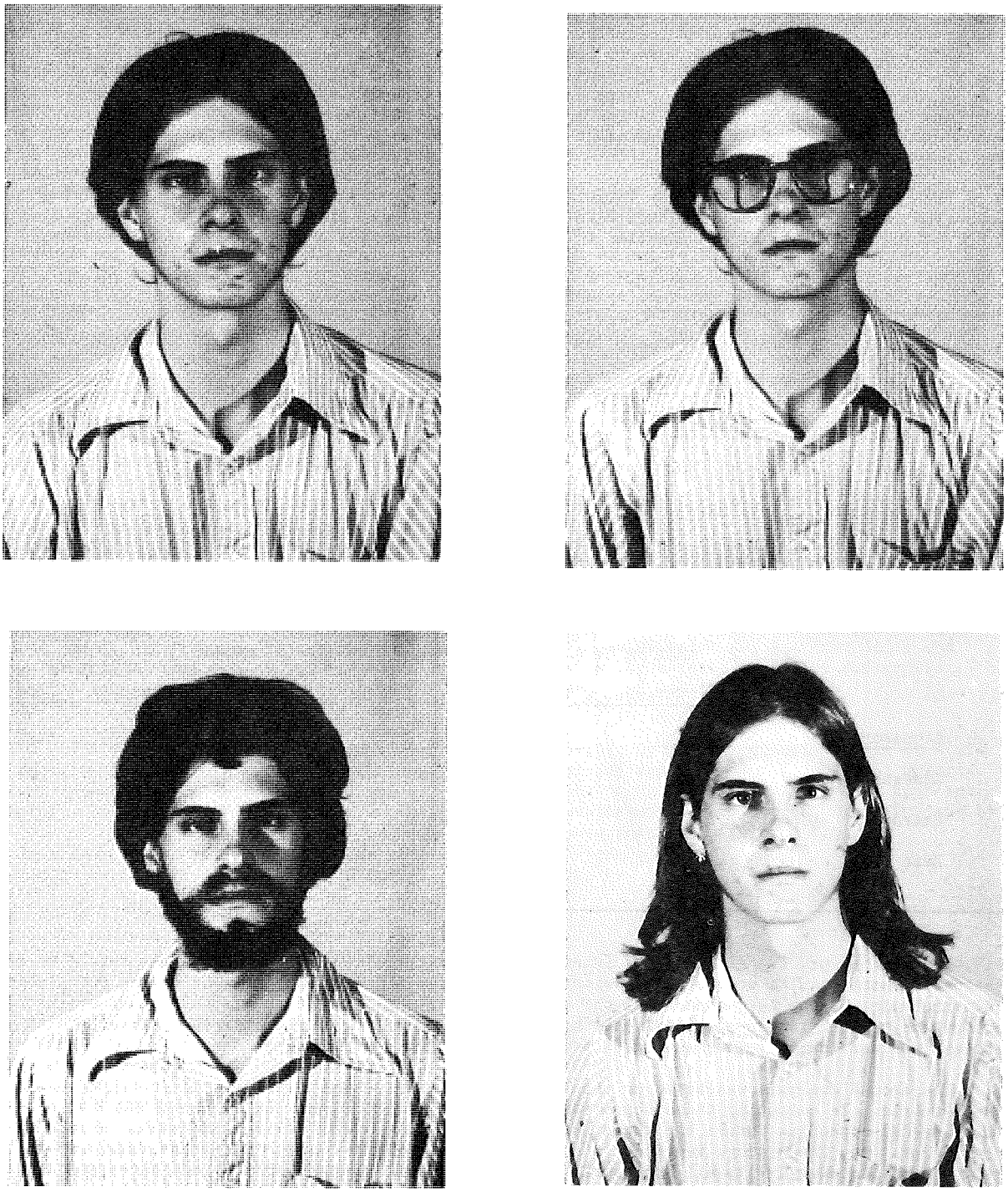

Figure 1. Sample Target with Different Accessories.

greatest to least performance decrement was beard, hair style and glasses. Although the H-M scores were used in the variance analysis, it is helpful in understanding the data to note the percentage of Ss who had a hit (marked a 4, 5 or 6 when the target appeared). These percentages are shown in parentheses in Table 1 and obviously reflect the effects revealed in the analysis of variance.

Two interactions involving the targets were also significant: accessory, $F(6,432) = 2.63$, $p<.025$, and view-search condition, $F(9,432) = 2.63$, $p<.01$. Although the interpretation of these results probably lies with idiosyncracies of the target persons, the exact nature of that interpretation is neither evident nor particularly interesting.

TABLE 1. MEAN HIT-MISS SCORES AND PERCENT OF SUBJECTS WHO HAD A HIT (IN PARENTHESES)

	Unchanged		Changed	
Accessory	With-with	Without-without	With-without	Without-with
Glasses	4.85 (82.5)	5.45 (92.5)	4.08 (65.0)	4.63 (77.5)
Hair Style	5.35 (90.0)	5.30 (87.5)	3.30 (47.5)	4.13 (67.5)
Beard	5.50 (92.5)	5.10 (82.5)	3.28 (50.0)	3.23 (52.5)

TABLE 2. MEAN FALSE ALARM-CORRECT REJECTION (FA-CR) SCORES

	Target with		Target without	
Accessory	Decoy with	Decoy without	Decoy with	Decoy without
Glasses	1.45	1.30	1.25	1.24
Beard	1.27	1.23	1.16	1.19
Hair	1.43	1.28	1.59	1.48

The second analysis was based on the FA-CR scores. In computing these scores only those decoys appearing before the target were considered. One FA-CR score was the S's mean response to the decoys with all accessories absent, while a second FA-CR score was the mean response with the accessory present. The accessory present corresponded to the accessory manipulated in the view-search condition of the target. The mean FA-CR scores are shown in Table 2. The analysis of variance carried out on these data considered viewing condition only in terms of the two initial viewing conditions of the target (accessory present or absent). Decoy was significant, $F(1,456) = 36.6$, $p<.01$, with a higher FA-CR score for decoys with the accessory. The effect of accessory was significatt, $F(2,456) = 9.34$, $p<.01$. Performance was poorest (higher scores) for hair style, best for beard, and glasses was intermediate. The decoy by viewing condition interaction reached significance, $F(1,456) = 12.94$, p 01, and indicated the difference between the decoy with and without the accessory was less when the target initially appeared without the accessory than when he initially appeared with it. The significant interaction between decoy and accessory, $F(2,456) = 8.90$, $p<.01$, is the result of a small difference in FA-CR scores for decoys with accessory and without accessory in the beard condition. This is contrasted with larger differences in the case of glasses and still larger differences for hair styles. Finally, the viewing condition by accessory interaction was significant, $F(2,456) = 4.43$, $p<.025$. With glasses and beard, initially viewing the target with the accessory resulted in higher FA-CR scores than when the target was initially viewed without the accessory. However, for hair style the reverse was true - higher FA-CR scores occurred when the a initially appeared without the accessory.

DISCUSSION

In general, the results of this study are consistent with expectations. When a facial accessory change occurs between the

initial encounter and the later recognition task, the probability of a correct identification is greatly reduced. In some cases, the probability of a hit is lowered as much as 42%. A point to be noted about these results is that performance is decremented by a change in either direction; that is, when the accessory is added or when it is deleted. Furthermore, the magnitude of the decrement is roughly equal with the two types of changes.

The significant interaction between the view-search and accessory variables makes sense in terms of the amount of change produced in the facial stimulus by adding or subtracting the various accessories. Glasses change a relatively small part of the face. Also, glasses are transparent and some information about the eyes is available and potentially useful when they are present. While a change in hair style does not typically affect the availability of information about other facial features, hair alterations probably produce significant effects because hair itself is an important feature or source of information in the recognition task (Lenorovitz, 1972).

Beards (including moustaches) result in major changes in facial appearance. Information about several features (e.g., chin, jaw line and mouth) is altered or concealed when a beard is added. When the beard is present during the initial exposure of the target, information relevant to later identification is simply not available. Indeed, the beard itself may be processed as relevant information; a possibility supported by the fact that that the with-with beard condition results in the best identification performance in the study.

The FA-CR scores reflect the errors made by subjects on the decoy pictures; the false positives corresponding to situations where a wrong person is identified as the target. The results, in general, make sense. The failure of the decoy and viewing condition variables to have an effect when the accessory was a beard, is probably due to the distinctiveness of the various beards. This notion is supported by the low FA-CR scores in the beard conditions. Errors when the accessory was hair showed more mistakes on decoys with long hair, regardless of the targets initial hair condition. It may be that long hair is simply more confusing. When the accessory was glasses and the target initially appeared without them, the errors on decoys with or without glasses were no different. A possible explanation is that Ss were not using information about the eyes, or if they were, it was still available with glasses present. The significant decoy effect when the target initially wore glasses, may be the result of Ss looking for a target wearing them.

Overall, the results of this study have important implications for criminal identification systems. When a criminal's appearance has been changed as a result of accessory differences between initial exposure and the mug file, lineup or other search procedure, the probability of a correct identification is lowered and false positives may be increased. Judicial procedures must take these facts into account in evaluating evidence based upon recognition by a witness.

It seems reasonable to assume that procedures could be developed which would permit an identification system to deal more effectively with accessory changes. For example, it should be possible to add or change accessories on pictures in a mug file. Such changes are well within the current technology of computerized systems. Of course, the legality of such procedures may be questioned; however, such issues are beyond the scope of this paper.

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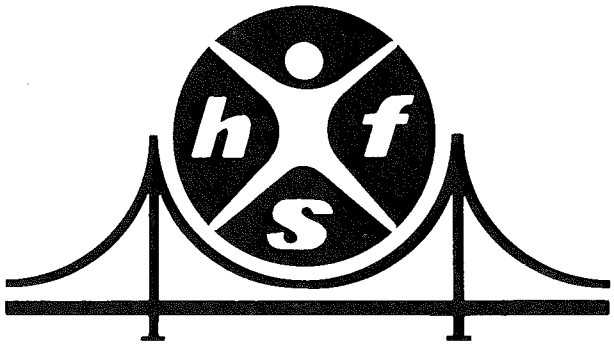
GATEWAYS TO  THE FUTURE