

Message Discrepancy and the Persistence of Attitude Change: Implications of an Information Integration Model

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A mathematical model of long-term attitude change is presented. The model integrates various processes (forgetting, cognitive responses, and external messages), which occur subsequent to initial attitude change, into an information integration model. There is also a discussion as to how message discrepancy might affect these processes, and it is shown that the discrepancy which produces the greater initial change need not produce the greater long-term change. This model was then used to analyze the data from an experiment in which subjects ($N = 442$) were given one or two messages which were either moderately or extremely discrepant from their own views and in which attitude change was measured both immediately after the message(s) and several days later. Initially, more attitude change was associated with *greater* discrepancy and with two (vs one) experimental messages. Later, the position advocated in the first message

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explains all significant group differences. Moreover, those who had received the *less* discrepant message showed more long-term attitude change. The data analysis demonstrates the estimation of parameters in the model and the values of these parameters provide some information as to the relationship between discrepancy and subsequent message processing. © 1986 Academic Press, Inc.

Many studies (e.g., Aronson, Turner, & Carlsmith, 1963; Bochner & Insko, 1966; Brewer & Crano, 1968; Fink, Kaplowitz, & Bauer, 1983; Freedman, 1964; Jaccard, 1981; Nemeth & Markowski, 1972; Whittaker, 1965) have examined the relationship between message discrepancy and attitude change. All of these studies, however, have only examined the *short-term* effects of message discrepancy. It may, however, be the case that the level of discrepancy in a message not only influences the short-term processing and hence, the initial attitude change produced by a message, but has effects on the *long-term* processing which produces delayed attitude change.

In this article, we show how an information integration approach, which has been found useful in relating message discrepancy to short-term attitude change, can also be used to understand the effect of discrepancy on long-term change. Having done so, we use this model to interpret the results of an experiment on the long-term effects of persuasive messages of different discrepancies.

Processes Leading to Delayed Attitude Change

As Cook and Flay (1978, p. 7) state, time has no psychological effect, in and of itself: "Rather, it is one kind of locator variable for interpersonal and intrapersonal processes which take place in time and directly mediate attitude change." Hence, we discuss some processes which cause delayed attitude change. We then relate these processes to message discrepancy.

One process which leads to delayed attitude change is *forgetting* (see Ebbinghaus, 1964). First, there is evidence that retention of some aspects of a message is positively related to the persistence of the attitude change induced by the message. While the relationship between retention and persistence has sometimes been found to be nonexistent (e.g., Cacioppo & Petty, 1979), Cook and Flay (1978, p. 31) conclude that while memory of message details supporting a view seems relatively unimportant, other aspects of memory appear more so. In particular, they suggest that (a) remembering the *conclusion* of a message and (b) remembering that a point of view *can be* supported are sometimes related to persistence. Second, Miller and Campbell's (1959) work on primacy and recency shows that when a sequence of messages is provided, the degree to which it is effective depends, in part, on the time interval between the messages and on the interval from the last message to the point of testing.

A different set of processes involves *active cognitive responding*. Much

recent research (see Petty, Ostrom, & Brock, 1981, for a review) shows that favorable and unfavorable thoughts generated by a message are associated with short-term attitude change. It is quite reasonable to expect that such thoughts continue to be generated, and to produce attitude change, long after the initial message is received. Tesser (1978) has shown that even in the absence of contemporaneous external messages, attitudes do in fact change over time. Moreover, Watts (1967) found that the retention of these self-generated thoughts has a clear relationship to the final attitude.

In addition to intrapersonal processes like forgetting and subvocal pro- and counterarguing, an interpersonal process may also be implicated in delayed attitude change. When people are exposed to events or messages which conflict with their beliefs, they experience dissonance. Under such circumstances, they are likely to communicate with others to seek support for their beliefs (Festinger, Riecken, & Schachter, 1956). Such communication will cause the subject to *receive further messages* on that same topic. These messages will, in turn, affect the time course of the attitude. In particular, if these messages support the attitude held *prior* to the first message, they should contribute to the decay of the attitude change caused by that first message.

Information Integration and Long-term Attitude Change

We now present a formal model which enables us to consider the implications of the processes of long-term attitude change which we have discussed above.

The model we are using is an information integration model based on the work of Saltiel and Woelfel (1975), and Himmelfarb (1974), and closely related to the work of Anderson (e.g., 1974, 1981) and Birnbaum and Stegner (1979). For predicting short-term attitude change, this model was found to be very successful by Fink et al. (1983). After presenting this model, we show how it can shed light on the persistence of attitude change. We use this model to show how phenomenally different processes (e.g., externally vs internally generated messages) can have functionally equivalent effects. We further show that knowing the outcome of these processes requires not simply knowing the number and direction of messages which occur after a specific stimulus message, but requires knowing the position that these messages are supporting.

The model assumes that the subject's attitude or belief regarding an issue can be represented as a location on a unidimensional continuum.¹

¹ While we believe that it is possible to evaluate a single entity as on a unidimensional continuum, following Woelfel and Fink (1980) and Kaplowitz and Fink (1982), we regard the entire system of attitudes and beliefs as multidimensional. We regard the information integration model of attitude change as a useful unidimensional simplification of motion which takes place in many dimensions.

It also assumes that each message relevant to the issue can be assigned a location or scale value on that same continuum. If the recipient views the message source as unbiased, the scale value of a message is the position that the subject interprets the message as advocating (but see Birnbaum & Stegner, 1979).

The model assumes that the subject's position is the weighted average of the scale values of all messages which he/she has received. Thus, when the subject's view is at equilibrium, the value of the equilibrium position, P_{EQ} , satisfies the equation

$$\sum_{i=1}^n (w_i S_i - P_{EQ}) = 0, \quad (1)$$

where S_i is the position of the stimulus message i , w_i is its weight (we assume that all w_i are nonnegative), and n is the total number of messages which have been received. In other words, at equilibrium, the subject's position is at the "center of gravity" of all previous messages.

The weight of a message may depend on a number of factors. Saltiel and Woelfel (1975) suggest that it depends on the length of and number of arguments contained in the message. Himmelfarb (1974) suggests that it may depend on the credibility of the source and on whatever other factors make the message more readily remembered. Birnbaum and Stegner (1979) show that expertise, which is one component of credibility, does in fact influence the weight of a message. Finally, the weight of a message is a decreasing function of the discrepancy of the message from the subject's own view (see Fink et al., 1983). Those factors which determine the weight of a message are, however, explicitly included in our equations only when they are directly relevant to our discussion of long-term attitude change.

Suppose the subject's attitude is initially at equilibrium at P_0 and he/she now receives a new stimulus message with position S_1 . We define the total weight of all previous messages as w_0 . We can treat this weight as if it were all at P_0 , the center of gravity. Then P_1 is simply the weighted average of P_0 and S_1 :

$$P_1 = \frac{w_0 P_0 + w_1 S_1}{w_0 + w_1}. \quad (2)$$

If the subject receives a number of new messages, we simply include all of their weights and scale values in the numerator and denominator of Eq. (2) above.

We now use the model above to consider the implications of various processes for long-term attitude change. As indicated above, the weight of a stimulus message depends, in part, on the degree to which the message (or at least its conclusion) is remembered. Hence, *forgetting*,

whether from simple disuse of learned material or from interference from other material (see Hintzman, 1978), should lead to a loss of weight of the message. Over time, not only may the stimulus message, S_1 , be forgotten somewhat, but so may the previous messages which created the subject's initial position, P_0 . Suppose that the final weight of all the previous messages is qw_0 , and the final weight of the stimulus message is rw_1 , where $0 \leq q, r \leq 1$ and where q and r reflect the degree to which each set of messages has been remembered. The relative sizes of r and q reflect the degree to which memory becomes biased toward the recent stimulus message, or to the prior messages, which formed the subject's prestimulus position.

The other subsequent processes of concern to us are the generation of *cognitive responses* and the receipt of *messages from others*. Both of these processes involve the subjects receiving additional messages, whether from themselves or from others. Applying our model, each of these messages can be assumed to have both a weight and a position or scale value. (In fact, it is possible that self-generated arguments have more effect, and hence should be regarded as having more weight than externally generated ones; Greenwald and Albert (1968) demonstrated a greater recall and persuasiveness of self-generated than externally generated arguments.) Thoughts or messages favorable to the experimental message, S_1 , will have scale values close to S_1 . Counterarguments, whether self-generated or from others, will have scale values far from S_1 , possibly even farther from S_1 than P_0 is.

Let us assume that the subject receives n subsequent messages, numbered $1L$ through nL (where the number indicates the order in which they were received and where L stands for later) whose average value is S_{DEL} . Substituting qw_0 for w_0 , rw_1 for w_1 , and including the effects of the subsequent messages, gives us an equation for P_2 , the final attitude:

$$P_2 = \frac{qw_0P_0 + rw_1S_1 + \sum_{i=1}^n w_{iL}S_{DEL}}{qw_0 + rw_1 + \sum_{i=1}^n w_{iL}}. \quad (3)$$

Rearranging the terms in Eq. (2) gives us

$$w_1S_1 = (w_0 + w_1)P_1 - w_0P_0. \quad (4)$$

Substituting for w_1S_1 and into Eq. (3) and rearranging terms gives us

$$P_2 - P_0 = \frac{r(w_0 + w_1)(P_1 - P_0) + (S_{DEL} - P_0)\left(\sum_{i=1}^n w_{iL}\right)}{qw_0 + rw_1 + \sum_{i=1}^n w_{iL}}. \quad (5)$$

Equation (5) can be rewritten as

$$P_2 - P_0 = a(P_1 - P_0) + k(S_{\text{DEL}} - P_0) \quad (6)$$

where

$$a = \frac{r(w_0 + w_1)}{qw_0 + rw_1 + \sum_{i=1}^n w_{iL}} \quad (7)$$

and

$$k = \frac{\sum_{i=1}^n w_{iL}}{qw_0 + rw_1 + \sum_{i=1}^n w_{iL}}. \quad (8)$$

By subtracting $P_1 - P_0$ from both sides of Eq. (6), we get an equation for the change between Time 1 (the time right after the stimulus message) and Time 2; recall that Time 0 is the time *prior* to the stimulus message

$$P_2 - P_1 = (a - 1)(P_1 - P_0) + k(S_{\text{DEL}} - P_0). \quad (9)$$

Let us now examine the implications of Eqs. (6)–(9), noting that $P_2 - P_0$ is the *final* total attitude change, that $P_1 - P_0$ is the *initial* attitude change, and that $P_2 - P_1$ is the *delayed* change.

Equations (6) and (9) show that there is a component of the final attitude change (and the delayed change) which is proportional to the initial attitude change. This has the important implication that, other things being equal, the greater the absolute value of the *initial* attitude change, the greater the absolute value of the delayed change. Equations (6) and (9) also show that there is a component of the delayed (and the final) change which is proportional to the difference between the scale value of the *subsequent* messages and P_0 .

The letter a is the coefficient of proportionality to the initial change and k is the coefficient of proportionality to the discrepancy of the subsequent messages from the initial view. For short, we will call a the *initial change coefficient* and k the *subsequent discrepancy coefficient*.

Let us now consider the range of possible values of a and k , and the consequences of those values for the final change. Since all of the quantities on the right sides of Eqs. (7) and (8) are assumed to be nonnegative, both a and k must be nonnegative. From Eq. (8), it is clear that k must be less than or equal to 1.

We see that a must also be less than or equal to 1 as long as the numerator of Eq. (7) is less than or equal to the denominator. If we

subtract rw_1 from both numerator and denominator, we see that this will be true as long as

$$rw_0 \leq qw_0 + \sum_{i=1}^n w_{iL}. \quad (10)$$

This inequality is likely to hold for two reasons. First, it must hold if $q \geq r$ (i.e., the memory of messages which determined the subject's original position decays no faster than the memory of the stimulus message(s)). If the original position has been integrated into various schemata and stored in long-term memory, it is, in fact, very likely that $q \geq r$. Second, even if $r > q$, Inequality (10) could still hold if the total weight of subsequent messages is sufficiently large (i.e., if the subject talks and/or thinks about the topic). Hence, except in situations designed to obliterate earlier memories, and which provide little desire or opportunity to talk or think about the topic of the stimulus message, the value of a should also be between 0 and 1.

Let us now consider how various subsequent processes affect the values of the initial change and subsequent discrepancy coefficients (a and k). All of these statements make the assumption of *ceteris paribus*.

1. The larger is q , the memory of the premessage position, the smaller are both a and k and consequently, the smaller is the final attitude change (i.e., the closer to P_0 is the final attitude).

2. Since r (the memory of the stimulus message), w_1 (the weight of the stimulus message), and w_0 (the weight of the original position) appear only in the denominator of the equation for k , the larger are these quantities, the smaller is k and so the less the final attitude approaches the subsequent (i.e., delayed) messages.

The effects of these quantities on a is as follows: The larger is r , the larger is a . If $q = r$, then it is also the case that a is an increasing function of both w_0 and w_1 (and of q as well).² The larger is a , the closer the final attitude change is to the initial change (i.e., the closer the final attitude is to P_1).

² By taking the partial derivative of a with respect to w_1 , we find that a is an increasing function of w_1 as long as

$$(q - r)w_0 + \sum_{i=1}^n w_{iL} > 0.$$

Analogously, we find that a is an increasing function of w_0 as long as

$$(r - q)w_1 + \sum_{i=1}^n w_{iL} > 0.$$

Hence, if $r = q$, and the weight of the delayed messages is nonzero, a is an increasing function of both variables. If, however, $r > q$, then a might be a decreasing function of w_1 , and if $q > r$, then a might be a decreasing function of w_0 .

3. The greater is the total weight of the *delayed* messages, the greater is k and the smaller is a . Consequently, the greater is this factor, the more the final attitude will approach the average scale value of the delayed messages.

In short, memory of the earlier information and greater weights of both the original position and the position in the stimulus message tend to contribute to greater values of a . Delayed messages contribute to k . Over time, however, we expect that the factors contributing to a get weaker, through forgetting, while k increases through an increasing number of poststimulus (delayed) messages. Hence, over time the final attitude should move toward the positions advocated by these delayed messages.

To summarize, we have identified seven variables which should jointly determine final attitude change: (1) initial attitude change ($P_1 - P_0$); (2) discrepancy of delayed messages from initial attitude ($S_{\text{DEL}} - P_0$); (3) memory of original position (q); (4) memory of stimulus message (r); (5) weight of initial position (w_0); (6) weight of stimulus message (w_1); (7) sum of weights of delayed messages (Σw_{iL}). We have also derived a functional relationship between them and final attitude change, within the framework of the information integration approach.

The Effect of Discrepancy on Final Attitude Change

While the effect of discrepancy on *short-term* attitude change has received considerable attention in both theoretical and empirical work, its effect on *long-term* change has been generally neglected. Equation (6) tells us the determinants of long-term change. Let us now consider how these factors may depend on discrepancy.

The initial change, $P_1 - P_0$, is well-known to be a function of the discrepancy between the stimulus message and the subject's initial position, generally reaching a maximum value at moderate discrepancies. Suppose that all other factors in Eq. (6) were independent of discrepancy. In this case, the difference between the *final* changes induced by two different levels of discrepancy would simply be the difference between the *initial* changes they had induced, multiplied by a . In other words, the final changes would be closer together (since a is generally less than 1), but their rank order would stay constant over time.

Let us now consider *whether the variables in Eq. (6) should be independent of discrepancy*. The weight of the original position, w_0 , was determined prior to the stimulus message, so it should, in fact, be independent of discrepancy (D). The weight of the stimulus message, w_1 , however, should be a decreasing function of D , in order to be consistent with the finding that the ratio of attitude change to D generally decreases as D increases. Let us now see if D might affect those processes which occur *after* the stimulus message is received.

Forgetting. Does the memory of one's original position, q , depend on how much one's attitude has changed as a result of the stimulus message? Since the initial change is a function of D , if the answer to the above question is "yes," then q depends on D .

The memory of the stimulus message, r , might depend directly on D . It also might depend on the gap between the position advocated in the stimulus message and P_1 . This gap, in turn, depends on D .

Theoretical arguments could be made to support either the view that retention would be greater for more discrepant messages or for the opposite view. Information or messages which are discrepant may be viewed as schema incongruent. Some authors argue that highly incongruent information is more memorable (Wyer & Gordon, 1982) while others (e.g., Taylor & Crocker, 1981) suggest that a schema filters out incongruent information. The empirical evidence is similarly mixed (see O'Sullivan & Durso, 1984).

Instead of being viewed as schema incongruent, discrepant messages could be viewed as unpleasant. Some (e.g., Freud, 1938) have suggested that people tend to selectively forget the unpleasant. One could argue instead that unpleasant stimuli create arousal. Moderate arousal, in turn, has been shown to accompany active cognitive processing (see Cacioppo & Sandman, 1981; Kahneman, 1973), which facilitates retention. Roberts (1985) tests the selective memory hypothesis in a meta-analysis and finds, overall, a small but significant positive correlation between agreement with messages and memory of them. Not only is the effect weak, but none of the studies are dealing precisely with our concern, namely, memory of messages, all of which disagree with the subject from the same direction, but which disagree to different degrees.

In short, the above discussion suggests that it is quite possible that messages of different discrepancies are remembered to different degrees, but we lack clear evidence as to the direction of any such effect.

Double messages and forgetting. Suppose the subject receives, not a single stimulus message, but two such messages, close together in time, which may differ in discrepancy. It has been found that the first message is especially likely to interfere with retention of the second (1) the smaller the time interval between the first message and the second (Underwood & Frund, 1968) and (2) the larger the interval from the second message to the time of measurement (see Hintzman, 1978). The results of these proactive interference experiments are consistent with, and explain, the primacy-recency results of Miller and Campbell (1959). While Miller and Campbell dealt with a situation in which the two messages took the opposite position, their findings may also be relevant to situations in which the messages, while varying in discrepancy, are both on the same side of the issue.

If the subject's attitude is measured immediately after receipt of the two stimulus messages occurring close together in time, both stimulus messages should be remembered and have an effect. As the time from the stimulus messages increases, there should be a primacy effect, in which the second message is forgotten. If this occurs, the discrepancy of the second message should have little, if any, effect on the subsequent cognitive processing and communication patterns. This suggests the following hypothesis:

H.1: Given the near simultaneous receipt of two messages, taking positions on the same topic, with a substantial delay prior to the final attitude measurement, the discrepancy of the first message will be the major determinant of the various subsequent processes which determine a and k .

Weight of poststimulus messages. Two factors which should determine this are the number of such messages received and the discrepancy of those messages from the subject's view (at the time those messages are received). The latter is related to the scale value of the poststimulus messages, which are considered below. We now consider the number of these messages.

The little evidence of which we are aware appears to indicate that greater discrepancies generate a greater number of *cognitive responses*. Brock (1967) found that more highly discrepant messages tend to generate a greater number of counterarguments. Even stronger evidence is Cacioppo and Petty's (1979) finding that a counterattitudinal (highly discrepant) message generated more total cognitive responses (favorable thoughts plus counterarguments) than did a proattitudinal (minimally discrepant) message.

While we are aware of no empirical studies of the effect of discrepancy on *externally generated messages*, there is a theoretical rationale for positing a relationship similar to the one indicated above for cognitive responses. Aronson et al. (1963) assert that the more discrepant the message, the greater the dissonance it will cause. They list four means of reducing this dissonance. The most important for the present discussion are (1) changing one's attitude to agree with the source and (2) seeking social support for one's original beliefs. A large number of studies show that for small discrepancies, attitude change increases with increasing discrepancy. Attitude change, however, does not typically increase in proportion to increases in discrepancy. If the Aronson et al. dissonance formulation is appropriate, it is reasonable to assume that greater discrepancy leads to a greater amount of unresolved dissonance and, hence, to more seeking of social support. This, in turn, should lead to a greater number of externally generated messages.

Let us now consider the effect of discrepancy on the *scale value* of

poststimulus messages. Here, too, the evidence is scant, but the existence of some effect is plausible. If the position advocated by a stimulus message is extremely discrepant and there is little or no rationale for that position, it is quite plausible that reactance will occur (see Brehm, 1966; Mazis, 1975). Such reactance could lead to the subject generating cognitive responses which cause the subject's view to move in the opposite direction from the change advocated by the stimulus message (e.g., a "boomerang" effect; see Cohen, 1962).

Suppose that discrepancy is positive and that initial attitude change is in the direction of the position advocated by the stimulus message (i.e., $P_1 - P_0 > 0$). From examining Eq. (6), it is clear that if a and k are both greater than 0, then the only way in which $P_2 - P_0$ can be less than 0 is if the scale value of the poststimulus messages is less than P_0 . Hence, with these assumptions, a "boomerang" effect is evidence that the subject has received such messages, whether internally or externally generated.

Unpublished data (Fink, Kaplowitz, & Bauer, 1979) show such a boomerang. In that study, subjects who received an extremely discrepant message (one advocating a 50% tuition increase) which did *not* include any rationale, recommended a smaller tuition increase than did control subjects. Those who received a moderately discrepant message (advocating 15% tuition increase) without a rationale did not show such a boomerang. Since this study did not allow for poststimulus external messages prior to measurement, its results suggest that greater discrepancies led to cognitive responses with scale values below P_0 .

If extremely discrepant messages can cause people to react with cognitive responses, whose scale value leads to a boomerang, it is also plausible that reporting such extremely discrepant messages to others can have a similar effect. It may cause these others to experience reactance and respond with external messages whose scale value may be below P_0 .

Summary and Implications

In addition to affecting the short-term change, $P_1 - P_0$, discrepancy may also affect some of the *subsequent* processes which lead to the long term change, $P_2 - P_0$. In particular, discrepancy may affect the memory of the stimulus message(s), the number (and hence weight) of delayed messages, and the scale value of such delayed messages.

If discrepancy does have such effects on subsequent processes, then our model implies that it is quite possible that a discrepancy which produced a greater amount of short-term change may produce a lesser amount of long-term change. We now show some of the plausible ways in which this can happen.

Discrepancy and the scale value of delayed messages. Suppose the greater discrepancy produces a greater value of P_1 than does the lesser

discrepancy, but results in a lower value of S_{DEL} , the average scale value of the delayed messages. If there are a sufficient number of delayed messages, the more discrepant message may produce a lesser value of P_2 .

Discrepancy and memory. Suppose the less discrepant message produces a greater value of P_1 (which is possible if the *less* discrepant message has an optimal discrepancy) but the more discrepant one is better remembered (i.e., has a higher value of r) thus causing a greater value of a . In this case, the more discrepant message may have a greater value of P_2 .

Discrepancy and weight of delayed messages. Suppose the more discrepant message produces a greater value of P_1 , but also produces a greater number, and hence weight, of delayed messages. This would result in a greater value of k and lesser value of a than the less discrepant message. (Refer to the discussion of Eqs. (6)–(8) to see why a and k are so affected.) As a consequence, P_2 for the *more* discrepant message will be relatively close to S_{DEL} for *that* condition. P_2 for the *less* discrepant message, however, will be relatively close to the corresponding value of P_1 . If the larger of the two values of S_{DEL} is less than the smaller of the two values of P_1 (in this example, the value for the less discrepant message), this could cause P_2 for the less discrepant message to be higher than P_2 for the more discrepant message.

As far as we know, the idea that the attitude change trajectories of different discrepancies may cross each other has never been previously predicted or found. Cook and Flay (1978, p. 6) show a number of theoretical patterns of trajectories for pairs of treatment groups. They show the two groups diverging over time, moving parallel to each other, and converging. They do not, however, show the trajectories crossing.

Below, we report a study showing the short-term and long-term attitude change resulting from different levels of discrepancy. It illustrates the utility of the expanded information integration model in the following ways. First, consistent with possibilities derived from the model, it finds the "cross-over" effect discussed above. Second, it enables us to demonstrate the calculation of two key model parameters, the a and k coefficients. Third, it permits us to see if the estimated values of the coefficients fall within the range predicted by the model. Fourth, it permits a test of our hypothesis regarding the effect of primacy on the subsequent processing. Finally, the estimated values of these coefficients shed some light on the way in which discrepancy influences subsequent processing.

METHOD

Overview

Subjects were undergraduate students at a large state university in Michigan. All subjects, except for control subjects, were exposed to an experimental stimulus which either contained

one message or two messages presented in rapid succession. Each message in the stimulus advocated either a moderate or an extreme increase in tuition. The moderately discrepant message advocated a 15% tuition increase. The extremely discrepant message advocated a 50% increase. Subjects were assigned randomly to conditions. A post-test only design was used, with measures immediately following treatment and about 4 days after the treatment.

Topic and Discrepancy Levels

The choice of tuition increase as the topic for the treatment messages replicates Fink et al. (1983). In that study, the selection was based on two criteria. First, they wanted a topic on which there was a high degree of personal involvement so that the attitudes involved should be fairly resistant to change. Second, they wanted a topic with very little variance in the subjects' initial attitudes.

In order to determine the issue which met these two criteria, two undergraduate classes were given questionnaires asking how important each of a number of issues was to them, and how often they discussed each issue. Students were also asked what they thought the actual state of affairs was for each issue, and what it should be. Of the 21 issues dealt with in these questionnaires, the one that was rated most important and was most often discussed was tuition. This was not surprising in that a possible tuition increase not only has a direct effect on students, but had been receiving a great deal of attention in the campus press. In addition, there was a high level of consensus concerning how much tuition should be raised the following year. Over half the sample (total $N = 63$) favored no increase in tuition (mean = 2.0%, standard deviation = 3.59%). Moreover, percentage tuition increase may be readily measured on a theoretically continuous and unbounded scale, which should enhance the precision of measurement and assist us in finding the correct functional form of relationship between the variables of interest.

To determine the appropriate tuition increases for experimental messages in the Fink et al. study, an undergraduate class ($N = 43$) was asked to indicate a percentage increase in tuition which was *moderately* discrepant from their own position, a percentage increase which was *substantially* discrepant from their own view, and one which was *extremely* discrepant from their own view. As the extreme view, Fink et al. chose a level (50%) which was considered extreme by all but three persons (7%) in that sample. The other attitudinal position was designed to advocate a view considerably more moderate than the extreme view but sufficiently discrepant from the subject's own view that it might seem extreme unless it was presented along with a much more extreme view. The 15% tuition increase was essentially the most extreme "moderate" view in the class, and it was also among the most moderate "extreme" views. Hence 15% was selected to represent a moderate position in the Fink et al. study. In the present study, the same levels for extreme and moderate discrepancies are used.

Procedure

For the first part of the study, experimenters approached undergraduates at different campus dormitories according to a systematic sampling procedure and asked them if they would participate in a survey of student opinion. If the subject agreed, he/she was handed a sheet of paper which identified the experimenter as someone working for the State Senate Subcommittee on Higher Education, in its attempt to assess student opinion regarding state funding for public colleges and universities. Each subject was then shown a bogus news clipping which indicated that in order to ease the state's financial burden, one or two consulting firms retained by the subcommittee had recommended increasing tuition at all state-funded colleges and universities.

Each subject was shown one of seven different bogus news clippings. In two of the clippings, one consulting firm recommended a specific percentage increase, either the

moderate (15%) increase or the extreme (50%) increase. Four of the clippings stated that recommendations had been made by *two* different consulting firms. Each possible combination of the two different positions was used: a 15% increase advocated by both firms; a 50% increase advocated by both firms; a 15% increase by one firm and then a 50% increase recommended by the other firm; and a 50% increase followed by a 15% increase. In the seventh condition, the clipping indicated that one firm was considering an increase in tuition, but no percentage increase was specified. Aside from these differences, the clippings differed only with respect to grammar.

After reading the bogus news article, subjects filled out a card with their names and phone numbers, indicating the percentage increase they thought appropriate. Presumably, this information was to be provided to the legislature. Subjects were shown a debriefing statement immediately after they filled out the cards. In this statement, they were told that the data collection was for a research study, not a Senate subcommittee, and that the newspaper article was bogus, but that the possibility of a tuition increase was real. (In fact, tuition was raised by about 15% the following academic year.) The debriefing statement also asked subjects not to speak to anyone about the study for a week, so that the study could be completed.

Each subject was called on the phone and asked to spend a few minutes answering some questions for an allegedly different study. (In most cases, this was 4 days after the time one contact. In a few cases it was more, with a maximum lapse of 8 days.) The telephone interviewer was never the same person who had approached the subject with the bogus article; usually it was someone of the opposite sex from the original interviewer. The telephone survey contained 20 questions including, "What percent should tuition be increased [at this university]?"

During the callback phase of the study, a control group was added. This consisted of subjects randomly selected according to telephone numbers in the student directory. These subjects did not participate in the earlier phase of the study, but were also undergraduates living in campus dormitories.

The experimenters were 57 undergraduates from a class in research methods, who were carefully trained and supervised. Each experimenter was given a detailed statement of the experimental procedures, and time was spent reviewing these instructions. Moreover, for the interview phase, the experimenters had to say very little; almost everything they needed to communicate was on one of the written sheets they were to show subjects. Finally, experimenters were warned that fabricating data would have consequences which were much more serious than the consequences of failing to turn in data, and that callbacks would be made to verify that the study was done appropriately. At least one subject for each experimenter was called back to provide a check on the possibility of fabrication. No evidence of any fabrication was found.

The sampling procedure for the interview phase was as follows. Groups of approximately eight experimenters were assigned to different dormitories. Group members were each to choose a different floor of the dorm, with male experimenters interviewing on the male side of each dormitory and female experimenters interviewing on the female side. Each experimenter was to go to every third room. The interview was to be done in private.

Each experimenter gathered data on one subject in each of the seven Time 1 conditions and on one subject in each of the eight Time 2 conditions. (See Table 1 for these conditions.) In the initial interview phase, the forms and information were always arranged so that the treatment condition would not be visible to the experimenter during the interaction with subjects. In all, the sample size was between 55 and 57 per cell at Time 1, for a Time 1 *N* of 394, and between 45 and 49 per cell at Time 2, for a Time 2 *N* of 381. The *N* for the entire study was 442, the 394 at Time 1, plus 48 in the control (no Time 1 contact) condition.

TABLE 1
GEOMETRIC MEAN (AND 95% CONFIDENCE INTERVAL)^a FOR PERCENTAGE TUITION INCREASE
ADVOCATED BY SUBJECTS, BY POSITION(S) ADVOCATED IN MESSAGE(S) AND BY TIME

Position(s) advocated in message(s)	Time	
	t_1	t_2
Control (No t_1 contact)	—	0.076 (0.033, 0.175)
NP (No specific percentage)	0.640 (0.278, 1.474)	0.175 (0.071, 0.428)
15%	0.331 (0.140, 0.781)	0.604 (0.256, 1.426)
50%	0.555 (0.218, 1.412)	0.130 (0.052, 0.325)
15% + 15%	1.630 (0.752, 3.530)	0.564 (0.215, 1.477)
50% + 50%	3.650 (1.737, 7.670)	0.257 (0.097, 0.680)
15% + 50%	1.139 (0.526, 2.687)	0.708 (0.287, 1.745)
50% + 15%	2.827 (1.375, 5.813)	0.218 (0.084, 0.567)

^a Note that confidence intervals were determined for the transformed data and then calculated back to original (percentage tuition increase) metric. These intervals are therefore asymmetric. Sample size is between 55 and 57 per cell, for a total N of 394 at t_1 . Sample size is between 45 and 49 per cell for a total N of 381 at t_2 .

RESULTS

Since the statistical tests used required that residuals meet the conditions of normality and homoscedasticity, a search was conducted for the transformation of the data that would minimize heteroscedasticity in the dependent variable, percentage increase in tuition advocated by the subject (see Bauer & Fink, 1983). The transformation which best fit this condition was the natural logarithm of the raw score ($\ln(X)$ for $X > 0$; $\ln(.01)$ for $X = 0$).³ However, in order to make the central tendencies for each condition readily interpretable, Table 1 presents the results in the original metric. This has been accomplished by taking the antilogarithms of the

³ The criterion used to find the appropriate transformation was the minimization of the ratio of the variance of the cell with the maximum variance to the variance of the cell with the minimum variance. The (maximum variance)/(minimum variance) ratio for the transformed data at Time 1 was 1.749. The (maximum variance)/(minimum variance) ratio for the transformed data at Time 2 was 1.371. This represents a major improvement over the raw data, which had a (maximum variance)/(minimum variance) ratio of 7.06 at Time 1 and 64.96 at Time 2 and thus appeared extremely heteroscedastic.

condition means of the logarithmically transformed data (i.e., undoing the effects of the transformation, for each mean). Thus, this table presents the *geometric* mean for each condition, with the proviso that 0 has been changed to 0.01.

In all further analysis, the "No Specific Percentage" (NP) condition was omitted, since we have no theoretical basis for deciding the discrepancy level of that message.

Time 1 Results

Recall that our experimental stimulus contained one or two messages. Each message (except for the NP condition) advocated a particular position. From Table 1 and Fig. 1, it appears that, holding the position advocated

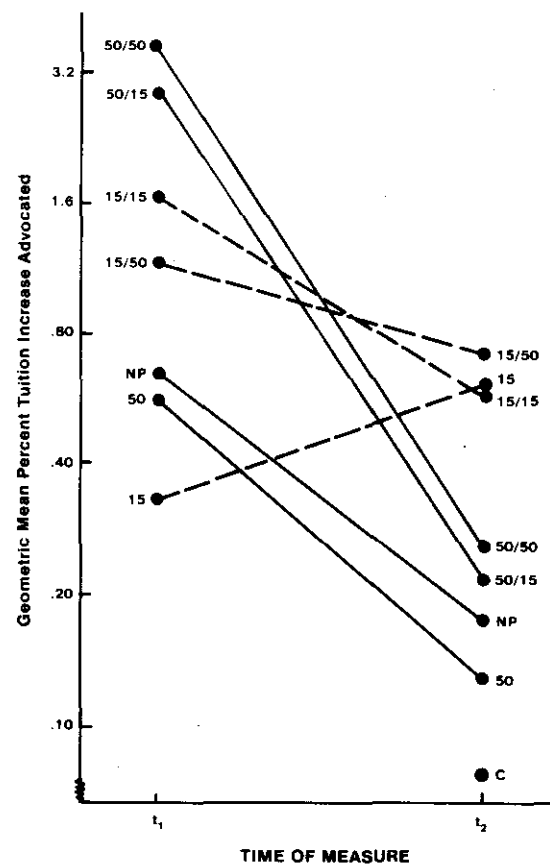


FIG. 1. Geometric mean of percentage tuition increase advocated by subjects, by position(s) advocated in experimental message(s) and by time. "NP" refers to the message condition in which no specific percentage was advocated. "C" is the control condition, with no Time 1 contact. The y axis is logarithmic; equal distance intervals represent equal ratios.

in the second experimental message constant, there was more attitude change if the first message advocated a 50% increase than if it advocated a 15% increase. The analysis did not show this effect to be significant at the .05 level ($F(1, 279) = 2.257$). The effect of the second message was highly significant, $F(2, 279) = 7.44, p = .001$. It appears from Table 1, however, that the effect of the second message was not due to its position, or to whether it took the same or a different position from the first message, but to its mere presence. Conditions which have a second experimental message showed more attitude change than did the single-message conditions.

Time 2 Results

The Time 2 results are dramatically different from the Time 1 results. Looking at Fig. 1, it is clear that all of the conditions in which 15% was the first or only position advocated have the highest means and are remarkably close to each other. All of the conditions in which 50% was the first or only position advocated are found to have induced *less* attitude change than the 15% messages. A two-way ANOVA on the Time 2 data, on the same conditions analyzed at Time 1 (i.e., excluding both the NP and the control groups) finds a highly significant effect of the position in the first message $F(1, 279) = 9.08, p = .003$. Recall that at Time 1, while the effect of the first message did not reach significance, the conditions in which 50% was advocated by the first or only message had *higher* means than did the corresponding 15% conditions.

The effects of both the position in the second message and the interaction of the first and second messages had effects which were nowhere near significant ($F < 0.5$ in both cases.) Again, recall that at Time 1, the contribution of the second message had a highly significant effect.

Time 1 and 2 Combined

A repeated measures ANOVA on the data from both times combined shows several significant effects: (1) a main effect of time ($F(1, 279) = 33.36, p < .0001$); (2) a main effect for the position in the second message ($F(2, 279) = 3.92, p = .02$); (3) an interaction between time and the position in the first experimental message ($F(1, 279) = 15.76, p = .0001$); and (4) an interaction between time and the position in the second experimental message ($F(2, 279) = 3.46, p = .03$). The interactions involving time show that the pattern of results is significantly different for Time 1 and Time 2.

According to Coleman (1968, p. 434), plotting change as a function of time merely

describes the change without giving any good ideas about the factors that may have brought it about. Thus it is necessary to introduce some of these factors to get insight into which ones contributed to the change.

We can introduce such factors by empirically determining the coefficients in Eq. (6)

$$P_2 - P_0 = a(P_1 - P_0) + k(S_{\text{DEL}} - P_0).$$

Estimating a and k requires that for each subject we have a value of P_0 , P_1 , P_2 , and S_{DEL} . We measured P_1 and P_2 for each subject. We assumed that P_0 is constant for all subjects and set it equal to the mean of the control condition. S_{DEL} , however, was not measured. While this means that we can not estimate k , we can estimate k' , where

$$k' = k(S_{\text{DEL}} - P_0). \quad (11)$$

Hypothesis 1 predicts that a and k (and k' as well) should depend only on the position advocated by the first message. To test this, we performed the following dummy variable regression using the six groups that received messages advocating a particular tuition level ($N = 285$).⁴ The regression evaluated, using the logarithmically transformed data, is

$$\hat{P}_2 - P_0 = b_0 + b_1 DUM + (b_2 + b_3 DUM)(P_1 - P_0). \quad (12)$$

where $DUM = 1$ if 15% was advocated by the first or only message and 0 if 50% was advocated by the first or only message.

In the regression, b_0 is the intercept and value of k' for the 50% first or only subjects, $b_0 + b_1$ is k' for the 15% first or only subjects, and the significance of b_1 tests for the significance of the difference between these two values. Similarly, b_2 is the slope, and the value of a , for the 50% first or only subjects; $b_2 + b_3$ is a for the 15% first or only subjects, and the significance of b_3 tests for the significance of the difference between these two values.

The results of this regression are (standard errors appear below the respective coefficients):

$$\hat{P}_2 - P_0 = -.51 + 2.04 DUM + (.47 - .24 DUM)(P_1 - P_0). \quad (13)$$

(.35) (.48) (.08) (.11)

$R^2(3, 281)$ for this regression is .16 ($p < .001$). The difference between the values of a for the 15 vs 50 first groups has $F(1, 281) = 4.69$ ($p < .05$) and the difference between values of k' has $F(1, 281) = 18.22$ ($p < .001$).

To see if the position in the second message affected these coefficients, we performed regressions in which we used separate dummies for each

⁴ Using dummy variables gives the same estimates as one gets from performing separate regressions on each condition. If, however, we can assume that the variance of the residuals is constant across conditions (a reasonable assumption, since we have transformed for homoscedasticity), using dummy variables gives us smaller standard errors (Kmenta, 1971, p. 421) and is therefore a more efficient procedure.

condition. By doing so, we obtained separate estimates of a and/or k' for each of the six conditions. Neither estimating a nor estimating k' separately made a statistically significant contribution to the explained variance. Hence, Hypothesis 1 is supported.

We now estimate a and k' separately for the 15% and the 50% first or only message conditions. We see that a is 0.23 in the conditions in which the position in the first or only message was 15% and 0.47 in the 50% conditions. The fact that both values of a are between 0 and 1 supports our prediction. (In fact, not only are the estimated values within that interval, but the 95% confidence intervals about each estimate are entirely contained within that interval.)

While a is greater in the 50% conditions, the opposite is true of k' , which is 1.52 in the 15% conditions and -0.51 in the 50% conditions. Since $k' = k(S_{\text{DEL}} - P_0)$ and, according to our model, k must not be negative, it follows that $(S_{\text{DEL}} - P_0)$ must be positive in the 15% conditions and negative in the 50% conditions.

DISCUSSION

The empirical results are important in several ways. First, they confirmed our prediction that it was possible that a level of discrepancy which produced the lesser amount of *initial* attitude change could produce the greater amount of *final* attitude change.

Second, we find strong support for the notion that forgetting influences the long-term effects of messages. While the experiment contained six distinct message treatments, and the position of the second message had significant effects at Time 1, only the position of the first message had a statistically significant effect on either the subject's attitude at Time 2 or on a and k . This indicates that the position of the second experimental message was forgotten between Times 1 and 2. That this happened is consistent with the research on primacy and recency.

Third, our theoretically based prediction that a would be between 0 and 1 was supported, lending additional credibility to the model.

Fourth, we have evidence that message discrepancy influenced the parameters a and k' , which reflect various aspects of subsequent processing. Recall that $(S_{\text{DEL}} - P_0)$ appears positive for the less discrepant (15%) message but negative for the more discrepant (50%) one. This suggests that the moderately discrepant message led to delayed messages (whether externally or self-generated) which, on the average, advocated a *larger* tuition increase than P_0 . The extremely discrepant message, on the other hand, led to delayed messages which advocated a smaller increase than P_0 .

We also found that a was greater for the extremely discrepant message than for the moderate one. In view of Eq. (7), this indicates that the more discrepant message was *either* remembered better *or* produced

fewer delayed messages. The former explanation is more plausible than the latter. First of all, the evidence of which we are aware indicates that greater discrepancies lead to more cognitive responses. Second, while Roberts' (1985) meta-analysis reports an overall tendency for people to better remember that with which they *agree*, he reports one article whose findings are strongly in the opposite direction (Cacioppo & Petty, 1979). These findings are, we believe, of special relevance, as they also dealt with attitudes toward possible tuition increases. That these results differ from many others may be because tuition increases have a more direct effect on most subjects, and may therefore produce greater involvement than other issues studied. We therefore believe that greater discrepancy led to greater memory of the position in the message which, in turn, affected the long-term attitude change.

Is the subsequent processing which affects a , k , and S_{DEL} determined only by the discrepancy of the message or is it also dependent on the initial attitude change? Our data provide some suggestive evidence. Recall that the second experimental message had a significant effect on the initial attitude, P_1 . If P_1 affected the subsequent processing, we should have found that the conditions which had the same first message, but different second messages, should have had significantly different values of a and k' . Since we did not find this, the subsequent processing appears to be independent of initial attitude change.

Possible Criticisms of the Study

Could the great difference between the Time 1 and Time 2 results be a result of the fact subjects were informed that the study was bogus immediately after the Time 1 measurement? Let us first explain why, despite the obvious dangers, we did such debriefing. Since this was a field study, there existed the very real possibility that failure to debrief at this time would mean failure to debrief the subjects at all. Further, the great concern that students have about tuition made it ethically necessary that we not leave students concerned about the possibility of an enormous tuition increase for even a few days.

How likely is it that the debriefing caused our results? While the debriefing may have contributed to the decay of the attitude change, we see no reason why it could have caused different *patterns* of decay in the different experimental conditions. Rather, it should have caused all conditions to converge toward the control condition. That it did not do so may be because the debriefing did state that the *possibility* of an increase was real.

A second possible criticism stems from the fact that we asked subjects not to talk about the study during the interval between the Time 1 and Time 2 measurements. Could this instruction, if followed, have suppressed one of the processes (external messages) with which we are concerned?

We do not think so. The request to not discuss the study meant, "Do not tell others about the *deception* in this study," not "Do not discuss *tuition*." We suspect that our subjects interpreted it in that way.

Third, the method of data gathering differed at Time 1 and Time 2 (face-to-face vs phone and interviewer of same vs opposite sex as respondent). While this could have had some effect on the mean level of tuition increase advocated at the two different times, we do not see how it could have caused the different patterns of change between Time 1 and Time 2 that we observed in the different conditions.

Still another possible criticism is that what was being measured at Time 1 was not the subjects' "true" attitudes, but their "naive psychology" of persuasion. In other words, since subjects were asked to communicate their opinions to a legislative committee, perhaps they were not stating what they really believed, but what they thought would be most effective at influencing the legislature.

There are, however, two reasons for doubting that this is what took place. First, although there is evidence from various studies for the occurrence of situationally determined "elastic shifts" in expressed opinion, these shifts are seen primarily as dependent on expectations that one will have to discuss or defend one's position (Cialdini, Levy, Herman, & Evenbeck, 1973; Cialdini, Levy, Herman, Kozlowski, & Petty, 1976).

Second, and even more persuasive, the pattern of results found at Time 1 in this study conforms to the pattern obtained in the Fink et al. (1983) study using the same attitude object (tuition increase) and the same levels of message discrepancy. There were five experimental conditions which appeared in both studies, with *N* of more than 30 per cell. Both studies had exactly the same order of message effectiveness, from most to least effective: 50%/15%, 15%/50%, 50%, 15%, and control (using, in the current study, Time 1 data for all conditions, except for the control condition, which only appears in the Time 2 data). Not only is the rank order correlation between cells perfect, but the Pearson correlation is .89 ($p < .05$). In the 1983 study, subjects were not led to believe that their responses would affect tuition levels. Thus, the "naive psychology of persuasion" explanation does not seem plausible.

Conclusion

We see this study as making a theoretical contribution in showing how an information integration model, which has been found useful for predicting initial attitude change as a function of discrepancy, can be extended to deal with some of the important processes involved in the persistence of attitude change. By extending the information integration model, we have identified a set of key variables involved in persistence and specified the functional relationship among them.

We see our empirical illustration as providing important ideas about

how the study of message discrepancy should be carried out. It used a dependent variable measured on a theoretically continuous, unbounded scale, thus avoiding problems of imprecision and those problems associated with the presence of a scale midpoint. The range of the discrepancies used was based on pretest data, and the design allowed for a discrepancy manipulation independent of the extremity of the subjects' initial positions. Measures were taken at two different times. Transformation of the data allowed for an appropriate functional form to be used in testing the relationships.

The fact that the pattern of results at Time 1 is so highly correlated with the results of our earlier study indicates that these results are fairly robust and are not an artifact of a particular method of collecting data.

The drastically different pattern of results obtained from Time 1 to Time 2 implies that an important consideration in further research in this area should be an examination of the effects of variables believed to be involved in attitude change *over time*. That the immediate treatment effects found in this research are substantially different from the apparent long-term effects is, we believe, a potential problem not only in previous discrepancy research, but also in many other areas of attitude research (e.g., see Watts & Holt, 1979).

Hovland (1959) argued that the long-term effects of a message may be quite different from the short-term effects, in large part because of what happens outside the controlled environment of the laboratory. The results of this study, which used a realistic mass media message and a field experimental design, show that what happens afterward may be very different for messages of different discrepancies.

We have demonstrated, however, how the very different pattern of long-term results can be interpreted within the same information integration model which explains short-term attitude change. We do so by assuming that certain additional processes (forgetting and receipt of further messages) take place in the interim and are a function of message discrepancy. In future research, these processes should be studied in a carefully controlled environment to see how they are related to message discrepancy and if they are related to final attitude change as we predict.

Our model has the virtues and vices of models in general. The model forces us to focus on specific parameters and their determinants and to ignore other processes not implicated by the model. Using the model helps us to interpret the results of this study. That it is able to do so in a plausible manner lends credence to our model.

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