POSITIONAL DISCREPANCY, PSYCHOLOGICAL DISCREPANCY, AND ATTITUDE CHANGE: EXPERIMENTAL TESTS OF SOME MATHEMATICAL MODELS[1]

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Conflicting models of the attitude change process were tested in two experiments. The simple linear balance model predicts that the amount of attitude change induced by a message is proportional to the discrepancy between the respondent's original position and the position advocated. The psychological-discrepancy-discounting model assumes that as messages become more psychologically discrepant from one's position, they lose their effectiveness in a nonlinear manner. This model assumes that the psychological discrepancy of a message is influenced by the other messages accompanying it (e.g., the presence of a more extreme message can make a given message seem less psychologically discrepant than it would otherwise be). This model also suggests that placing an extreme message before a moderate one will produce less psychological discrepancy and more attitude change than would the reverse order. In two studies (N = 193 and N = 114), subjects read one or two messages, each advocating either a 15 percent or a 50 percent increase in tuition (or in control conditions, read no message at all), and then indicated the tuition increase they favored. Subjects were also asked how psychologically discrepant they found each message. The results supported the predictions regarding the effect of other messages on the psychological discrepancy induced by a message. Where the message was accompanied by supportive arguments, the attitude change results supported the psychological-discrepancy-discounting model much better than the linear balance model.

IF you want to change someone's attitude or belief, should you take a position which is extremely different from those you wish to influence, or a position which is only moderately different? Empirical research indicates that extreme discrepancies are less effective in producing attitude change than are moderate ones.[2] The theoretical rationales for this may be divided into information integration, social judgment, cognitive dissonance, and cognitive response approaches.

The information integration approach assumes that messages that are more discrepant may have less weight in a weighted average formula than messages which are less discrepant. This may be because less attention is paid to such messages, or because they are inconsis-

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[2]For examples see E. Aronson, J.A. Turner, and J.M. Carlsmith, "Communicator Credibility and Communication Discrepancy as Determinants of Opinion Change," *Journal of Abnormal and Social Psychology*, 67 (1963), 31–36; S. Bochner and C.A. Insko, "Communicator Discrepancy, Source Credibility and Opinion Change," *Journal of Personality and Social Psychology*, 4 (1966), 614–21; J.O. Whittaker, "Attitude Change and Communication-Attitude Discrepancy," *Journal of Social Psychology*, 65 (1965), 141–47; J.L. Freedman, "Involvement, Discrepancy and Opinion Change," *Journal of Abnormal and Social Psychology*, 69 (1964), 290–95; M.B. Brewer and W.D. Crano, "Attitude Change as a Function of Discrepancy and Source of Influence," *Journal of Social Psychology*, 76 (1968), 13–18; and C. Nemeth and J. Markowski, "Conformity and Discrepancy of Position," *Sociometry*, 35 (1972), 562–75.

tent with previous information, or because of other contextual influences.[3]

A second approach to the discounting of extremely discrepant messages is found in the social judgment approach. Using a loosely drawn analogy from psychophysics, Sherif and Hovland posit that messages stating extremely discrepant positions are perceived to be even more discrepant and are rejected. Messages stating positions moderately discrepant are perceived to be less discrepant than they are, and these messages are accepted.[4] However, Anderson states that "evidence for these two concepts [assimilation and contrast] is scant."[5]

Cognitive dynamics, or the active cognitive processing of information, can also explain why discrepant messages may be less effective. Aronson, Turner, and Carlsmith state that increasing message discrepancies may produce cognitive dissonance. They claim that in the usual laboratory experiment, there are two possible ways to reduce this dissonance: to agree with the communicator's view or to disparage the communicator. They further argue that at small discrepancies the former will take place while at large discrepancies the latter will occur. Thus, Aronson, et al. expect attitude change to be curvilinearly related to discrepancy. (This prediction requires many assumptions to be derived from dissonance theory; Bochner and Insko describe it as a "common-sense hunch."[6]) Empirical support for this prediction is mixed.[7] Laroche derived a mathematical model consistent with both social judgment and dissonance premises. It assumes that the larger the discrepancy, the more the credibility of the source and non-involvement of the subject are discounted.[8] Laroche's model was tested and supported in a secondary analysis of over fifty data sets.

According to the cognitive response approach, extremely discrepant messages produce more counterarguments (or fewer favorable arguments), and are therefore less effective.[9] In fact, Brock demonstrates this relationship between discrepancy and counterarguing.[10] Moreover, Brock's study and several others also provide evidence that more counter-arguments lead to less attitude change.[11]

[3]Compare N.H. Anderson, "Cognitive Algebra: Integration Theory Applied to Social Attribution," in *Advances in Experimental Social Psychology*, ed. L. Berkowitz (New York: Academic Press, 1974), VII, pp. 1–101; N.H. Anderson, "Integration Theory Applied to Cognitive Responses and Attitudes," in *Cognitive Responses in Persuasion*, ed. R.E. Petty, T.M. Ostrom, and T.C. Brock (Hillsdale, NJ: Lawrence Erlbaum, 1981), pp. 361–97; and S. Himmelfarb, " 'Resistance' to Persuasion Induced by Information Integration," in *Readings in Attitude Change*, ed. S. Himmelfarb and A.H. Eagly (New York: Wiley, 1974), pp. 413–17.

[4]M. Sherif and C.I. Hovland, *Social Judgment: Assimilation and Contrast Effects in Communication and Attitude Change* (New Haven: Yale University Press, 1961).

[5]Anderson, 1974, p. 6. Also, see A.L. Atkins, K.K. Deaux and J. Bieri, "Latitude of Acceptance and Attitude Change: Empirical Evidence for a Reformulation," *Journal of Personality and Social Psychology*, 6 (1967), 47–54; P.D. Peterson and D. Koulack, "Attitude Change as a Function of Latitudes of Acceptance and Rejection," *Journal of Personality and Social Psychology*, 11 (1969), 309–11; and A.H. Eagly and K. Telaak, "Width of Latitude of Acceptance as a Determinant of Attitude Change," *Journal of Personality and Social Psychology*, 23 (1972), 388–97.

[6]Bochner and Insko, p. 615.

[7]See Aronson et al.; Bochner and Insko; and A. Bergin, "The Effect of Dissonant Persuasive Communications Upon Changes in a Self-Referring Attitude," *Journal of Personality and Social Psychology*, 30 (1962), 423–38.

[8]M. Laroche, "A Model of Attitude Change in Groups Following a Persuasive Communication: An Attempt at Formalizing Research Findings," *Behavioral Science*, 22 (1977), 246–57.

[9]R.E. Petty, T.M. Ostrom, and T.C. Brock, "Historical Foundations of the Cognitive Response Approach to Attitudes and Persuasion," in *Cognitive Responses in Persuasion*, ed. R.E. Petty, T.M. Ostrom, and T.C. Brock (Hillsdale, NJ: Lawrence Erlbaum Associates, 1981), pp. 5–29.

[10]T.C. Brock, "Communication Discrepancy and Intent to Persuade as Determinants of Counterargument Production," *Journal of Experimental Social Psychology*, 3 (1967), 296–309.

[11]See N. Miller and D.E. Colman, "Methodological Issues in Analyzing the Cognitive Mediation of Persuasion." in *Cognitive Responses in Persuasion*, ed. R.E.

The above discussion justifies the assumption that we may expect extremely discrepant messages to be discounted. But what should happen if a subject receives two messages, one advocating a moderately discrepant position and one advocating an extremely discrepant one? A simple additive model would suggest that such a combination, while *more* effective than two extreme (and thus, ineffective) messages, should be *less* effective than two moderate ones. However, a position which, by itself, is perceived as extreme may seem relatively moderate when a still more extreme position is advocated. As a consequence of this perspective effect, it is possible that a combination of a relatively moderate message and a more extreme one will produce more attitude change than will two relatively moderate messages.

The preceding discussion suggests that we should distinguish between the discrepancy of *position* between two views and the *psychological* discrepancy between them.[12] Positional discrepancies are expressed in units which have a widely shared meaning in a given culture (e.g., dollars, hours, or miles in American culture). The positional discrepancy is simply the numerical difference between the two positions, expressed in those units. For example, if a person believes the cost of a gallon of gasoline should be $1.00 and receives a message advocating a price of $1.50, the positional discrepancy is 50¢. By contrast, the psychological discrepancy is the level of discrepancy between two positions as experienced by an individual. For example, a person could regard a 50¢ per gallon positional discrepancy as slightly, moderately, or extremely discrepant from his/her own view. Having distinguished between these two kinds of discrepancies, let us formalize the ideas presented above.

Proposition 1. The same message (i.e., same positional discrepancy) may induce a very large psychological discrepancy in one context and a much smaller one in another context (e.g., if accompanied by a still larger positional discrepancy).

Proposition 2. Controlling for the positional discrepancy, the greater the psychological discrepancy induced by a position, the less attitude change it will produce. (The relationship between psychological discrepancy and attitude change is not assumed to be linear.)

Proposition 1 has received support from studies showing that the rating or label one assigns to a position depends, in part, on the range of positions to which one is exposed.[13] A person is, for example, more likely to define him/herself as "very pro-Black" when the most favorable statement he/she has been exposed to favors non-discrimination than when it favors black supremacy.

Proposition 2, by contrast, appears to have eluded successful testing. Weiss and Choo tried and failed to manipulate "perceived" (i.e., psychological) discrepancy while holding positional discrepancy constant.[14] While Choo found perceived discrepancy to be positively correlated with attitude change (contrary to the prediction of Proposition 2), this relationship is confounded with the effects of positional discrepancy. Ostrom, et al. claim to have manipulated "per-

Petty, T.M. Ostrom, and T.C. Brock (Hillsdale, NJ: Lawrence Erlbaum Associates, 1981), pp. 105–25.

[12]Others, e.g., Laroche, p. 255, and Bochner and Insko, p. 621, also make this suggestion.

[13]See T.M. Ostrom and H.S. Upshaw, "Psychological Perspective and Attitude Change," in *Psychological Foundations of Attitudes*, ed. A.G. Greenwald, T.C. Brock, and T.M. Ostrom (New York: Academic Press, 1968), pp. 217–42; cf. C. Judd and B.M. DePaulo, "The Effect of Perspective Differences on the Measurement of Involving Attitudes," *Social Psychology Quarterly*, 42 (1979), 185–89, and J.R. Eiser and J.v.D. Pilght, "Accentuation and Perspective in Attitudinal Judgment," *Journal of Personality and Social Psychology*, 42 (1982), 224–38.

[14]W. Weiss, "The Relationship Between Judgments of a Communicator's Position and Extent of Opinion Change," *Journal of Abnormal and Social Psychology*, 56 (1958), 380–84; and T.H. Choo, "Communicator Credibility and Communication Discrepancy as Determinants of Opinion Change," *Journal of Social Psychology*, 64 (1964), 65–76.

ceived" discrepancy while holding "actual" discrepancy constant.[15] While they concluded that there is no causal relationship between "perceived" discrepancy and attitude change, we attribute their conflicting results to manipulations whose validity we question.[16]

In the study to be reported below, we test a model relating attitude change to both positional and psychological discrepancy. This study, unlike any others of which we are aware, does all of the following: (1) uses the perspective effect discussed above to vary the psychological discrepancy of the position in a message, (2) directly measures the psychological discrepancy of that position, and (3) fits a mathematical function for the discounting of such messages. Such a function, if correct, should explain not only single message results but multiple message results as well. Hence, (4) we evaluate this model for both single and double messages. Finally, to evaluate the adequacy of the function properly, (5) we statistically compare its adequacy with that of a more parsimonious relative, the linear balance model, which does not take psychological discrepancy into account. We know of no study that tests this comparison. The study we shall report tests a mathematical model which incorporates Propositions 1 and 2 above into a framework which can also account for the non-monotonic effect of discrepancy on attitude change which many studies have found

Mathematical Models

There are a number of mathematical models of attitude change as a function of message discrepancy. Hunter and Cohen developed mathematical models for both the social judgment (Sherif et al.) and dissonance (Aronson et al.) approaches to discrepancy, creating equations in which attitude change is a non-monotonic function of discrepancy.[17] Fishbein and Ajzen present a model based on the probability of accepting the message.[18] This model specifies attitude change as a different non-monotonic function of discrepancy than that discussed by Hunter and Cohen. Laroche presents still another non-monotonic function.[19] As is the case with Fishbein and Ajzen's formulation, however, Laroche's sense of process is too imprecise to derive the specific function which he proposes.

We shall present a model which is similar to the preceding ones in allowing for a non-monotonic effect of discrepancy on attitude change. It differs in considering the number of messages one has received, the effects of perspective on psychological discrepancy, and the effects of both positional and psychological discrepancy on attitude change.[20]

[15]T.M. Ostrom, C. Steele, and J. Smilansky, "Perceived Discrepancy and Attitude Change: An Unsubstantiated Relationship," *Representative Research in Social Psychology*, 5 (1974), 7–15.

[16]Following H. Peak, "Psychological Structure and Psychological Activity," *Psychological Review*, 65 (1958), 325–47, they assume that the greater number of distinct steps or categories which a subject sees between two points, the greater the psychological distance between those points. While the authors were able to manipulate the number of steps perceived by the subjects, neither they nor Peak demonstrate that subjects do, in fact, see many small steps as traversing more psychological distance than a few large steps.

[17]J. Hunter and S. Cohen, "Mathematical Models of Attitude Change in the Passive Communication Context," Unpublished ms. Department of Psychology, Michigan State University, 1972; C.W. Sherif, M. Sherif, and G. Nebergall, *Attitude and Attitude Change* (Philadelphia: Saunders, 1965); and Aronson et al.

[18]M. Fishbein and I. Ajzen, *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research* (Reading, MA: Addison-Wesley, 1975), Ch. 11

[19]Laroche, pp. 247ff.

[20]In all of the models that follow, the following assumptions will be made:

A.0. The subjects are capable of attending to and comprehending the messages.

A.1. The subjects' attitudes and the relevant messages may be placed on a unidimensional continuum.

A.2. Each equation is static, and thus assumes that an equilibrium has been achieved prior to or simultaneously with the measurement process.

A.3. Unless otherwise stated, parameters in the attitude change models to be presented below are

Model 1. Linear Balance Model

This model is presented by Saltiel and Woelfel and is an information integration model.[21] We assume that the effect of a message is the weighted average of the position advocated in the message and all previous messages. Thus, if P_0 is the subject's initial attitudinal position, then when a subject's view is in equilibrium, his/her own view is at a point, P_0, such that P_0 satisfies the equation $\Sigma_{i=1}^{n}(w_iS_i - P_0) = 0$, where S_i is the position of the stimulus message i, w_i is its weight, and n is the total number of messages which have been received. In other words, at equilibrium, the net torque is 0 and P_0 is at the center of mass of all previous messages.

Let us now see the effect of a new message. Suppose the total weight of all previous messages equals w_0. (We assume all w_i are non-negative.) We can treat this weight as if it were all at the center of mass, P_0. Then if S_1 is the position of the new stimulus message w_1, P_1 (the subject's new position) is simply the weighted average of S_1 and P_0,

$$P_1 = \frac{w_0P_0 + w_1S_1}{w_0 + w_1}. \qquad (1)$$

If the subject receives two stimulus messages, S_1 and S_2, of weights w_1 and w_2, then

$$eP_2 = \frac{(w_0 + w_1)P_1 + w_2S_2}{(w_0 + w_1) + w_2} = \frac{w_0P_0 + w_1S_1 + w_2S_2}{w_0 + w_1 + w_2}. \qquad (2)$$

The linear balance model implies the following hypotheses:

H.1A: A message advocating change will always have an effect in the direction advocated, and therefore should be more effective than no message.

H.1B: If the position advocated in the second message (S_2) is in the same direction from P_0 that P_1 is, but is further from P_0 than P_1, then the second message will produce additional attitude change in the same direction as the first message.

H.2 The greater the positional discrepancy ($|S - P_0|$) of a message, the more change it will produce.

H.3: If there are two messages which are of different discrepancies from P_0, there will be more attitude change if and only if the more discrepant message has the greater weight than if the weights are reversed. (In this model the order of messages in and of itself has no effect on the message's weight; however, other factors such as message length and number of arguments within a message could affect the weight the message receives.)

Model 2. A Balance Model with Psychological Discounting

While the simple balance model assumes that the weight of a message is independent of its discrepancy, we now allow for the possibility that messages may be psychologically discounted, thereby becoming less effective. We assume that such discounting is a function of the psychological discrepancy, ψ, of a particular message from the subject's own view. Suppose that a message given to a subject who agrees with it (i.e., positional discrepancy = 0) has weight w_1. The effective weight of a message after discounting is $w_1\Delta(\psi)$, where $\Delta(\psi)$ is a function of ψ whose value is less than 1 whenever $\psi > 0$. Using the effective

identical for all subjects given the same facilitating or inhibiting factors represented by the equivalent experimental conditions.

[21]This model is also called a proportional change model or distance-proportional model. See J. Saltiel and J. Woelfel, "Inertia in Cognitive Processes: The Role of Accumulated Information in Attitude Change," *Human Communication Research*, 1 (1975), 333–44; Anderson, "Cognitive Algebra"; Anderson, Integration Theory"; Himmelfarb; J. Woelfel and E.L. Fink, *The Measurement of Communication Processes* (New York: Academic Press, 1980), pp. 150–53; J.E. Danes, "Communication Models of the Message-Belief Change Process," in *Communication Yearbook 2*, ed. B.D. Ruben (New Brunswick, NJ: Transaction Books, 1978), pp. 109–24; and J.E. Danes, J.E. Hunter, and J. Woelfel, "Mass Communication and Belief Change," *Human Communication Research*, 4 (1978), 243–52.

weight in the simple balance model (equation 1),

$$P_1 = \frac{w_0 P_0 + w_1 \Delta(\psi) S_1}{w_0 + w_1 \Delta(\psi)}. \quad (3)$$

If there are two messages, of weights w_1 and w_2, and of different positions, the equation for attitude change is the same as equation (2) except for the inclusion of the discounting factor:

$$P_2 = \frac{w_0 P_0 + w_1 \Delta(\psi_1) S_1 + w_2 \Delta(\psi_2) S_2}{w_0 + w_1 \Delta(\psi_1) + w_2 \Delta(\psi_2)}. \quad (4)$$

We assume that $\Delta(\psi)$ is a function which equals one when ψ is zero and is monotonically decreasing. If $\lim_{\psi \to \infty} \Delta(\psi) = 0$ (which implies that while an extreme message can be totally ineffective, it will never have a negative effect), an obvious function is

$$\Delta(\psi) = e^{-\gamma\psi}.$$

Like the linear balance model, this model assumes that holding all else constant, larger values of the positional discrepancy, D, lead to greater attitude change. But, holding D constant, greater values of ψ lead to lower values of $\Delta(\psi)$, and hence to less attitude change. Because increases in D also lead to increases in ψ, the model allows for attitude change to be a non-monotonic function of D.[22]

In addition to its dependence on D, we also expect ψ to depend on other variables. In particular, a message without supporting arguments or with weak ones may produce a higher value of ψ than one with strong supporting arguments. Second, ψ may depend on source credibility. (This variable has, however, been kept constant within our experiments.) Finally, the context (i.e., other messages) surrounding a particular message may affect its ψ value. This leads to our elaboration of this model.

Model 2 Elaboration. The Effects of Perspective and Repetition on Psychological Discrepancies

Suppose a subject receives a message, and changes his/her position in response to it. If the subject then receives another message stating the same position, the second message will have a smaller positional discrepancy than did the first, and hence a smaller psychological discrepancy. But is it possible that a message whose position is so discrepant as to produce no attitude change could still make a less extreme message seem less psychologically discrepant than it would otherwise appear? Perspective theory suggests that this is indeed possible. Ostrom and Upshaw propose that

$$R = f\left(\frac{C - L}{U - L}\right),$$

where R is the psychological rating one assigns to a position, C is the content of the position, U and L are the respective contents of the upper and lower bounds considered by the subject, and f is a linear function.[23] (The difference between C and one's own position is our positional discrepancy.)

Assume that the psychological discrepancy of a stimulus position S,

$$\psi_S = r_S - r_P,$$

where r_S and r_P are the subject's ratings of the stimulus message and his/her own position, respectively. Since f is a linear

[22] If we assume $\psi = \alpha D^\beta = \alpha |S - P_0|^\beta$, then it can be analytically demonstrated that, if γ is positive, P_1 is first an increasing, and then a decreasing, function of S. This is done by replacing $\Delta(\psi)$ in equation (3) with the equivalent function of S_1, and differentiating P_1 with respect to S_1. This derivative is initially positive (with $S_1 = 0$), and becomes negative as S_1 approaches infinity. This analysis is available from the authors.

The relation between ψ and $|S - P_0|$ indicated above is consistent with our expectations from psychophysical research; see J.C. Baird and E. Noma, *Fundamentals of Scaling and Psychophysics* (New York: Wiley, 1978), p. 3.

[23] Ostrom and Upshaw, pp. 217-42.

function,

$$\psi_S = f\left(\frac{S - P}{U - L}\right).$$

Assume further that a moderate position M, and an extreme one, E, are both greater than P. Finally, suppose that E is greater than U, the upper bound previously perceived by the subject. In this case,

$$\psi_{M(E,M)} = f\left(\frac{M - P}{E - L}\right) < f\left(\frac{M - P}{U - L}\right) = \psi_{M(M)},$$

where $\psi_{M(M)}$ = the psychological discrepancy between the subject's initial position and the position advocated by a message with moderate discrepancy, given that it is the only message which has just been received, and $\psi_{M(E,M)}$ = the psychological discrepancy of a moderate message which is preceded by an extreme message. $\psi_{E(E)}$, $\psi_{M(M,E)}$, etc., are defined analogously. (If both M and E are less than P, the proof is analogous.)

While the presentation of E can raise U or lower L, once the subject has been exposed to E, M (if between P and E) is already within the interval whose endpoints are L and U. Hence, the presentation of the moderate view should not affect the discrepancy of the extreme view and we expect

$$\psi_{E(E,M)} = \psi_{E(M,E)} = \psi_{E(E)}.$$

Will $\psi_{M(M,E)}$ equal $\psi_{M(E,M)}$? If the subject has seen both messages before creating a value of ψ_M or if the subject re-evaluates the discrepancy of the first message after seeing the second, the order of presentation should make no difference.

On the other hand, suppose the subject (1) receives the moderate message, (2) decides on a ψ value, $\psi_{M(M)}$, (3) receives the extreme message, and (4) decides on $\psi_{E(M,E)}$, without re-evaluating ψ_M. In this case, we have, contrary to the above,

$$\psi_{M(M,E)} = \psi_{M(M)}.$$

But since we predicted above that $\psi_{M(E,M)} < \psi_{M(M)}$, this implies that

$$\psi_{M(E,M)} < \psi_{M(M,E)}.$$

If however, some subjects process the information one way, but others process it the other way, we should have

$$\psi_{M(E,M)} < \psi_{M(M,E)} < \psi_{M(M)}.$$

Finally, the "mere exposure" literature suggests that repetition of a message may make it seem less discrepant, in which case

$$\psi_{E(E,E)} < \psi_{E(E)} \text{ and } \psi_{M(M,M)} < \psi_{M(M)}.$$[24]

Above we predicted that the presentation of an extremely discrepant position reduces the psychological discrepancy of a moderately discrepant position presented later (thereby facilitating attitude change) while the presentation of a moderately discrepant position has no effect on the psychological discrepancy of an extreme position. Assuming that messages that are highly discrepant are also highly intense, and that prior to the receipt of any experimental message a subject expects a message which is no more than moderately discrepant, this prediction is consistent with Miller and Burgoon's research on receiver expectations and attitude change.[25] They found

[24] R.B. Zajonc, "Attitudinal Effects of Mere Exposure," *Journal of Personality and Social Psychology*, 8 (1968), 1–27. See also A.A. Harrison, "Mere Exposure," in *Advances in Experimental Social Psychology*, X, ed. L. Berkowitz (New York: Academic Press, 1977), pp. 39–83; and A. Sawyer, "Repetition, Cognitive Responses and Persuasion," in *Cognitive Responses in Persuasion*, ed. R.E. Petty, T.M. Ostrom, and T.C. Brock (Hillsdale, NJ: Lawrence Erlbaum, 1981), pp. 237–61.

[25] M.D. Miller and M. Burgoon, "The Relationship between Violations of Expectations and the Induction of Resistance to Persuasion," *Human Communication Research*, 5 (1979), 301–13. For a study on attitude attribution which formalizes the notion of expectancy, see L.L. Lopes, "A Unified Integration Model for 'Prior

that a message which is less intense than expected facilitated initial attitude change. Exposure to an extremely discrepant (highly intense) message changes the subject's expectation so that a subsequent moderately discrepant message is less intense than expected. Receipt of a moderate message, however, should have less, if any, effect on the reaction to a subsequent extreme message. Such a moderate message is close to the subject's prior expectations, and therefore leaves these expectations relatively unchanged.[26]

The preceding discussion can be summarized with the following hypotheses:

H.4: The psychological discrepancy produced by an extreme message will be greater than that produced by a moderate one.

H.5: The presence of an extreme message will make a moderate one seem less discrepant than it would be alone.

H.6: The presence of a moderate message will have no effect on the psychological discrepancy of an extreme message.

H.7: The psychological discrepancy of a moderate message will be less if presented *after* an extreme message than if presented *before* an extreme message.

H.8: The same message should be less psychologically discrepant if it is given more than once.

Summary. We have constructed a model which allows for the non-monotonic effect of positional discrepancy on attitude change. It assumes that, other things being equal, positional discrepancy facilitates attitude change but psychological discrepancy inhibits change. It also looks at the effects of perspective on psychological discrepancy and hence on attitude change. By doing so, it allows for the possibility that stating a position which by itself is so extreme as to be rejected may, nonetheless, facilitate attitude change.

Method

Overview. Subjects were each given a form in which various tuition increases were advocated. After reading these statements, they were asked how (psychologically) discrepant the positions stated were from their own position, what percentage increase in tuition they themselves favored, and how often they had spoken about the issue in the past week and the past year.

Moderately discrepant (from the subject's own position) messages advocated a 15 percent increase. *Extremely* discrepant messages advocated at 50 percent increase. All subjects, except for control subjects, were exposed to one or two such messages.

The choice of the tuition issue was based on three criteria. (1) We wanted to test for the existence of a non-monotonic relationship between amount of discrepancy and attitude change induced. To do that we needed a situation conducive to producing this effect. This required that we choose an issue on which people's attitudes were rather resistant to change, hence something they really cared about. (2) Because we had decided to use a post-test only design (to reduce suspicion), we wanted an issue about which there was a great deal of initial agreement. (3) We wanted to use messages which specify their own scale value in consensual, numerical units.[27]

To find which issue met these criteria, two undergraduate classes in communication were given questionnaires asking their views on twenty-one different issues. The one which was clearly rated

Expectancy and Behavioral Extremity as Determinants of Attitude Attribution,'" *Journal of Experimental Social Psychology*, 8 (1972), 156–60.

[26]This discusses only part of Miller and Burgoon's predictions. The processes posited by Miller and Burgoon as taking place between their first and second attitude measurements are not relevant to our study, since this would require a third message given several days later.

[27]See Anderson, 1974, p. 50. An additional reason for using tuition is that it provides a theoretically continuous and unbounded scale, which we view as advantageous.

most important and most often discussed was tuition. In addition, we found a very high level of consensus as to how much tuition should be increased for the following year. Over half of our sample ($N = 63$) favored no tuition increase at all (mean = 2.07 percent, standard deviation = 3.59 percent).

To determine the appropriate tuition increases for our experimental messages, we asked students in an undergraduate class ($N = 43$) to indicate a percentage increase in tuition which was *moderately* discrepant from their own position, an increase which was *substantially* discrepant, and one which was *extremely* discrepant. We chose a level (50 percent) which was considered extreme by all but three persons (7 percent) in our sample.

Our other message 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 presented with a much more extreme view. The 15 percent tuition increase was essentially the most extreme "moderate" view in the class, and it was also among the most moderate "extreme" views. Hence 15 percent was selected to represent a moderate position.

The Fall Study

Sample and procedure. Subjects were 193 students in two undergraduate sociology classes at Michigan State University. Students spent ten minutes at the beginning of a class period completing questionnaires. Different forms were systematically interspersed before distribution. Subjects were told not to look at each other's forms and were to refrain from talking while the forms were being filled out. The forms looked identical from the cover sheet, but the students were told that in fact the forms were not identical.

Manipulating position advocated. There were four conditions of tuition increase advocated in this experiment: (1) 15 percent advocated by the first person, and 50 percent advocated by the second (15 percent/50 percent); (2) 50 percent/15 percent; (3) only one message, advocating a 15 percent increase; (4) one message, advocating 50 percent.[28] In addition, there was a control condition. The messages were attributed to people identified only as "T.L." and "F.G." Where change was advocated, T.L., the first person, gave the following statement:

> In deciding on tuition levels at our state colleges and universities, we should keep in mind the following considerations. First, our institutions of higher education have for a number of years lacked sufficient funds to maintain high quality libraries and other educational facilities. Second, inflation makes it necessary to increase tuition just to stay even with increasing expenses. Third, students currently pay only a small fraction of the cost of their education through tuition. The state financial position makes it difficult to maintain such a high level of contribution to each student's education. On the other hand, we don't wish to excessively burden students and their families. I believe that the tuition at all state colleges and universities should be increased _____% next fall.

Where there was a second message from F.G., it stated:

> Like T.L., I believe that we should set a tuition rate which takes into account the needs of quality higher education and the needs of our college students and their families. However, I think that T.L. has not balanced those needs in a fair and reasonable manner. I think that tuition at every

[28] In addition to these four conditions, there were four parallel conditions in the fall study, in which supportive arguments were omitted. These conditions will not be discussed in the text. Results from these conditions provide partial support to our hypotheses concerning the relation of psychological discrepancy to positional discrepancy. In addition, we find that messages with supportive arguments are less psychologically discrepant than the same messages without supportive arguments. Some of these non-argument conditions produced attitude change in the direction opposite from that advocated in the message. This is inconsistent with both the linear balance and psychological discrepancy models. Results for these conditions may be obtained from the authors.

university and college that is state-supported should be increased _____% for the 1980-1981 academic year.

Dependent variables and their measurements. One of our major dependent variables, psychological discrepancy from position advocated, was measured as follows. On the page following the views of T.L. (and F.G., if there were two positions stated), the form stated (in part):

Now we want you to indicate how *different T.L.'s* view is from your own. If *T.L.'s* view is *not* different from yours, write 0 (zero). If T.L.'s view is *moderately* different from yours, write 100. If you think the difference between your view and T.L.'s is *twice* as much as a moderate difference, rate it as a 200. If you think the difference . . . is *half* as much as a moderate difference, rate it as 50. While 0 is the lowest number you can use, there is no "highest number."

If there was also a view stated by F.G., subjects were asked to evaluate that position using the same procedure.

Next on the form was the measure of the subject's own position. To measure the subject's own attitude on tuition, the subject was asked "What is your opinion? That is, what percent do you think tuition at public institutions of higher education *should* be increased next year?" Finally, the form asked how often the subject had discussed the issue in the last year and in the last week.

The Spring Study

This was performed six months later ($N = 114$) but followed procedures identical to those in the fall study described above. The differences were that two conditions which had previously been missing (15 percent/15 percent and 50 percent/50 percent) were added.[29] For the 15 percent/15 percent and 50 percent/50 percent conditions, the second and third sentences of the message from F.G. (the second message) were modified to read

. . . I think that T.L. has balanced those needs in a fair and reasonable manner. I also think that. .

RESULTS

Before doing any other analysis on the fall data, we searched for the transformation which would minimize the heteroscedasticity of each of our endogenous variables. For P (the tuition increase advocated), this was ln(P). For ψ, it was $\ln(\psi + 11.5)$.[30] When the spring data

[29]In the spring study, subjects were asked if they had previously heard of the study. Those three who had were eliminated from the analysis.

[30]*F* tests require that the population variables of interest be normally distributed and homoscedastic across conditions. Whenever these two assumptions are not met, the data should be transformed to approximate these assumptions prior to any other analysis. If the populations are substantially heteroscedastic with respect to a variable, the distribution of the *F* statistic and hence the *p* level may be misleading. See J.E.K. Smith, "Data Transformations in Analysis of Variance," *Journal of Verbal Learning and Verbal Behavior*, 15 (1976), 339–46; G.E.P. Box and D.R. Cox, "An Analysis of Transformations," *Journal of the Royal Statistical Society*, Series B, 26 (1964). 211–43; J.B. Kruskal, "Special Problems of Statistical Analysis: Transformations of Data," in *International Encyclopedia of the Social Sciences*, ed. D.L. Sills (New York: Macmillan and Free Press, 1968), 15, pp. 182–93; F. Mosteller and J.W. Tukey, *Data Analysis and Regression* (Reading, MA: Addison-Wesley, 1977); S. Leinhardt and S.S. Wasserman, "Exploratory Data Analysis," in *Sociological Methodology 1979*, ed. K.F. Schuessler (San Francisco: Jossey-Bass, 1978), pp. 311-65; and C.L. Bauer and E.L. Fink, "Fitting Equations with Power Transformations: Examining Variables with Error," in *Communication Yearbook 7*, ed. R.N Bostrom (Beverly Hills, CA: Sage, 1983).

For the tuition increase advocated by the subject, the fall study had a ratio of maximum variance to minimum variance equal to 3.7, with Cochran's $C = .245$, $p = .004$, clearly forcing us to reject the null hypothesis of homoscedasticity. A number of power transformations were tried along with the logarithmic. The logarithmic transformation was chosen because it was as effective as any of the others in reducing heteroscedasticity and because such a function is more suitable on theoretical grounds. With the transformation, the ratio of maximum variance to minimum variance is 1.41 and Cochran's C is reduced to .13, $p = 1.00$; thus, the data now appear homoscedastic.

For ψ on the first message, the untransformed data had a ratio of maximum variance to minimum variance equal to 1,456, Cochran's $C = .277$, $p = .002$. We found, however, that none of the transformations described above created data which appeared homoscedastic. For the log transformation, for example, the ratio

TABLE 1

MEAN (AND STANDARD ERROR) PERCENT TUITION INCREASE ADVOCATED BY SUBJECTS BY POSITION(S) ADVOCATED IN MESSAGE(S) AND BY STUDY[a]

Position(s) Advocated in Message	Combining Both Studies[c] (1)	Fall Study (2)	Spring Study (3)
Control[b]	−.79	−.5615	−1.0567
		(.7191)	(.8050)
15%	−.04	−.5943	.7773
		(.6683)	(.5866)
50%	.51	.3731	.6672
		(.7097)	(.7544)
15%/50%	.54	−.0701	1.3139
		(.7297)	(.6290)
50%/15%	1.00	.4445	1.8043
		(.5881)	(.4500)
15%/15%	—	—	1.3757
			(.5917)
50%/50%	—	—	−.4428
			(.6325)

[a]Transformed data: If subject recommended an increase of X percent this was transformed to ln (X) for X > 0, ln (.01) for X = 0. Sample size is between 33 and 39 per cell, column 1; 18–23 per cell, column 2; 15–17 per cell, column 3.

[b]The control group received no message.

[c]Standard errors are not provided for column 1 because they will not be relevant to the analysis. These standard errors are inflated by differences between terms. The analysis takes term into account.

were gathered, we used the same transformations, for the sake of comparability. All analyses use these transformed values unless otherwise stated. The results of the two studies are presented in Tables 1 and 2.

of maximum variance to minimum variance equaled 27.9. To further reduce heteroscedasticity, we tried ln(x + k), for many different values of k. We found that the ratio of maximum variance to minimum variance reached a minimum value of 9.87 when k = 11.5; for this transformation, Cochran's $C = .2172$, $p = .08$. If heteroscedasticity has not been totally eliminated, it has been substantially reduced.

For ψ of the second message, the untransformed data had a ratio of maximum variance to minimum variance equal to 198, Cochran's $C = .66$, $p = 0$. For comparability, we used the same transformation as used for ψ of the first message. In this case, the data appear homoscedastic, as the ratio of maximum variance to minimum variance equaled 1.45, Cochran's $C = .29$, $p = .77$. In the spring study, the transformation had a very similar effect in reducing the substantial heteroscedasticity of the untransformed data.

In general, heteroscedasticity and skewness go together and this is also the case with these data. In the combined untransformed data for the two studies, our three dependent measures had skewness values ranging from 5.1 to 6.2. By contrast, the skewness values of our transformed variables range between 0.6 and 0.8 (ignoring the sign).

The two studies contain five conditions in common—the four conditions appearing in the fall study, and the control condition. From examining the data, we find that in most of the conditions, subjects in the spring study recommended a greater tuition increase and found a given increase recommended by T. L. or F. G. less psychologically discrepant. This can readily be attributed to history. When the fall data were gathered, the annual inflation rate was 11%. When the spring data were gathered, the inflation rate had risen to 18% and was receiving much media attention.

A two-way (message condition x study) ANOVA was performed on P. The main effect of study (term) on P had $F(1, 169) = 3.45$, $p = .07$. The effect of study on ψ of the 15 percent message had $F(1,108) = 1.57$, $p > .10$; its effect on ψ of the 50 percent message had $F(1,106) = 23.32$, $p < .001$. While the rank ordering of the five common conditions for the two terms shown in Table 1 is not identical, the interaction effect in

TABLE 1

MEAN (AND STANDARD ERROR) PSYCHOLOGICAL DISCREPANCIES OF POSITION(S) ADVOCATED IN MESSAGE(S), BY POSITION(S) ADVOCATED AND BY STUDY[a]

Position(s) Advocated in Message(s)	Combining Both Studies (1)		Fall Study (2)		Spring Study (3)	
	Discrepancy of 15%	Discrepancy of 50%	Discrepancy of 15%	Discrepancy of 50%	Discrepancy of 15%	Discrepancy of 50%
15%	5.02		5.1054 (.0881)		4.8973 (.1091)	
50%	—	5.36	—	5.5460 (.2353)		5.1436 (.2377)
15%/50%	4.61	5.47	4.8016 (.2835)	6.2540 (.2686)	4.3494 (.2589)	4.4404 (.2123)
50%/15%	4.20	5.18	4.1954 (.2254)	5.3426 (.1585)	4.1953 (.1849)	4.9368 (.1635)
15%/15%[b]	—	—	—	—	4.3709 (.2441)	
50%/50%[b]	—	—	—	—	—	5.5414 (.3735)

[a]Transformed data: If subject's response was X, this was transformed to ln(X + 11.5). Raw scores greater than 10,000 were first converted to 10,000. In conditions in which the subjects received two messages, the same subjects are represented in the paired adjacent columns. Sample size is 36–39 per cell, column 1; 19–23 per cell, column 2; 16–17 per cell, column 3.

[b]For these conditions, the data are based on the discrepancy rating of the first of the two messages. In both conditions however, the mean rating of the second message is within .08 of the mean rating of the first message.

[c]Standard errors are not provided for column 1 since they will not be relevant to the analysis. These standard errors are inflated by differences between terms. The analysis takes term into account.

our two-way ANOVA has $F(4,169) = .75$, $p = .56$. Hence, in testing our models, main effects due to history will be taken into account by adding the dichotomous variable "study (term)" at the theoretically appropriate place in the equations. The absence of a statistically significant interaction effect of message condition x study (term) allows us to combine these data to increase the sample size per cell, without any belief that the pattern of means differs systematically due to the term in which the data were gathered.

The Simple Linear Balance Model

This model does not deal with psychological discrepancy. It does, however, make several very clear predictions regarding the relative effectiveness of various messages and message combinations.

From the fact that the pilot study found the mean tuition increase advocated to be 2.07 percent, and from hypotheses 1A and 2 above, we predict that the control condition will show the lowest mean tuition increase recommendation and that the 50 percent condition will show a higher mean recommendation than the 15 percent condition. Examining Table 1, column 1 we see that this prediction is supported by the combined data.

Hypothesis 1B is a conditional hypothesis; it is applicable only if the position advocated in a second message (S_2) is more extreme than the subject's position adopted after the first message (P_1). To determine if this condition is met, we must place the stimuli (S) and responses (P) on comparable scales. Because the responses have been transformed logarithmically, we must do the same for our stimuli. When we do so, we note that the 15 percent message advo-

cates a position which is clearly greater than the mean response given for either the 15 percent or 50 percent condition (ln [15] = 2.71; 15 percent mean = −.04; 50 percent mean = .51). Thus, hypothesis 1B implies that the 15 percent/50 percent and 50 percent/15 percent condition will each be more effective than the 50 percent or 15 percent condition alone. Finally, if we assume that the first message, being longer and containing more supportive arguments, has more weight than the second message, hypothesis 3 implies that the 50 percent/15 percent message will be more effective than the 15 percent/50 percent. Combining hypotheses 1A, 1B, 2, and 3, we expect the conditions to be ordered as follows, from least to most effective: control; 15 percent; 50 percent; 15 percent/50 percent; 50 percent/15 percent. From Table 1, column 1 we see that the means are ordered precisely as predicted for the combined data. To evaluate this statistically, we examine the linear trend of these conditions. We find the unique linear term to have t (174) = 2.73 ($p = .004$, one-tailed).[31]

Examining the two conditions for which we have data only for the spring term, we have mixed results. By hypothesis 1B, the 15 percent/15 percent message should be more effective than the 15 percent message alone. By hypothesis 2, the 50 percent/15 percent message should be more effective than the 15 percent/15 percent. The results tend to support these predictions, but fail to be statistically significant.

[31]This ANOVA was a one-way analysis, ignoring the effects of term. It was not possible to take term into account adequately with ANOVA. We are confident that this did not create spurious results for two reasons. First, term was uncorrelated with message condition. Second, the fact that term had an effect should have increased the within cell variance. Hence, this analysis is overly conservative. Note that the differential weight notion is not significantly supported by the analysis of equations (7) and (8) reported below. In other words, these ANOVA results are a function of different ψ values rather than different values of model coefficients.

We also have some results which contradict the model. By hypotheses 1B and 2, the 50 percent/50 percent condition should show the greatest attitude change. Looking at Table 1, however, we see that, for the spring data, the 50 percent/50 percent condition has a lower mean tuition increase than do most other conditions, and the difference between this condition and the 50 percent/15 percent condition is significant (t [31] = 2.9, $p < .01$).

The Psychological-Discrepancy-Discounting Model

We shall first examine the effects of our exogenous variables on psychological discrepancy.

Testing hypothesis 4 (Table 2), we find that the 50 percent message is significantly more discrepant than the 15 percent message (t [70] = 1.88, $p = .03$, one-tailed).

H.5 predicts that the presence of the 50 percent message would make the 15 percent message seem less discrepant than it would be by itself. From Table 2, we see that the 15 percent message is more psychologically discrepant by itself than in either the 15 percent/50 percent or the 50 percent/15 percent condition. A two-way condition by term ANOVA on those conditions shows a significant effect of condition, F (2,108) = 7.84, $p = .001$.

H.6 predicts that the presence or absence of a 15 percent message will have no effect on the discrepancy of the 50 percent message. (This, in turn, implies that the message order has no effect on the discrepancy of that message.) An analysis of variance was performed to see if ψ_{50} varied across the 50 percent, 15 percent/50 percent and 50 percent/15 percent conditions; the differences were not statistically significant.

H.7 predicts that $\psi_{15(50,15)} < \psi_{15(15,50)}$. Table 2 shows that the results are as

predicted, t (72) = 1.68, $p = .05$, one-tailed.

H.8 predicts that repetition of a message makes that message seem less discrepant. The results in Table 2 give partial support to that hypothesis. We see that $\psi_{15(15,15)} < \psi_{15(15)}$, t (31) = 1.93, $p = .03$, one-tailed. While Table 2 shows $\psi_{50(50,50)} > \psi_{50(50)}$, this difference is not statistically significant ($p > .20$).

We now test equations (3) and (4), which use ψ as well as the position of the stimulus message, S, to predict attitude change. To do so, we must make an explicit assumption as to $\Delta(\psi)$, the function which discounts the weight. We will assume that $\Delta(\psi) = e^{-\gamma(\psi+k)}$, with k estimated as 11.5.[32] Thus, equation (1) can be expressed as:

$$P_1 = b_1 + b_2T + b_3S_1. \qquad (5)$$

and equation (3) can be expressed as:

$$P_1 = \frac{B_1(B_2 + B_4T) + S_1e^{B_3(\psi+11.5)}}{B_1 + e^{B_3(\psi+11.5)}} \qquad (6)$$

where B_1 is the estimate of w_0/w_1, the weight of the initial position (P_0) divided by the weight of message, and

$B_2 + B_4$ is the estimate of P_0 for fall, 1979,

$B_2 + 2B_4$ is the estimate of P_0 for spring, 1980,

$B_3 = -\gamma$

$$T = \begin{cases} 1 \text{ for fall} \\ 2 \text{ for spring,} \end{cases}$$

and P_1, S, and ψ are untransformed scores.

[32]In the applications of the nonlinear model to follow, we need to "align" $\Delta(\psi)$ with P_1 by empirically determining their relative origins. Thus, the empirical equation relating ψ to $\Delta(\psi)$ is $\Delta(\psi) = e^{-\gamma(\psi+k)}$. The value of k is estimated as 11.5 from our investigation of transformations of ψ. See note 30 above. See Mosteller and Tukey, chs. 4 and 5, and R.L. Hamblin, "Social Attitudes: Magnitude Measurement and Theory," in *Measurement in the Social Sciences*, ed. H.M. Blalock, Jr. (Chicago: Aldine, 1974), pp. 61–120, for different methods of estimating k.

The model was also tested on all of the double-message conditions. As before, we started with a three-parameter linear model which assumed that the two messages were weighted equally. We looked at the increment in explained variance from adding a parameter by going to a nonlinear model. The linear balance model tested was:

$$P_2 = b_1 + b_2S_1 + b_2S_2 + b_3T. \qquad (7)$$

The psychological-discrepancy-discounting model tested was:

$$P_2 = \frac{[B_1(B_2 + B_4T) + S_1e^{B_3(\psi_1+11.5)}] + S_2e^{B_3(\psi_2+11.5)}}{B_1 + e^{B_3(\psi_1+11.5)} + e^{B_3(\psi_2+11.5)}} \qquad (8)$$

As can be seen in Table 3, the nonlinear model for the single message conditions significantly increases the variance explained by the linear model from 7 percent to 13 percent.[33] Table 5 contains the parameter estimates from the psychological-discrepancy-discounting equations.

As can be seen in Table 4, the nonlinear model greatly added to the explained variance for the double messages. The linear balance version explains 6 percent of the variance; the

[33]The F statistic reported assumes, of course, homoscedasticity and normality of (population) residuals. For our models, no single test of residuals is adequate. However, we have examined scatterplots of the residuals and the skewness of the residuals from the nonlinear models. There does not seem to be any serious violation of the statistical assumptions.

The approach taken to model evaluation here is consistent with that suggested by C.A. Lave and J.G. March, *An Introduction to Models in the Social Sciences* (New York: Harper & Row, 1975), pp. 58–61. We are comparing the psychological-discrepancy-discounting model not against a null hypothesis of "no relation," but against a plausible competitor, the linear balance model. Others have found support for the linear model; see note 21. None to our knowledge have contrasted the linear model with our nonlinear one. This is because other studies have not attempted to measure psychological discrepancy directly. Thus, our statistical test is conservative, since we require our nonlinear model to be an improvement on the plausible linear one, rather than an improvement on an implausible model of "no relation."

TABLE 3

ANALYSIS OF LINEAR BALANCE (EQUATION 5) AND PSYCHOLOGICAL-DISCREPANCY-DISCOUNTING (EQUATION 6) MODELS, FOR SINGLE MESSAGE CONDITIONS[a]

	Sum of Squares	df	MS	F	p
Total	2005.79	71			
Explained by Linear Balance Model	143.97	2	71.99	2.67	<.10
Unexplained by Linear Balance Model	1861.82	69	26.98		
Increment Explained by Psychological-Discrepancy-Discounting Model (Nonlinear)	114.86	1	114.86	4.47	<.05
Unexplained	1746.97	68	25.69		

[a]Untransformed variables. Term of study included. See equations (5) and (6).

psychological-discrepancy-discounting version increases the explained variance to 29 percent.

Aside from testing whether a nonlinear model added significantly to the explained variance, we also considered the possibility that the first and second messages, because of their different lengths, had different weights. First we tested linear models in which the two messages were used separately as predictors. The inclusion of the additional parameter made no significant increment to the explained variance (F [1, 102] = 0.67). In addition, we allowed $-\gamma$, the coefficient of ψ, to differ for the first and second messages, which, in effect, allows the two messages to have unequal weight. This added a fifth parameter to the nonlinear model. While adopting the nonlinear four-parameter model had made a tremendous difference in explained variance, the addition of a parameter reflecting differential weight leads to no significant increment in explained variance, F (1, 101) = 2.13.

Not only does the inclusion of ψ significantly increase the explained variance, but the results support the theory in several other ways.

First, as stated earlier, $B_2 + B_4$ is the estimator of the fall-term value of P_0, the subject's initial position, and $B_2 + 2B_4$ is the estimator of P_0 for the spring. Comparing these predicted values with the actual value of the control condition, we find them quite close, especially given the standard errors for each statistic, and the fact that all three estimates of P_0 for each term are entirely independent. See Table 6.

In addition, B_3, the estimate of $-\gamma$, is negative. This confirms the model's claim that higher values of ψ lead to less attitude change. Moreover, the fact that B_1 is positive indicates that, controlling

TABLE 4

ANALYSIS OF LINEAR BALANCE (EQUATION 7) AND PSYCHOLOGICAL-DISCREPANCY-DISCOUNTING (EQUATION 8) MODELS, FOR DOUBLE MESSAGE CONDITIONS[a]

	Sum of Squares	df	MS	F	p
Total	3991.35	105			
Explained by Linear Balance Model	231.59	2	115.79	3.17	.046
Unexplained by Linear Balance Model	3759.75	103	36.50		
Increment Explained by Psychological-Discrepancy-Discounting Model (Nonlinear)	924.16	1	924.16	33.24	.001
Unexplained	2835.59	102	27.80		

[a]Untransformed variables. Term of study included. See equations (7) and (8).

TABLE

ESTIMATED COEFFICIENTS (AND APPROXIMATE STANDARD ERRORS) FROM THE PSYCHOLOGICAL-DISCREPANCY-DISCOUNTING MODEL, FOR SINGLE AND DOUBLE MESSAGE CONDITIONS*

Estimated Coefficient	Conditions	
	Single Message (equation 6)	Double Message (equation 8)
B_1	4.295 (2.086)	2.035 (.617)
B_2	3.025 (2.232)	2.164 (2.082)
B_3	.004 (.003)	.015 (.004)
B_4	.126 (1.345)	1.245 (1.300)

*Untransformed data; term included.

TABLE 6

A COMPARISON OF ESTIMATES OF SUBJECTS' INITIAL POSITION (PO) FROM PSYCHOLOGICAL-DISCREPANCY-DISCOUNTING MODEL, AND FROM CONTROL GROUPS, BY TERM

Source	Term	
	Fall, 1979	Spring, 1980
Control Group	4.12	3.97
Single Message Nonlinear Equation	3.15	3.28
Double Message Nonlinear Equation	3.41	4.65

for ψ, greater positional discrepancy leads to more attitude change. The analysis was done so as to guarantee that B_1 and B_3 would have the appropriate signs, provided a local minimum to the sum of squares existed in those ranges.[34] The fact that such a local minimum exists provides partial support for the model. Finally, the model is supported to the extent that the parameters estimated in the double message conditions are close to those found in the single message conditions. While these estimates are not identical, neither are they very different; three of the four pairs of parameter estimates do not significantly differ.

DISCUSSION

We proposed a model which accounts for the non-monotonic effect of message discrepancy on attitude change, which systematically related both psychological discrepancy and positional discrepancy to such change, and which deals with the effect of multiple messages. We contrasted this model with the linear balance model, which did not take psychological discrepancies into account. An especially interesting prediction was that a message which was so extreme as to be quite ineffective might, in concert with a less extreme message, be more effective than would two less extreme messages.

The results have not fully demonstrated that particular phenomenon in that the 50 percent message was more effective than expected. While subjects who were asked to think of an extremely discrepant position chose a 50 percent increase, to those who were actually exposed to that position, it apparently did not seem quite so extreme.

While our complete set of predictions concerning the 50 percent message were not supported, the results have supported

[34]In the particular analysis reported here, the estimates of the parameters were specified to fall within certain values. While these bounds do, to some degree, determine the solution reached, it should be noted that if there were no local minimum within those ranges, the procedure would not have achieved solution. Tolerance limits on the parameter and on the sum of squares function were set at the value of 5×10^{-5}. For a discussion of problems associated with nonlinear regression analysis, see S.L. Meyer, *Data Analysis for Scientists and Engineers* (New York: Wiley, 1975), especially pp. 399–400; J.V. Beck and K.J. Arnold, *Parameter Estimation in Engineering and Science* (New York: Wiley, 1977); and C. Daniel and F.S. Wood, *Fitting Equations to Data* (New York: Wiley, 1980).

some more general principles from which the interesting prediction mentioned above can be derived:

(1) Other things being equal, greater psychological discrepancy is associated with less acceptance of a message; (2) the psychological discrepancy of a message is influenced by the surrounding messages, and in the manner predicted by the model. Moreover, the particular form of the psychological-discrepancy model we have proposed performed rather well.

The fact that psychological discrepancy can be manipulated by using other messages is very useful for establishing the utility of this model. Otherwise, it would be possible to claim that while including psychological discrepancy in our model has increased the explained variance, this is because different values of psychological discrepancy, in the same experimental condition, reflect nothing more than individual differences. In other words, those who initially accept a tuition increase (have higher values of P_0) or are easier to influence will have lower psychological discrepancies for the same message and will recommend greater tuition increases. Comparing the condition in which the moderate message precedes the extreme message with the condition in which the order was reversed shows, however, that psychological discrepancy can be manipulated and that changing psychological discrepancy has consequences for the amount of attitude change caused by a given message. The fact that the psychological discrepancy of the moderate message is less when the extreme message precedes the moderate message than vice versa helps explain the greater attitude change in the former condition. The linear balance model, however, cannot explain this finding. To explain this by using that model requires assuming the first message to have more weight than the second, an assumption inconsistent with our results.

Two issues cannot be resolved by the present study. The first, a mechanism explaining the discounting function, needs to be explicated and tested. Discounting may be due to less attention being paid to more discrepant messages, or to active resistance to them.[35] An investigation of this issue seems a significant next step.

Second, one may question the causal ordering of the position of the stimulus message, the psychological discrepancy it induces, and the position adopted by the recipient of the message. We have assumed changes in psychological discrepancy are causally prior to attitude change. This may not be the case. For example, subjects may read our message, establish their own position, and then evaluate the psychological discrepancy of the message. While this seems unlikely, this possibility needs to be experimentally evaluated.[36]

Aside from trying to refine the model presented herein as indicated above, we see three major directions for research in this area which we have begun. One is to place discrepant messages into an explicitly multi-dimensional framework, trying to ascertain more fully the relationship between the configuration of concepts and the force generated by messages invoking these concepts.[37] Another is to measure attitudes at many different points in time, thus learning more about the internal cognitive forces which operate after the receipt of a message and about the trajectory of the attitude

[35]Cf. Anderson, 1974, pp. 69–71.

[36]We have attempted to test this using a nonrecursive causal model and some of the data reported above. The results show a substantial negative effect of ψ on P_1, but essentially no effect of P_1 on ψ. However, the nonrecursive model tested is not directly comparable with our psychological-discrepancy-discounting model.

[37]See Woelfel and Fink; S.A. Kaplowitz and E.L. Fink, "Attitude Change and Attitudinal Trajectories: A Dynamic Multidimensional Theory," in *Communication Yearbook 6*, ed. M. Burgoon (Beverly Hills, CA: Sage, 1982), pp. 364–94.

change.[38] Third is to carry out field experiments testing some of these ideas.[39]

While the study of the discrepancy of messages and their impact upon the receiver has a long history in the rhetorical domain of our field,[40] the study of this topic aided by mathematical models is relatively new. Assuming our psychological-discrepancy-discounting model to be correct, we hope that our colleagues will not find it so discrepant that they will discount it.

[38]See S.A. Kaplowitz, E.L. Fink, and C.L. Bauer, "A Dynamic Model of the Effect of Discrepant Information on Unidimensional Attitude Change," *Behavioral Science*, 28 (1983), 233–50.

[39]See G.A. Armstrong, C.L. Bauer, E.L. Fink, and S.A. Kaplowitz, "The Persistence of Attitude Change Induced by Varying Levels of Message Discrepancy," annual conference of the International Communication Association, May, 1981, Minneapolis; and Kaplowitz, Fink, and Bauer.

[40]See, e.g., J.S. Mill, *Autobiography* (London: Longmans Green, 1908), p. 168.