EFFECTS OF FEEDBACK AND PERSUASIVE COMMUNICATIONS ON DENTAL HYGIENE BEHAVIOR

A Thesis

Presented to

the Faculty of the Department of Psychology

University of Houston

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

By

Robert M. Noblitt

May, 1973

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ABSTRACT

As part of an ostensible dental health education program, junior high school homemaking students were exposed to positive(optimistic) and fear-arousing filmed persuasive communications. Subgroups received feedback on teeth cleanliness. The dependent variable was a chemical indicator of actual toothbrushing behavior administered precommunication, and one-, two-, five-, and ten-weeks postcommunication. Hypotheses predicted that the feedback and positive-appeal treatments would produce greater behavior change in accordance with recommendations than the control groups. Results failed to support the hypotheses, but suggested that repeated behavioral measures alone were sufficient to produce and maintain significant behavior improvement through the ten-week posttest. Methodological implications for studies which use repeated obtrusive measures are discussed.

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CHAPTER I

INTRODUCTION AND STATEMENT OF THE PROBLEM

Feedback

The importance of feedback for the acquisition and maintenance of motor skills is well documented (see Chapter II). Therefore, it follows that the motor skill of proper toothbrushing is probably maintained, at least to some extent, by certain forms of feedback. To a degree, at least one kind of feedback, sensory feedback, is probably inherent in the task. While brushing, one may be aware of which areas of the mouth are being reached by the bristles of one's brush. And if one runs the tongue over the tooth surfaces after brushing, the feel of clean teeth provides sensory feedback on the effectiveness of brushing. In addition, disclosing wafers are now commercially available which, when chewed, stain red the areas of the teeth which were not effectively cleaned. A new device, the "Plak Lite", accomplishes much the same result. Unfortunately, these chemical feedback devices are not widely used, and even the built-in sensory feedback, the "feel" of clean teeth, may not be attended to or interpreted correctly by an individual.

One possible approach then, for the social scientist who wishes to modify toothbrushing behavior, is to provide subjects with feedback on the effectiveness of their dental

hygiene practices. This approach seems particularly appropriate in light of the fact that effects of persuasion alone typically attenuate over time (e.g. Evans, Rozelle, Lasater, Dembroski, and Allen, 1970), and feedback has been shown to be effective in maintaining learned behaviors. This will be discussed in more detail in the next chapter.

Persuasive Communication and Dental Hygiene

Beginning with the study by Janis and Feshbach (1953) a number of experimenters have attempted to influence dental hygiene attitudes and behavior by the use of persuasive communications. These studies have employed a variety of approaches that are reviewed in more detail in the next chapter. Viewed as a whole, however, the results can be described as contradictory and inconsistent, particularly with regard to the issue of direction and strength of affective appeal, i.e. positive vs. neutral vs. low fear vs. high fear appeals. Further research on this issue is clearly warranted. For the present investigation, it was decided for practical reasons to limit the manipulation of the variable of affective appeal to three levels : positive appeal, fear appeal, and no communication.

The Present Study

Basically, the study[1] is an extension of the previous research by Evans et al. (1970), concentrating on a comparison of the relative effectiveness of positive and fear-arousing persuasive communications, and introducing

a previously untried feedback variable. Thus, the study is a 2x3 factorial design incorporated within a modified time-series consisting of pretest, treatment, and four posttests at one-, two-, five-, and ten-weeks after presentation of the messages. The only dependent variable to be reported here is a behavioral measure of toothbrushing, although a number of other measures were administered, including information retained, anxiety, reported behavior, and attitude toward the program. The entire study involved the collaboration of a number of investigators. Evans, Rozelle, Noblitt, and Williams (1973a) report the present results in a paper which has been submitted for publication. Findings for the dependent measures of reported vs. actual behavior, and attitude toward the program are reported in papers by Williams (1973) and Evans, Rozelle, Noblitt, and Williams (1973b).

CHAPTER II

REVIEW OF THE LITERATURE

Feedback

The term, feedback, refers to stimuli which are presented during the course or after the end of a response, are under an experimenter's control, and are related to the response (Bilodeau, 1966). The term has, at times, been used somewhat interchangeably with knowledge of results and reinforcement. However, feedback differs from reinforcement in that the latter construct depends for its definition upon the effect which it has on the response. Also, reinforcement tends to infer reward or punishment, whereas feedback is relatively free of this association, implying instead an informational quality. Use of the term, knowledge of results, has been criticized (Bilodeau, 1966) for the tendency of knowledge to infer an internal process. Thus its use may be misleading when the actual operation referred to consists entirely of the manipulation of external stimuli (as is usually the case).

The following review of the feedback literature is limited to a consideration of two basic issues : (a) presence vs. absence of feedback, and (b) the effect of delayed feedback. These are the most relevant issues for the present study because the experimenter-controlled feedback is

limited in its manipulation to either presence or absence, and it is by necessity a form of delayed feedback. This is because, on a day the feedback was to be administered, a subject had her last opportunity to brush immediately before coming to school in the morning. In fact, the actual feedback delay from the time of last brushing probably ranged from an hour or two, to a period of several days, a length of delay rarely considered in the published literature. This problem becomes even more serious when one considers yet another delay inherent in the experimental procedure, the delay from feedback to the next opportunity to brush. Assuming that most subjects did not carry a toothbrush to school with them, this delay was probably in the range of three to six hours. And again, the delay until the actual time of next brushing was probably even greater in most cases.

Presence vs. Absence of Feedback

The facilitation of learning and performance produced by feedback is well documented. As early as 1931, Thorndike wrote of the influence of "after-effects of a connection (pp. 30-81)," and described a series of experiments in which the verbal stimuli, "Right" and "Wrong", were used to modify Ss' responses in a number of tasks.

Several early studies, using a variety of tasks, demonstrated no improvement in performance when feedback was withheld from Ss. Using a line-continuation task, Judd (1905) found no evidence of learning as a result of mere

practice. Similarly, Thorndike (1931) found no improvement in line-drawing performance when Ss were not informed as to the accuracy of their responses. These results were confirmed by Eaton (1935), using a circle-drawing task. Lincoln (1954) had Ss try to turn a handwheel at given rates, and found that accuracy actually deteriorated with practice until verbal descriptions of error were provided. More recently, Becker, Mussina, and Persons (1963) found no improvement in accuracy of line drawing in a no-feedback condition. Perhaps the most definitive study of mere presence or absence of feedback was the Bilodeau, Bilodeau, and Schumsky (1959) study, which utilized a lever-displacement task, and varied the time of introduction and removal of feedback. The results demonstrated (a) no improvement without feedback, (b) progressive improvement with feedback, and (c) response deterioration after the removal of feedback. Furthermore, an early series of trials without feedback had no latent effect on the learning shown when feedback was eventually introduced.

Delay of Feedback

As Bilodeau and Bilodeau (1958) have pointed out, there are two basic time variables associated with the effects of feedback : (a) feedback delay (time from response to feedback), and (b) post-feedback delay (time from feedback to next response). A number of studies have investigated the effects of one or both of these variables.

Bilodeau (1966) concluded that feedback delay disrupts performance when a subject is required to respond continuously to a continuously changing feedback array, as in tasks involving speech (Smith, 1962), tracking (Garvey, Sweeney, and Birmingham, 1958), and handwriting (Smith, McCrary, and Smith,1960). In addition, animal studies of delay of reinforcement have usually shown greater disruption of performance with increased delay (Marx, 1969).

However, the bulk of the evidence from human studies suggests that in most cases, delay of feedback has little or no effect. For example, Lorge and Thorndike (1935), using a ball-throwing task, found that a relatively empty delay period of up to 6 sec. between response and feedback interfered not at all with learning. These results have been confirmed by a number of studies using a variety of tasks, including line drawing with delay up to 20 sec. (Saltzman, Kanfer, and Greenspoon, 1955), trial-and-error learning with delay up to 3 sec. (Noble and Alcock, 1958), and pulling a yardstick 10 in. with delay up to 1 week[2] (Bilodeau and Bilodeau, 1958). In addition, these results seem to apply to response classes other than motor behavior, such as concept formation (Bourne and Bunderson, 1963), and verbal discrimination (Jones and Bourne, 1964). In sum, for most of the tasks which have been studied experimentally, and within the reported ranges of delay (usually no more than a few minutes), it appears that simple delay

of feedback, with a minimum of interfering interpolated activity, has little or no effect on human performance.

A few studies have investigated the effect of post-feedback delay (delay from feedback to next response). Bilodeau and Bilodeau (1958) varied feedback delay and post-feedback delay over a wide range of time periods using a number of tasks. Their conclusion was that post-feedback delay has more influence than feedback delay, but the strongest time-related variable is intertrial interval (the sum of the two delay periods), such that the longer the interval, the poorer the performance. These results were confirmed by Denny, Allard, Hall, and Rokeach (1960). Interestingly enough, Bourne and Bunderson (1963) found that, for a concept-learning task and post-feedback delay up to 9 sec., performance improved with increases of post-feedback delay. A possible explanation of this discrepancy among the published studies is that concept learning benefits from increased post-feedback delay, whereas simpler motor tasks do not. Another study (Weinberg, Guy, and Tupper, 1964) varied post-feedback delay from 1 to 20 sec., using a simple motor task, and found the optimal delay to be 5 sec. Evidently, as the delay increased, Ss had greater opportunity to make use of feedback received on a given trial, but after about 5 sec., forgetting began to occur. In sum, the published studies suggest that increased post-feedback delay

serves to impair performance once an optimal value of a few seconds is surpassed.

Persuasive Communication and Dental Hygiene

The reader who desires a complete review of the affect-arousal persuasive communication literature is referred to the reviews by Higbee (1969), Janis (1967), Leventhal (1965), McGuire (1966), Miller (1963), Sears and Abeles (1969), and Fishbein and Ajzen (1972). The total body of the literature is too great in size to be reviewed here, but as Higbee (1969) has pointed out, "there is some inconsistency among the studies on fear-arousing communications, some indicating a negative relationship between threat level and persuasion, some indicating no relationship, and most studies indicating a positive relationship (p.428)." Also as Higbee has noted, much of the contradiction among the studies may be due to the wide variety of topics, subjects, media, and criteria of strength of affective arousal used by different experimenters. For this reason, the present review is limited to a consideration of persuasive attempts to modify dental health practices, in an effort to inject some degree of order into a more circumscribed area of study.

Janis and Feshbach (1953) presented strong, moderate, and minimal fear-arousing lectures on dental hygiene to high school students, and administered questionnaires one week before the communications, immediately after the messages, and one week later. The results were that the

minimal appeal produced the greatest reported behavior change in compliance with the recommendations, and the greatest resistance to counterpropaganda one week after the communication. The authors' conclusion was that a strong fear appeal is less effective if it evokes a high degree of emotional tension without adequately satisfying the need for reassurance. Thus, a high fear appeal may motivate an audience to minimize or ignore the importance of the threat. This study has enjoyed frequent citation in later papers and texts, but unfortunately, its results are not typical of the larger body of fear-arousal research (see Higbee, 1969).

In a follow-up study, Janis and Milholland (1954) presented strong- and mild-threat dental hygiene communications in written form to matched groups of adult Ss. A detailed measure of recall demonstrated that the two groups correctly recalled about the same number of total items, but different kinds of items tended to be recalled. The strong-threat group tended to recall more items having to do with the negative consequences of poor dental care, whereas those who read the mild-threat communication had better recall for material on the causes of dental problems. The authors reasoned that if Ss who received a strong-threat appeal were less able to remember the causes of a possible threat, they might be less able to take the appropriate actions to ward off the threat. Thus, the authors

provided support of an explanatory nature for the results of the earlier Janis and Feshbach (1953) study.

Moltz and Thistlethwaite (1955) also attempted an extension of the Janis and Feshbach (1953) study, based on the conclusion of the latter authors that a high fear appeal may be less effective if it evokes tension without adequate reassurance. Air Force recruits were presented strong and weak anxiety-arousal lectures on dental decay and disease. These groups were divided into subgroups which differed in the presence or absence of assurances that proper dental hygiene practices would prevent tooth decay. The results lended only partial support to Janis and Feshbach (1953) in that the assurance Ss reported less anxiety than the no-assurance group, but the groups did not differ in reported conformity to recommendations one week later. An additional curious result of the study was that the anxiety-arousal communications failed to arouse more reported anxiety than did a neutral lecture on an irrelevant topic.

Goldstein (1959) hypothesized the existence of individual differences in response to fear-arousing communications. A sentence-completion test was used to differentiate high school freshmen into groups of "copers" and "avoiders", depending on whether Ss tended to relate sexual and aggressive implications of the sentence stems to their own needs and emotions. One week later, he presented the same strong and minimal fear appeals used by Moltz and Thistlethwaite (1955),

then administered posttest questionnaires immediately after the communications and again two weeks later. In terms of reported conformity to the recommendations, Goldstein found that copers responded about equally well to both the strong and minimal fear appeals, whereas avoiders responded much more favorably to the minimal appeal. Thus, overall, the minimal appeal was more effective, confirming the earlier results of Janis and Feshbach (1953). However, contrary to Janis and Fechbach, the results could not be explained in terms of differential recall of the communications by copers and avoiders, or by differential arousal of anxiety (confirming the findings of Moltz and Thistlethwaite, 1955).

A study (Haefner, 1956) which was published only in summary form found that a low-fear message was more effective than high fear in eliciting immediate opinion change.

All the studies reviewed thus far have lent at least partial support to the early Janis and Feshbach (1953) findings. Curiously enough, beginning about 1966, this trend was reversed such that dental-hygiene-related studies published subsequently have tended to negate the earlier results. For example, Singer (1966) presented high-fear, low-fear, and recommendations-only dental hygiene persuasive communications to high school freshmen. Questionnaires were administered prior to, immediately after, and two weeks after the communication. For the first time in the series of studies reviewed here, a behavioral measure was performed (getting a free toothbrush) immediately and two weeks after

the message. The results were that the high-fear message produced the greatest reported anxiety, dental concern, intention to follow the recommendations, and more positive evaluation of the communication. In addition, both fear-arousal messages were superior to recommendations-only in eliciting toothbrush-getting and perceived cavity-reducing effectiveness of the message. Thus, for the first time in studies involving dental hygiene, results were obtained which were clearly in contrast to the results of Janis and Feshbach (1953), indicating a positive relationship between fear level and persuasion.

This trend was continued by a study (Leventhal and Singer, 1966) in which high-fear, low-fear, and recommendations-only communications were presented to visitors at a state exposition. Questionnaires measured perceived likelihood of dental disease, emotional arousal, acceptance of communications, and perceived effectiveness of recommendations. Results indicated that the higher the level of fear, the greater the acceptance of the recommendations. In addition, it was found that positioning the recommendations after the high-fear stimuli decreased fear arousal, but had no effect on acceptance, suggesting that acceptance may not depend on fear reduction.

A problem common to all the studies cited thus far has been that none have used a behavioral measure of toothbrushing. All have used questionnaire measures of various kinds to

determine the effectiveness of independent variables. Only Singer (1966) used any kind of behavioral measure, this being a measure of whether Ss accepted a free toothbrush. Whether Ss used their toothbrushes was not determined.

Arnim (1963) described a method for measuring tooth cleanliness, involving the use of a disclosing agent (erythrosine) in tablet form which, when chewed, dyes red the bacterial plaque on the teeth. This behavioral measure of toothbrushing was first utilized in a persuasive communication study by Evans, Rozelle, Lasater, Dembroski, and Allen (1968). Eighth and ninth grade students were presented dental hygiene communications designed to be fear-arousing, positive (optimistic), or neutral in affect. Pre- and posttest color slides were made of the Ss' erythrosine-stained teeth, and a procedure was developed whereby relative ratings were assigned to each of the photographs. The results indicated that both the fear- and positive-appeal groups improved significantly (and about equally) from pre- to posttest, whereas the neutral-appeal group did not. This suggested that affective arousal of some kind may be necessary in order for persuasion to effect a behavior change, but it may be equally as effective to emphasize the positive benefits of proper dental care, as it is to describe the negative consequences of poor brushing.

A more thorough comparison of dental hygiene persuasive communications was performed in a recent study by Evans,

Rozelle, Lasater, Dembroski, and Allen (1970). High-fear, low-fear, positive-affect, brief recommendations-only, and elaborated recommendations-only communications were presented to junior high school students. Measures included the behavioral measure of toothbrushing previously used by Evans et al. (1968), and questionnaire measures of anxiety, information retained, intention to behave, and reported behavior change. These measures were administered precommunication, immediately, five days, and six weeks after the communication. Major findings were that elaborated recommendations and positive-affect were most effective in improving behavior, but high-fear and brief recommendations-only produced the greatest change in reported behavior. In fact, the rank-order effectiveness of the various communications was almost reversed for the two measures. In addition, it was found that fear appeals were most effective in producing reported anxiety and intention to behave, but least effective in terms of information retained. The most unusual finding of the study was the unexpected effectiveness of the recommendations-only communications, suggesting that affect arousal may not be necessary for attitude and behavior change.

Stacey (1970) performed an extension of the Evans et al. (1970) study, using a similar set of persuasive communications and measures, and introducing an interschool competition variable. The results were to some degree invalidated due

to methodological problems; nevertheless, an intriguing finding was that the control groups scored higher than most of the experimental groups on most measures, suggesting that the repeated behavioral measure may have in itself been a sufficient motivator to change.

Summarizing the results of the studies cited above is difficult due to the extreme inconsistency of the findings. A major problem, as Higbee (1969) noted, is the diversity among the studies along factors such as subjects, media, message content, measurement techniques, criteria of affect arousal, and other situational variables. For example, experimenters have used as their chief dependent variables such diverse measures as recall, attitude change, acceptance of communications, intention to behave, reported behavior, and actual behavior. Unfortunately, as at least one study (Evans et al., 1970) has demonstrated, the correlation between these dependent variables is probably poor. Of particular concern to experimenters should be the poor correlation between reported and actual behavior which was found by Evans et al. (1970), especially in light of the paucity of behavioral measures in the other studies cited.

The overall results on the issue of affect arousal are difficult to interpret. There has been little direct support for the early contention of Janis and Feshbach (1953) that low-fear appeals are more effective than high-fear in producing behavior change. Most studies, although

not all, have suggested that some degree of affect arousal is more effective than a neutral message. Recent studies by Evans et al. (1968,1970) have found that a positive (optimistic) appeal may be equal or superior to a fear appeal in changing actual toothbrushing behavior. Studies which have measured long-term effects of communications have indicated a general reduction of persuasion over time. The overall results seem to indicate a need for further comparisons of affective appeals and investigations into means of extending the persuasive effects of communications over time.

CHAPTER III

HYPOTHESES

On the basis of the results of previous studies relating persuasion and dental hygiene, the following hypotheses were formulated :

1. Feedback groups maintain behavior improvement for a longer period of time than non-feedback groups.

This prediction was based on results such as those of Bilodeau, Bilodeau, and Schumsky (1959), who found progressive improvement of performance in the presence of feedback, and response deterioration in its absence.

2. Groups which receive the positive appeal exhibit greater behavior improvement than groups which receive the fear appeal.

Evans et al. (1970) found a positive appeal more effective than a fear appeal in producing behavior change in accordance with recommendations.

3. Groups which receive either affective appeal exhibit greater behavior improvement than groups which receive no appeal.

Studies which have included a no-communication control group are rare, but indications are that affect arousal is usually more effective than a neutral message (e.g. Evans et al., 1968), and elaborated recommendations are more effective than brief recommendations (e.g. Evans et al., 1970); thus, any communication which includes both affect arousal and recommendations (as in the present study) should

be more effective than no communication.

CHAPTER IV

METHOD

The present investigation was conducted in the natural setting of three junior high schools of an independent school district near Houston, Texas. The study was incorporated into the homemaking curricula of the schools, in the context of an ostensible program of dental hygiene training.

The 2x3 factorial design included three levels of persuasion (fear appeal, positive appeal, and no communication) and two levels of feedback (presence and absence), a total of six experimental conditions. These conditions were assigned to ten available homemaking classes; thus, four of the conditions were presented to two classes each. Only the fear-appeal plus feedback, and positive-appeal plus feedback conditions were represented by only one class each. Double representation of the groups judged most vital to the study provided a safety factor to guard against the occurrence of unforseen methodological problems.

It was further judged desirable to maximize isolation of the no-communication control group from possible contamination by the other experimental conditions. Therefore, the school with only two homemaking classes was chosen to receive the control condition. The assignment of the other treatments was executed in such a way that when possible, a given

treatment group included Ss from both schools which had four classes each. This was done in order to balance, as much as possible, the effect of schools across treatments.

Subjects

Ss were 181 female junior high school students attending ten homemaking classes in three junior high schools of an independent school district near Houston, Texas. Results of a pretest questionnaire indicated that Ss were from 13 to 15 years of age, and all groups were roughly middle-class in socio-economic level by the Hollingshead and Redlich (1958) five class index of social position.

Independent Variables

Persuasive Communications. Two varieties of persuasive communications were used in the present study, fear appeal and positive (optimistic) appeal. In addition, a no-communication control condition was included. The affective messages were films which had been used previously by Stacey (1970), and were similar to the live presentations utilized by Evans et al. (1970). In both films, the same real dentist served as narrator, and the same order of presentation was used : first the affective message, then identical sets of specific dental hygiene recommendations. The showing of each film was followed by a live demonstration of the recommended procedures, along with distribution of dental care kits which had been supplied by Proctor and Gamble. Each kit included a small tube of toothpaste, a

toothbrush, four disclosing wafers, a supply of dental floss, and a set of printed instructions similar to the recommendations of the film and live demonstration.

The affective portion of the fear-appeal film was designed to arouse anxiety concerning dental health. It included color photographs of various oral diseases and emphasized the danger and pain associated with dental disease and treatment. Death was mentioned as a possible consequence of severe infection. It was also pointed out that decay and other problems frequently befall people who think they are taking proper care of their teeth.

The positive-appeal communication emphasized the favorable benefits of proper dental care. It suggested that popularity and success in school are at least partly due to good dental health. A chronicle of a brother and sister inferred a cause and effect relationship between their correct dental health practices and their social success and popularity. It was stated that anyone can be healthy and popular if he takes good care of his teeth.

In both films, the affective appeal was followed by the same set of specific dental hygiene recommendations. This consisted of a four-step description of how to properly clean the teeth. The same four steps were repeated after the film in a live presentation in which one research assistant used a plastic model and his own mouth to demonstrate proper brushing and flossing. Simultaneously, another

assistant presented the following verbal communication :

1. Brush your teeth with toothpaste in your usual way, being as thorough as you can and remember to brush the back of your teeth. After brushing them as clean as you can, rinse your mouth thoroughly with water.
2. Clean more thoroughly in between the teeth. The dental floss is used to help clean the places a toothbrush misses. This is easy to do. Cut off a piece of dental floss about a foot or so long. Wrap the floss around your index finger and grab the loose end with your other hand, so that about an inch of floss is left between your hands. Slip the floss between each pair of teeth by moving it gently back and forth. Then scrape the floss against both sides of the teeth until you feel they are clean.
3. Chew the disclosing wafer and swish it around your teeth to see if you have missed any places.
4. Spot brush the few remaining places away and remember these places you've missed the next time you're brushing your teeth.

Feedback. Feedback on teeth cleanliness was based on Ss' actual scores on the simplified oral hygiene index developed by Greene and Vermillion (1964), hereafter referred

to as the Greene-Vermillion Index, or GVI. The GVI measurement involved having S rinse her mouth with erythrosine dye, which colors red the areas of buildup of bacterial plaque. The research assistant then inspected and assigned a rating to each of of six particular tooth surfaces in S's mouth.

These ratings were summed, allowing the final summed score to range from 0 to 18. S was shown where her scores for the previous and present measurements fell on a chart which depicted the range of possible scores divided into five categories from very clean to very dirty. The extreme categories of the chart were actually beyond the range of possibility, so that no S was told that she could do no better or no worse than her present condition. After being shown where her previous and current scores fell on the chart, one of the following statements of what "experts say" about the S's state of dental health was read from the chart by the research assistant :

(Scores 0-4) Your teeth are clean, but there is some room for improvement.

(Scores 5-7) Your teeth are fairly clean, but you could be doing a better job of taking care of your teeth.

(Scores 8-18) Your teeth are not clean. By working harder, you could be doing a much better job of taking care of your teeth.

Dependent Variables

In addition to the behavioral measure described below, each subject contact included questionnaire measures of reported toothbrushing behavior, anxiety aroused by the communications, retention of the message content, and attitude toward the program. The results of these measures are reported in a separate paper (Evans, Rozelle, Noblitt, and Williams, 1973b).

Behavioral Measure. Arnim (1963) described a method for measuring tooth cleanliness, involving the use of a disclosing agent (erythrosine) in tablet form which, when chewed, dyes red the bacterial plaque on the teeth. Evans et al. (1968) developed a standardized technique for rating 35 mm. color slides of erythrosine-stained teeth. This technique was later validated in an unpublished study (Forbes, 1971) as an indicator of length of time since last brushing. The present investigation utilized this method as a measure of actual toothbrushing behavior. The ratings assigned to the slides ranged from 1 (very clean) to 5 (very dirty).

Procedure

The design of the present study was a modified time-series consisting of six subject contacts. A subject contact involved a visit by one of two research teams, each of which consisted of three experimenters (Es). Teachers

were instructed not to announce in advance the dates of Es' visits. Informal checks of this precaution indicated that, in most cases, Ss were not forewarned of specific visits.

Permission Slips. At the beginning of the semester in which the study was carried out, slips were distributed by the teachers of the 10 homemaking classes used in the study, for the purpose of gaining permission from Ss' parents for their participation. The permission slips were designed so that a parent could give or refuse acceptance, but in either case the student was required to return a signed slip. Possibly due to this regulation, and to a high initial degree of cooperation from teachers, the return rate of permission slips was approximately 95%. Of the 229 returned slips, 14 parents refused permission for their child to participate in the study.

Pretest. The pretest was scheduled about three weeks after distribution of permission slips in order to decrease the likelihood of subject reactivity to the slips.

At the assigned date and time for a given group's pretest, the research team entered the classroom and identified themselves with the dental health program referred to in the permission slips. Ss were then called by name in groups of five and led to a separate testing room, where Ss rinsed their mouths with erythrosine dye and held their lips in a retracted position while E photographed S's teeth.[3] E used a 35 mm. camera with electronic flash and color slide

film. Next, another E performed a visual inspection of S's erythrosine-stained teeth and recorded the GVI score. S was then allowed to retire to the restroom to rinse her mouth. Finally, S was given a questionnaire to complete in the regular classroom. The questionnaire included a statement that S's answers could in no way affect her evaluation in any school activity, since no school personnel would have access to her performance in the dental program.

Presentation of Persuasive Communications. The films and live demonstrations were presented one week after the pretest. Immediately following the presentation, questionnaires were administered which measured anxiety, retention, and attitude toward the communication. For the control and feedback-only groups, there were no subject contacts during this week.

One-Week, Two-Week, Five-Week, and Ten-Week Posttests. Each of these measures occurred the designated number of weeks after the presentation of the persuasive messages. Each was essentially a repetition of the procedure of the pretest, including teeth photographs, GVI, and questionnaire measures. In addition, at the time of all posttests except the ten-week measure, feedback was administered to those groups which were designated to receive it. This was not done at the ten-week interval because there would have been no measure of its effects.

CHAPTER V

RESULTS

Behavioral Measure

During the course of the study, each S's teeth were photographed five times, producing a total of 717 slides. The slides were assigned cleanliness ratings from one to five, using the technique developed by Evans et al. (1968).

Following the precedent of earlier studies (e.g. Evans et al., 1970), behavioral change scores were calculated for the purpose of assesing relative change among experimental conditions at each posttest. The data for each subject contact were analyzed using Winer's (1962, pp.241-244) unweighted means analysis of variance for a factorial design with unequal ns. When the analysis of variance revealed overall significance, post-hoc comparisons of the treatment conditions were performed using the method recommended by Hays (1963, pp.483-487).

The analysis of each posttest included only data from Ss who had been present for all previous measures. Once a S was absent or refused to cooperate with Es (as occasionally happened), her data were excluded from analyses of later measures. This procedure resulted in a cumulative attrition rate, at the ten-week posttest, of 23% to 50% for the different treatment groups. The 50% loss which one group

had suffered by the end of the study was due to an unusually high rate of absence in one of the two classes which constituted that group. The remaining Ss did not appear to differ systematically from Ss of other groups, however, and were retained in the analysis of the data.

The analysis of variance for the pretest behavioral data yielded no significant differences among the six treatment groups. The posttest change scores are shown in Figure 1. Significance was indicated only at the one-week ($F=2.34$, $df=5/157$, $p<.05$) and two-week ($F=2.65$, $df=5/135$, $p<.05$) posttests. However, post-hoc pairwise comparisons of the treatment groups at these two times revealed no between-group significant differences.

As can be seen in Figure 1, the group rank order of effectiveness in producing behavior change varied greatly from posttest to posttest. No single treatment group was consistently found to be superior or inferior to the other groups, including the control group.

The overall shape of Figure 1 reveals that behavior improvement diminished somewhat over time, although not as greatly as in previous studies (Evans et al.,1970; Stacey, 1970). Ignoring group distinctions, the mean slide rating for each posttest was found to be significantly cleaner than the mean pretest score (one-week: $t=2.83$, $p<.01$; two-weeks: $t=6.07$, $p<.01$; five-weeks: $t=3.62$, $p<.01$; ten-weeks: $t=3.97$, $p<.01$).

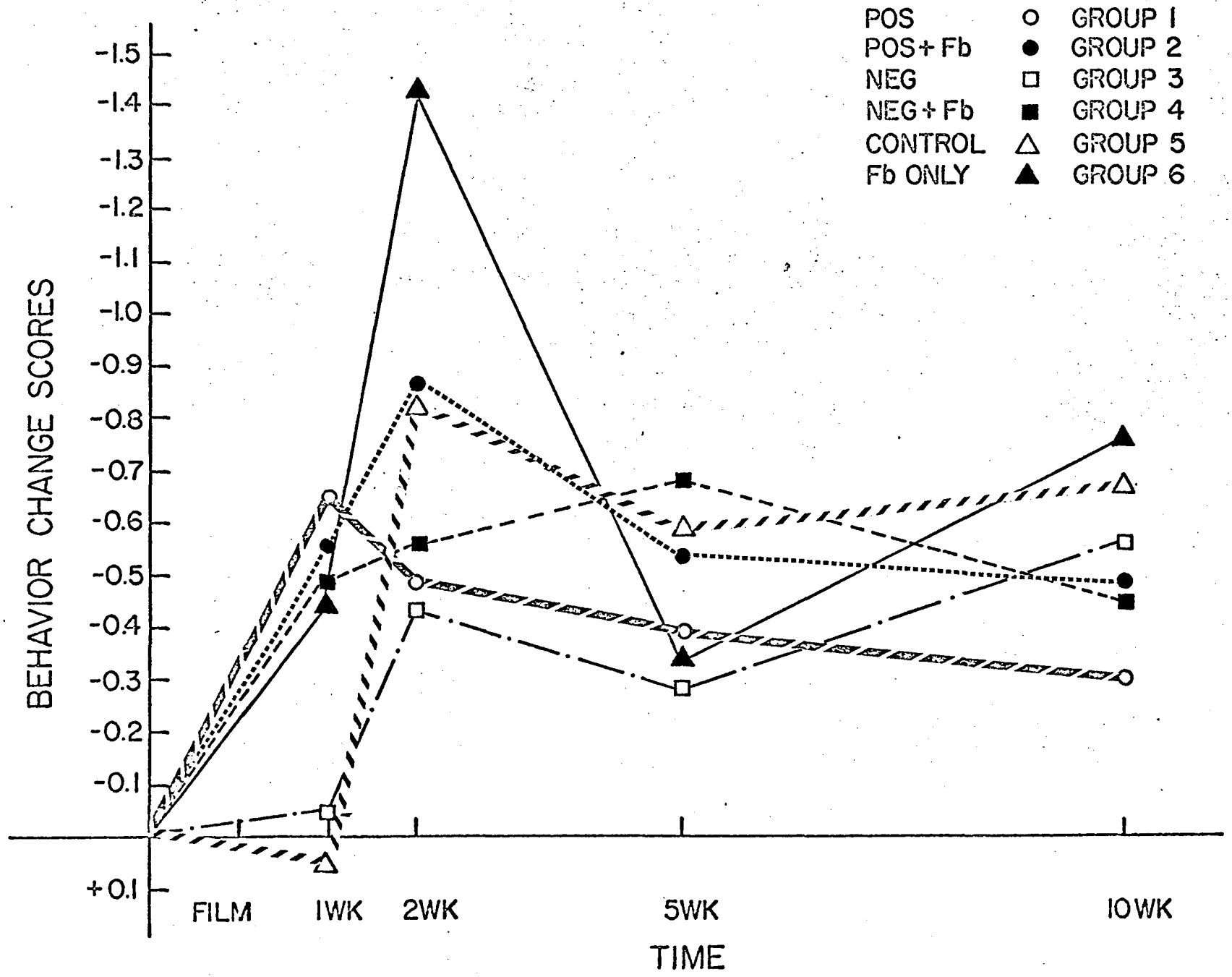

FIG. 1. BEHAVIOR CHANGE FOR ALL GROUPS.

When all Ss who received feedback are grouped and compared with those who received none, the results appear as seen in Figure 2. As predicted by Hypothesis 1, presence of feedback tended to produce somewhat greater behavior improvement, but this trend is statistically nonsignificant. The meaningfulness of this trend is further jeopardized by the observation that feedback was administered for the first time immediately following the behavioral measure for the one-week posttest. Therefore, the difference between groups at the one-week interval cannot be accounted for by feedback.

In Figure 3, Ss who received either of the two affective appeals are compared to those who did not. Statistical tests demonstrated no significant differences between groups at any of the posttest administrations. Examination of rank order effectiveness reveals a trend of nonsignificant superiority of the positive appeal through the one- and two-week posttests, in partial support of Hypothesis 2. However, by the time of the ten-week measures, the rank order had reversed, with the control Ss demonstrating greatest behavior change.

The chief consideration of the present report is with behavioral data. However, two of the findings from the questionnaire measures may be particularly relevant to an understanding of the apparent lack of behavioral effects attributable to the persuasive communications.

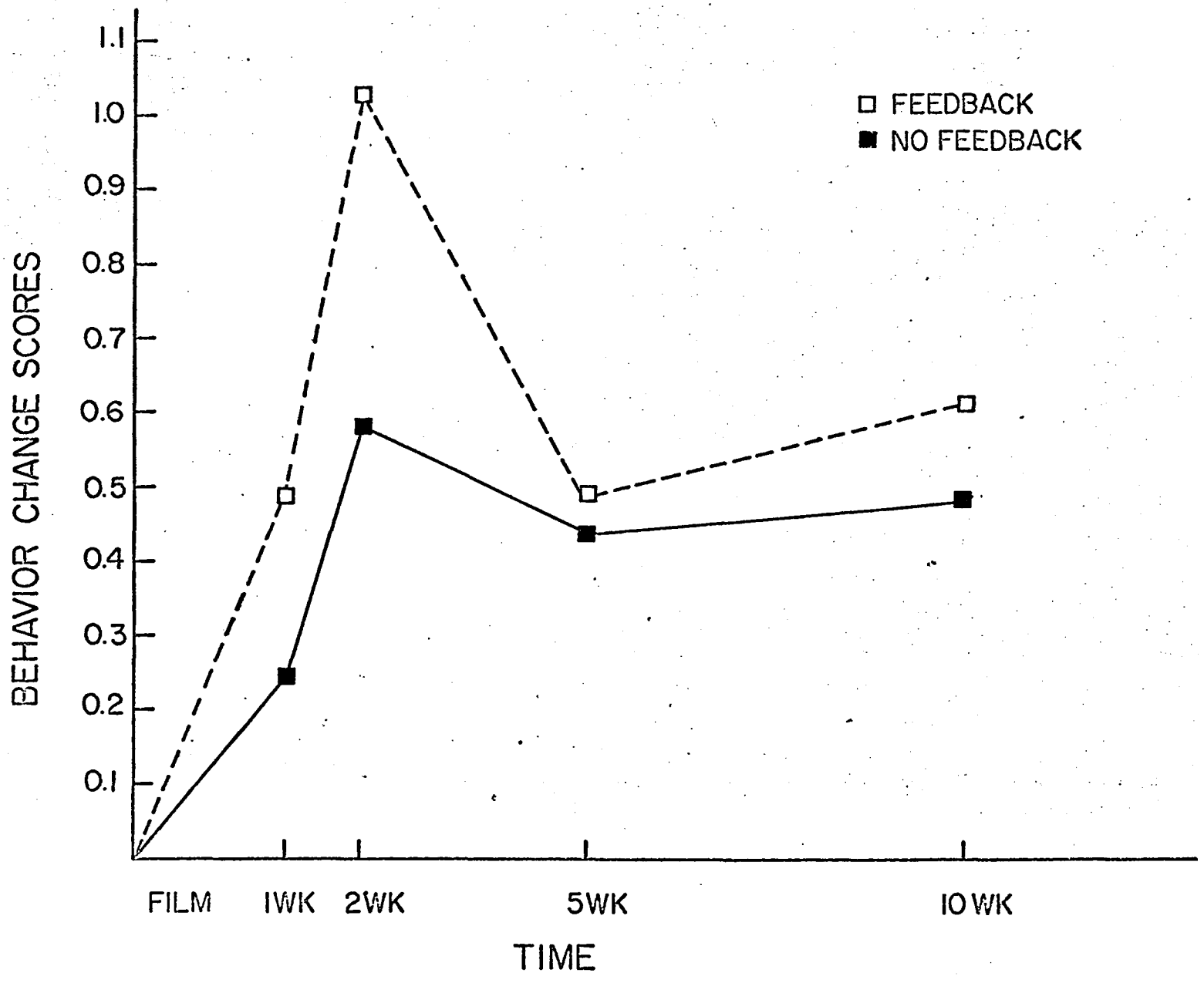

FIG. 2. BEHAVIOR CHANGE FOR FEEDBACK VS. NO FEEDBACK CONDITIONS.

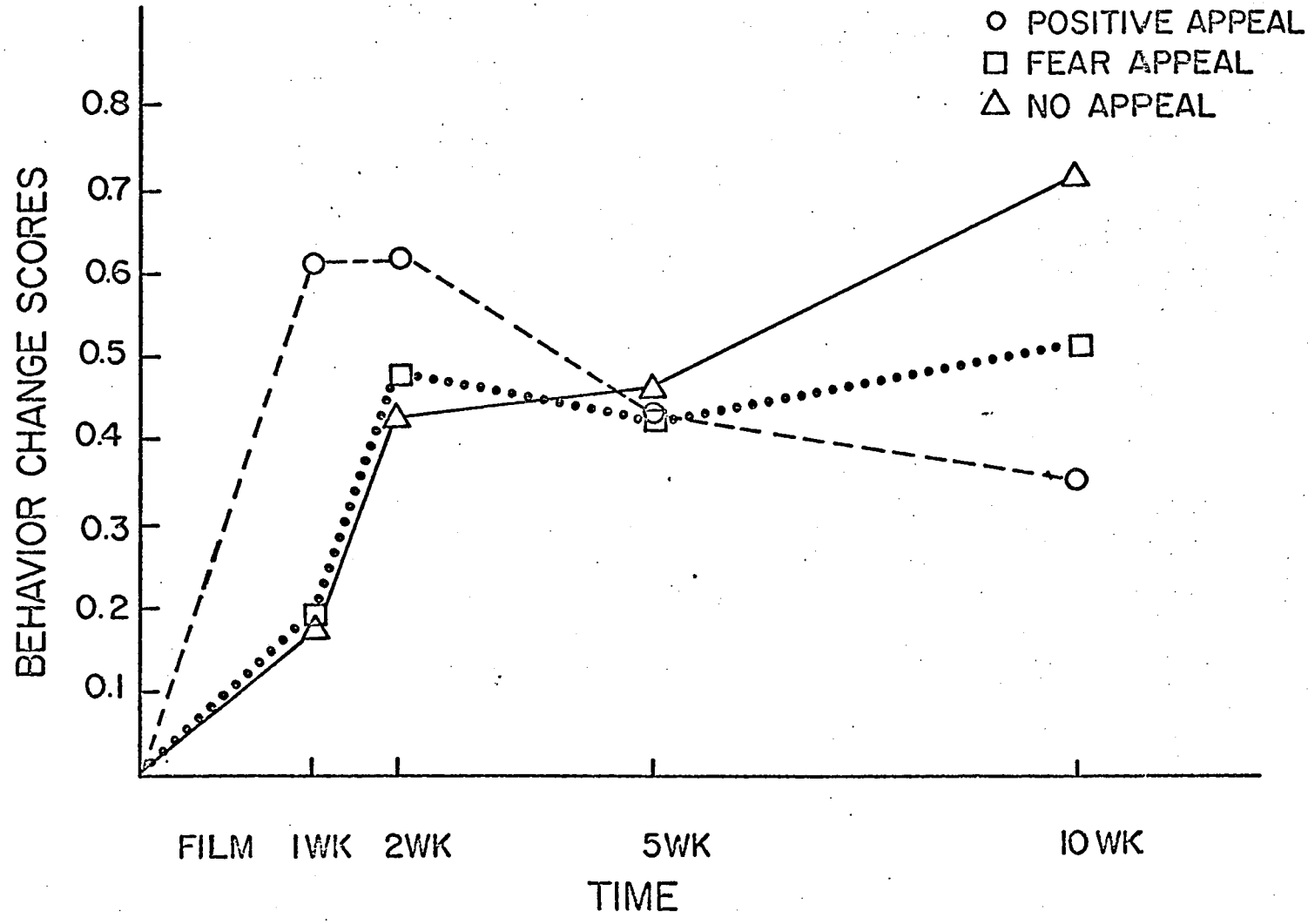

FIG. 3. BEHAVIOR CHANGE FOR AFFECTIVE APPEAL CONDITIONS.

Information Retained

Immediately following the messages, and again as a part of each posttest, questionnaires were administered which included measures of retention of the affective and recommendations portions of the communication. A one-way analysis of variance indicated no significant differences in retention between groups at any of the posttest periods.

Reported Anxiety

The questionnaires also included items designed to measure degree of anxiety aroused by the communications. Results indicated that the fear appeal failed to arouse greater reported anxiety than the positive appeal. Surprising as this finding is, it is not without precedent in the fear-arousal literature. For example, the fear appeals used by Moltz and Thistlethwaite (1955) failed to elicit more reported anxiety than a neutral lecture on an irrelevant topic.

CHAPTER VI

DISCUSSION

Feedback

The data failed to demonstrate a significant effect of feedback in maintaining behavior change. Therefore, Hypothesis 1 cannot be accepted. This finding appears contradictory to the bulk of evidence from learning studies (see Chapter II) which have demonstrated the effectiveness of feedback in maintaining a variety of behaviors. On the other hand, the results are compatible with those of Stacey (1970), who found an interschool competition variable (which involved elements of group feedback) to be ineffective in maintaining toothbrushing behavior.

Certainly, the present results cannot presume to question the overwhelming evidence from other studies that feedback is an effective variable. The following discussion presents possible explanations for the variable's apparent ineffectiveness in the present study.

As was mentioned earlier, the feedback used in the present study was, by necessity, delayed feedback. At least an hour or two, and probably more, intervened from the time of last brushing until presentation of feedback. In addition, another delay of at least several hours ensued between feedback and the next opportunity to brush. The

literature (e.g. Bilodeau and Bilodeau, 1958) indicates that the latter type of delay, post-feedback delay, tends to be the more disruptive of the two. Also, length of intertrial interval, or total time between responses (probably at least seven to eight hours in this case) has been shown to influence effectiveness of feedback (Bilodeau and Bilodeau, 1958).

A factor related to the above discussion is the relative infrequency of feedback compared to the recommended frequency of brushing. Brushing should be done at least on a daily basis, whereas length of time between feedback sessions ranged from one to five weeks. Thus, the effects of feedback may have dissipated by the time the next measurement occurred, due to the large number of intervening responses made without feedback. Withdrawal of feedback is known to cause a deterioration of performance (Bilodeau, Bilodeau, and Schumsky, 1959) and this effect may have undermined the positive benefits of feedback before the time arrived for the next measurement. This argument is supported by an examination of Figure 2. Feedback appears to have had its greatest effect at the two-week posttest, which followed the last previous feedback session by only one week. The effects of feedback are seen to be minimal at the five- and ten-week posttests, when perhaps too many intervening non-reinforced responses have occurred.

A meaningful comparison of feedback and non-feedback

conditions obviously demands an absence of feedback regarding the behavior of interest, in the non-feedback groups. This requirement may not have been fulfilled in the present study. After rinsing with erythrosine, Ss were frequently observed comparing and otherwise responding to the amounts of dye on one another's teeth. Following the measurement procedure, Ss were encouraged to rinse their mouths at a restroom sink. This process no doubt included looking in a restroom mirror to observe the initial amount of stain and the dye remaining after successive rinsings. Thus, S was free to provide for herself a form of feedback which could easily have been more potent than the verbal statements delivered by E. In any event, it was clear that Ss typically responded to the measurement procedure with nervousness and embarrassment. This emotional arousal could have had an effect similar to feedback in motivating Ss of all groups to improve their dental hygiene habits.

Regardless of the reasons for the failure of the feedback variable used in the present study, it is probably true that a form of manipulated feedback could be devised, which would be effective in controlling toothbrushing behavior. This is a possible issue for future research to consider.

Persuasive Communications

Unfortunately, the present results do not greatly clarify the conflicting evidence concerning effectiveness of persuasive appeals. In contradiction to Hypotheses 2

and 3, neither affective appeal was significantly more effective than no appeal, in producing behavior change. Furthermore, the two films failed to arouse measurably different degrees of reported anxiety. Since the fear-arousal treatment may have failed to arouse anxiety, no conclusion may be made regarding the effects (or lack of effects) of fear-arousing communications.

Alternatively, it may be true that the questionnaire measure of reported anxiety was at fault in the present study. A previous study (Stacey, 1970) which used the same films, but a larger number of reported-anxiety questionnaire items, was successful in demonstrating affect arousal in fear-arousal Ss.

The present results lend support to no general theoretical principle extolling the superiority of either positive or fear-arousing appeals. As Higbee (1969) noted, it appears that the effects of persuasion depend largely on situational factors other than strength and direction of affective appeal. These factors may include subjects, topics, experimenters, message content and length, measures, criteria of affect arousal, and media. Evidence of the possible effect of media can be found in the observation that both Stacey (1970) and the present study, using the same films, failed to demonstrate differential behavioral effects, whereas an earlier study (Evans et al., 1970), which used similar live presentations, succeeded.

A possible direction for future research is to systematically explore the effects of situational factors and their possible interactions with affect arousal.

Repeated Measures

The clearest indication of the present study is that repeated measures were probably effective in producing and maintaining a significant improvement in toothbrushing behavior. This conclusion depends on the assumption that behavior change was not primarily due to the passage of time and junior high school girls' growing awareness of their appearance. An additional control group which received only pretest and final posttest measures would have helped to gauge the contribution of this factor.

Of course, the measurement process involved a constellation of different stimuli, and it is impossible to conclude that any particular stimulus or subset of stimuli were definitely responsible for the behavior obtained. Nevertheless, based on incidental observations of Ss' behavior, it appeared that the staining and photographing of teeth produced greater emotional arousal and involvement than any other (independent or dependent) stimuli. Whereas Ss expressed only mild interest in the films and feedback, their anxiety regarding the behavioral measure remained noticeable throughout the 11-week span of the study. This procedure, or some portion of it, was probably the major determinant of the measured behavior change. No definite

conclusion is possible, however, without further research in which these variables are manipulated.

Another indication regarding future research is that the presentation of independent variables should not be confounded with frequency of measurement. In the present study, dependent measures were most frequent in the weeks immediately following the presentation of persuasive messages. Thus, the strongest reaction to the behavioral measures probably occurred at about the same time as the greatest effect of persuasion, making the two effects difficult to separate. Similarly, frequency of feedback presentation was confounded with frequency of measurement.

Two methodological suggestions are indicated for future research using repeated obtrusive measures. First, a sufficient number of pretests should be scheduled to insure that effects of the measures themselves reach a plateau before the introduction of independent variables. Secondly, pre- and posttests should be scheduled at approximately equal time intervals, and independently from the manipulated variables. These precautions would facilitate clearer separation of the effects of independent and dependent variables.

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FOOTNOTES

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[1]The present study was supported within the context of Training Grant No. 5 TI DE 138 from the National Institute of Dental Research, National Institutes of Health, Department of Health, Education, and Welfare, under the direction of Dr. Richard I. Evans.

[2]In this experimental condition learning was hindered somewhat, but no more so than another group which received immediate feedback and returned one week later for the next trial. Thus, the authors concluded that learning was hindered not by delayed feedback per se, but by the length of the intertrial interval.

[3]Due to administrative problems, the measurement technique varied slightly during the course of the study. Midway through the pretest, school personnel requested that the method of displaying teeth for photographs be changed from use of lip retractors to use of Ss' fingers. This request was honored, as was a later request (during the one-week posttest) by Ss of one class that the procedure for staining teeth be altered from use of an admittedly bad-tasting liquid form of dying agent, to a better-flavored tablet form of the same agent. D. L. Williams and the present author performed an unpublished independent study to determine the effects on the slide ratings of the changes in measurement technique. Results indicated no significant differences in slide ratings due to variations in measurement.