The SAGE Handbook of Persuasion

Second Edition

Developments in Theory and Practice

Edited by

James Price Dillard

Pennsylvania State University

Lijiang Shen

University of Georgia

(203)

SAGE

Los Angeles | London | New Delhi
Singapore | Washington DC

CHAPTER 6

Discrepancy Models of Belief Change

Edward L. Fink and Deborah A. Cai

In the context of attitude and belief change, *discrepancy* refers to the difference between a position advocated in a message (P_A) and the immediately prior premessage position of an individual (P_0); thus, message discrepancy (hereinafter *discrepancy*) = ($P_A - P_0$). Suppose for example that you were asked to contribute (perhaps with some justification) \$100.00 (P_A) to your alma mater, and your immediately prior view regarding how much you would be willing to give your alma mater was \$10.00 (P_0). In this case, the discrepancy of the message is \$90.00.

The logic behind discrepancy studies is a simple one: It is assumed that discrepancy is a predictor of change in attitude or belief (and sometimes behavior). To be precise, an *attitude* is a response of the form or a conveyance of the idea that "I like [or dislike] *X*." An *evaluative belief* is a response of the form or conveyance of the idea "*X* is good [or bad]." A *nonevaluative belief* is a response of the form or a conveyance of the idea "*X* is *Y*," where *Y* is nonevaluative. These definitions are not meant to be restrictive but rather to differentiate possible foci of research (cf. Woelfel & Fink, 1980). However, the use of a standard terminology is complicated in part because different authors studying this phenomenon have used different terms. For simplicity in what follows, the discussion of discrepancy models as applied to attitudes also applies to beliefs, and belief is used as the generic term throughout.

AUTHOR' NOTE: Some of the ideas presented here are taken from Kaplowitz, S. A., & Fink, E. L. (1997). Message discrepancy and persuasion. In G. A. Barnett & F. J. Boster (Eds.), *Progress in communication sciences* (Vol. 13, pp. 75–106). Greenwich, CT: Ablex.

The authors acknowledge the work of our collaborators in the study of discrepancy models, and in particular Joseph Woelfel, Stan A. Kaplowitz, and Sungeun Chung. We thank Jeffrey C. Williams for description of discrepancy models from other sciences.

A *discrepancy model* is a model that relates the differences between values of a dependent variable to differences in the values of one or more independent variables. This chapter first describes the logic and role of discrepancy models in the sciences. Next, we examine the simplest belief change model regarding discrepancy, the linear discrepancy model. We indicate its assumptions and its implications for message repetition and message order, and explicate the meaning of its single parameter. Finally, we examine the theories and literature regarding discrepancy models of belief change and the evidence regarding the validity of the linear discrepancy model and its major tenets. This discussion includes an excursus in the form of a methodological wish list, recommending how research in this area may be improved.

Discrepancy Models in Scientific Theory

Discrepancy models play a central role in scientific theory: It is common for differences in one or more variables to predict differences in a dependent variable. Here are a few examples from physics.

Models

Bernoulli's Principle

Bernoulli's principle states that the difference in pressures of a fluid system at any two points in a flow is a function of the difference in the flow velocities squared and the difference in the vertical locations of the two points (Bar-Meir, 2011).

First Law of Thermodynamics

The First Law of Thermodynamics relates the differences in the internal energy of a system at equilibrium to the difference between the heat transfer and the work done (Knight, 2007).

Kinematics of a Particle With Constant Acceleration

The equations relating the three basic quantities of particle kinematics (position, velocity, and acceleration) are explained in terms of differences in time, differences in displacement, and velocity in acceleration (Knight, 2007).

Relevance of Physical Models

What is the relevance of these physical examples for human communication science? First, these examples show the successful application of a model (Lave & March, 1993); these examples are literally textbook cases. Second, these examples are parsimonious: The variables and relationships that are included fit within a framework that implicitly dismisses variables that are deemed irrelevant. Compare these examples with studies in the communication discipline that add a potpourri of variables, seemingly without limit (see Pacanowsky, 1976, for an example of a line of research that, although a caricature, fits into the "no variable need be excluded" category and appears all too realistic).

Third, the physics examples all specify the measurement rules—the metrics—that apply to all included variables; these metrics are balanced in the sense that the units on one side of the equation generate the same units as the other side. Thus, the units on both sides work out to be the same (created by what is referred to as *dimensional analysis*).

These examples are only a few that could be used to show the success of models based on discrepancy. In the following, we start with a simple discrepancy model, a model applied to beliefs, and then examine the extent to which theory and research have extended, modified, and complemented the simple ideas about discrepancy and belief change.

A Linear Model

The simplest form of change induced by discrepancy would be linear. If we define the relevant change induced by a message as the difference between the position adopted by the individual after message receipt (P_1) and the individual's premessage position (P_0), then belief change = ($P_1 - P_0$). The linear function relating change to discrepancy is

$$(P_1 - P_0) = \forall(P_A - P_0), \qquad (1)$$

where $\forall$ is a constant of proportionality. This model has several different names, including the *linear discrepancy model*, the *linear balance model*, the *distance-proportional model* (Anderson & Hovland, 1957), and the *proportional change model* (e.g., Danes, Hunter, & Woelfel, 1978); the model is also consistent with the logic of Anderson's (1974) *information integration theory.*

We may rewrite Equation 1 as follows:

$$P_1 = P_0 + \forall(P_A - P_0)$$
$$\therefore P_1 = P_0 + \forall P_A - \forall P_0$$
$$\therefore P_1 = (1 - \forall)P_0 + \forall P_A. \qquad (2)$$

Equation 2, which is mathematically equivalent to Equation 1, highlights another aspect of this model: Because $(1 - \forall)$ and $\forall$ sum to 1, we see that the new position (P_1) is the weighted sum of the initial position (P_0) and the position advocated in the message (P_A). This model can be directly applied to the receipt of more than one message, either simultaneously or sequentially; the latter case is addressed in the following.

Using the "contribution to alma mater" example, if the linear discrepancy model were correct and we arbitrarily set $\forall = \frac{1}{3}$ (the meaning of $\forall$ is discussed in detail two sections later in this chapter), then

$$(P_1 - P_0) = \forall(P_A - P_0)$$
$$(P_1 - 10) = \tfrac{1}{3}(100 - 10)$$
$$(P_1 - 10) = 30$$
$$P_1 = 10 + 30 = 40.$$

So, the new position adopted by the individual would be a contribution of $40.00.

Assumptions

This model has several assumptions. The first set of assumptions reflects general issues of attitude and belief change studies:

> A.0. The subjects [i.e., individuals who are involved in the investigation] are capable of attending to and comprehending the messages.
>
> A.1. The subjects' attitudes [and beliefs] and the relevant messages may be placed on a unidimensional [quantitative] continuum.
>
> A.2. Each equation is static, and thus assumes that an equilibrium value for the dependent variable has been achieved prior to or simultaneously with [its measurement].
>
> A.3. . . . parameters in the attitude [and belief] change models . . . are identical for all subjects given the same facilitating or inhibiting factors represented by the equivalent experimental conditions. (bracketed material added; Fink, Kaplowitz, & Bauer, 1983, n20, pp. 416–417)

Assumptions A.0, A.2, and A.3 are typical assumptions in experimental attitude and belief change research, although these assumptions are generally implicit. Assumption A.1 is particularly relevant to discrepancy models: Attitude or belief positions may be implicit in messages and in the message recipient, but the model requires that they be made explicit. If the information is not explicit, this assumption may be interpreted in two different ways: (1) All messages and positions can be quantified, even if they are not quantified explicitly in a message or by the message recipient. So, if you are asked to donate to your alma mater, you may respond as if your initial position (P_0) was $10.00, although you may not have been aware of that number, and a message like "Please donate to our alma mater" may be interpreted by you to mean "donate

$100.00." (2) An alternate interpretation is to suggest that the message position, the recipient's initial position, and the new position are qualitative (categorical); in that case, belief change would be better modeled by logistic regression, a catastrophe model (Flay, 1978; Latané & Nowak, 1994; van der Maas, Kolstein, & van der Plight, 2003), or a cellular automata model (Corman, 1996); due to space limitations, these models are not discussed further, but suffice it to say that the linear discrepancy model is incompatible with this second possibility.

Assumption A.2 means that the time interval between message receipt and P_1 is long enough for the individual to integrate the message in his or her set of beliefs; the actual time interval has been estimated using a dynamic model, discussed next.

A different assumption concerns the range of values for $\forall$. Many authors, including, for example, Hunter, Levine, and Sayers (1976), assume that $0 < \forall < 1$ (Assumption A.4). This assumption means that (for $0 < \forall$) there can be no boomerang effect: A message cannot cause a person to change an attitude or belief in a direction opposite to that which was advocated. This assumption also means that (for $\forall < 1$) the person cannot adopt a position more discrepant than that which was advocated. In the following section, we examine the effect of various values of $\forall$ that disregard Assumption A.4.

Message Repetition

We can use the linear discrepancy model recursively. If the same message is given repeatedly with enough time for each message in the sequence to be integrated (Assumption A.2), one can take Equation 1 and change the 0 subscript to 1 and the 1 to 2, and we have

$$(P_2 - P_1) = \forall(P_A - P_1).$$

Or, in general,

$$(P_\tau - P_{\tau-1}) = \forall(P_A - P_{\tau-1}),$$

where τ is the number of repetitions. Note that we have another assumption here, namely (Assumption B.0) that the model, and more specifically the value of $\forall$, is unchanged by repetition.

Given assumptions A.1-A.3 and B.0, if $\forall = 0$ (which disregards A.4), the person's initial position is unchanged by repetition: If $P_0 = 0$ and $P_A = 100$, repetition of the message leaves all subsequent positions (P_1, P_2, etc.) = 0.

In Figures 6.1., 6.2., and 6.3., the effect of repetition is shown with other values of $\forall$. Figure 6.1. shows that if $0 < \forall \leq 1$, repetition causes the individual to move toward the position advocated (here, 100). With $0 < \forall < 1$, an individual's position approaches 1.00 asymptotically; with $\forall = 1$, the individual adopts the position advocated ($P_A = 100$) after the first message and remains at that value with additional repetitions of the message.

Figure 6.2. shows that when $\forall > 1.00$, the trajectory of belief positions oscillates due to message repetition. With $\forall = 1.50$, we see that the newly adopted positions oscillate with damping

Figure 6.1 Effect of Number of Repetitions on Belief Position, by Different Values of Alpha: 1.00, 0.75, 0.50, 0.25. $P_0 = 0$, $P_A = 100$

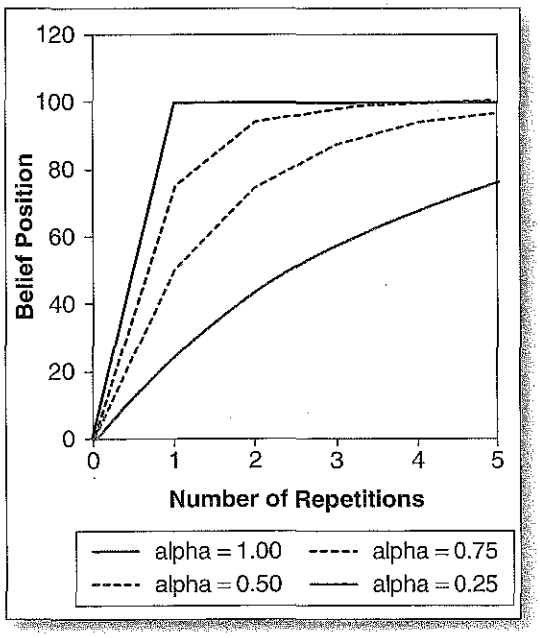


Figure 6.2 Effect of Number of Repetitions on Belief Position, by Different Values of Alpha: 2.00, 1.50. $P_0 = 0$, $P_A = 100$

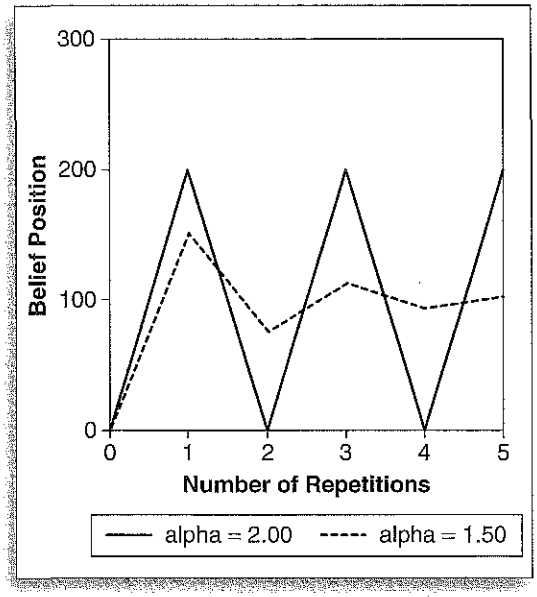
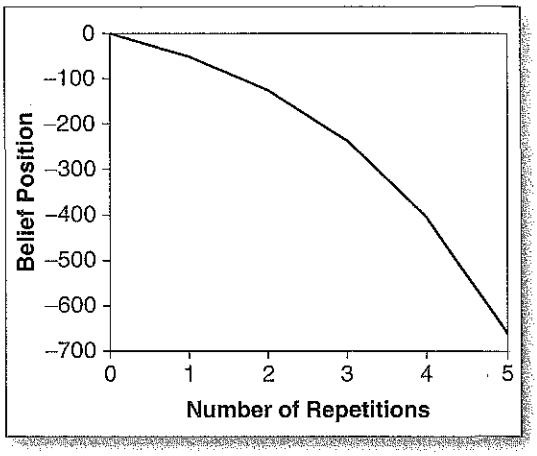


Figure 6.3 Effect of Number of Repetitions on Belief Position, Alpha = -0.50. $P_0 = 0$, $P_A = 100$



(the decrease in oscillation amplitude), alternately overshooting and undershooting the position advocated, with the absolute value of the difference from the position advocated getting smaller and smaller. With $\forall = 2.00$, message repetition causes the position adopted to alternate between a position of 200 (for an odd number of repetitions) and a new position of 0 (for an even number of repetitions). Not shown in Figure 6.2. is what happens if $\forall > 2.00$: In that case, the oscillations explode, increasingly moving away from the position advocated.

Figure 6.3. shows the effect of a negative value for $\forall$. In this case, repetition causes the positions adopted by the individual to move increasingly away from the position advocated, always in a negative direction.

What Is $\forall$?

The value $\forall$ has so far been mysterious. Clearly $\forall$ is the ratio of the change achieved by a message $(P_1 - P_0)$ to the change advocated by the message $(P_A - P_0)$: It is the slope of the line relating these two quantities. However, neither of these descriptions of $\forall$ relates it to the study of belief change.

Let's consider Berlo's (1960; see also Shannon & Weaver, 1949) four aspects of communication: source, message, channel, and receiver. Imagine a thought experiment (*Gedankenexperiment*) in which we hold the message, channel, and receiver constant, and vary only the source. In other words, we have two or more sources, and we have empirically determined the receiver's P_0 and the message's P_A. After giving the message and having the receiver integrate the message with other attitudes and beliefs (Assumption A.2), we measure P_1, which allows us to estimate $\forall$. We would expect that some sources are more effective than others, and that these more effective sources are associated with higher values of $\forall$, which is consistent with findings regarding source credibility (Aronson, Turner, & Carlsmith, 1963; Hovland & Weiss, 1951; Jaccard, 1981). In this case, $\forall$ is source credibility: Credibility means believability, so rather than say that properties of a source, as assessed by a scale, provide an operationalization of credibility, we can say that such measures may be indicators of

credibility, but, in our hypothetical example, the value of ∀ *is* the source's level of credibility.

Our next thought experiment holds source, channel, and receiver constant, and varies the message. By the same logic as previously noted, in this case ∀ is message persuadability or message effectiveness. Continuing this logic, if we hold the source, the message, and the receiver constant, ∀ becomes channel effectiveness. Finally, if we hold the source, the message, and the channel constant, ∀ is receiver persuadability or, more derisively, gullibility.

Of course, in an actual investigation (1) we may never completely hold these factors constant, (2) these factors may interact in predicting belief change, and (3) there may be factors to consider other than or as a component of source, message, channel, and receiver. For example, greater ego involvement (a receiver characteristic) should reduce belief change (Freedman, 1964; Jaccard, 1981; Zimbardo, 1960), which should reduce ∀, whereas stronger arguments (a message characteristic) should increase ∀ (Petty & Cacioppo, 1986).

Another interpretation of ∀ is to consider it as the ratio of the weight of the message position (P_A) divided by the weight of the message position plus the weight that exists for the effects of prior messages (which becomes the weight of P_0). Because the coefficients for P_0 and P_A sum to 1 (see Equation 2), (1 - ∀) reflects the ratio of the weight of the initial position (P_0) divided by the weight of the message position plus the weight of the initial position. Algebraically,

$$\forall = w_A/(w_A + w_0) \quad (3)$$

and

$$(1 - \forall) = w_0/(w_A + w_0) \quad (4)$$

so that

$$P_1 = [w_0/(w_A + w_0)]P_0 + [w_A/(w_A + w_0)]P_A \quad (5)$$

(see Fink et al., 1983; Saltiel & Woelfel, 1975). By this interpretation, the greater the weight of the message position, the more belief change is achieved. On the other hand, holding the weight of a new message position constant, the more massive ("weightier") a receiver's initial position, the less the belief change induced by a new message. The weight of the initial position can reflect the number of or involvement with prior messages while taking into account the processes of forgetting, which should reduce the weight, and activation, which may increase or restore the weight to a previous higher value.

Summarizing this discussion, the value of ∀ is composed of factors that inhibit (low values of ∀) or bolster (high values of ∀) belief change; in any given investigation, its composition reflects the factors that vary the most across the comparisons to be assessed. The linear model assumes that ∀ is a constant, and this assumption is investigated further.

Message Order

The linear discrepancy model makes specific predictions about the way that combinations of messages produce belief change. If we retain Assumption A.2, we can consider whether a message that is extremely discrepant followed by a message that is moderately discrepant is more or less effective than if the messages were in the opposite order.

In the following example, let $P_0 = 0$, ∀ = 0.50, P_E (the position of an extremely discrepant message) = 100, and P_M (the position of a moderately discrepant message) = 40. The analysis of the two message orders looks like this:

The extreme message followed by the moderate message:	**The moderate message followed by the extreme message:**
$(P_1 - P_0) = \forall(P_E - P_0)$	$(P_1 - P_0) = \forall(P_M - P_0)$
$(P_1 - 0) = 0.50(100 - 0)$	$(P_1 - 0) = 0.50(40 - 0)$
$P_1 = 50$	$P_1 = 20$
$(P_2 - P_1) = \forall(P_M - P_1)$	$(P_2 - P_1) = \forall(P_E - P_1)$
$(P_2 - 50) = 0.50$ $(40 - 50)$	$(P_2 - 20) = 0.50$ $(100 - 20)$
$P_2 = 45$	$P_2 = 60$

We see that, with the assumptions that were made, the moderate message followed by the extreme message is more effective than the messages in the reverse order.

Summarizing this section, we see the linear discrepancy model makes clear predictions about several aspects of belief change: the effect due to a single message, the relation of communication factors (e.g., source, message, channel, receiver) to the model's single parameter ($\forall$), the effect of message repetition, and the effect of message order. The model has nonobvious implications; for example, the same equation, used to assess message repetition, generates incremental upward motion toward an asymptote, oscillatory motion that damps out, oscillatory motion that does not damp out, oscillatory motion that is unstable, and accelerating motion away from the position advocated. We now examine how various theories relate to this model.

Theories Regarding Discrepancy

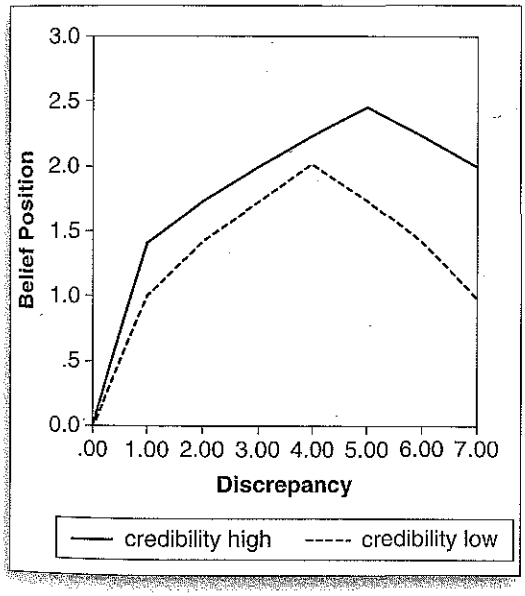
Social Judgment Theory

M. Sherif and Hovland (1961; C. W. Sherif & Sherif, 1967; C. W. Sherif, Sherif, & Nebergall, 1965) created social judgment theory, which is based on the idea that beliefs are perceived, and therefore judged, the way that physical quantities are perceived and judged. The usual analogy (referred to as the contrast principle) considers how a hand first put in cold water, after adapting to that temperature, when put in lukewarm water feels hot, whereas a hand first put in hot water, after adapting to that temperature, when put in lukewarm water feels cold. In other words, the initial location (i.e., cold or hot water) acts as an anchor that leads to a misperception of how hot or cold the subsequent location (i.e., lukewarm water) is. C. W. Sherif et al. (1965) proposed that an individual's initial beliefs or attitudes determine how a position in a message is perceived. If the position in the message is close to the individual's initial position (i.e., it is within the individual's *latitude of acceptance*), the message position is perceived to be closer than it actually is, and therefore the message seems not very discrepant (i.e., it is assimilated). If the position in the message is far from the individual's initial position (i.e., it is within the individual's *latitude of rejection*), the message position is perceived to be further than it actually is, and therefore the message seems very discrepant (i.e., it is contrasted). The less discrepant the message appears, the more change it induces. Therefore, messages within the latitude of acceptance are effective in bringing about belief or attitude change, whereas messages within the latitude of rejection are ineffective in bringing about such change. (C. W. Sherif et al. also posit a latitude of noncommitment, in which no distortion of the message position is perceived.)

The implication of the social judgment approach is that the relation of discrepancy and belief change should not be linear: A message that is as discrepant as possible but still within the individual's latitude of acceptance should be most persuasive. Messages within the latitude of acceptance would be expected to cause change similar to that expected by the linear discrepancy model, whereas messages in the latitude of rejection should bring about less change. Overall, the curve representing the relation of discrepancy to belief change should be an inverted-*U*, first increasing to the point of maximum change and then decreasing; see Figure 6.4. In the terminology of the linear discrepancy model, $\forall$ (the slope) is not a constant: At low levels of discrepancy it is positive, and then at high levels of discrepancy it becomes negative.

Social judgment theory complicates this simple picture by adding the effects of two other variables. First, source credibility is expected to interact with discrepancy: In general, the greater the credibility, the greater the belief change (a main effect), but more important, the extremum of the curve (here, the maximum, which is the highest point on the y-axis) should occur at higher values of discrepancy the more credible the source. (Note: The extremum is not an inflection point.)

Figure 6.4 Hypothetical Relationship Between Discrepancy and Belief Change as Affected by Source Credibility, Consistent With the Social Judgment Approach and Cognitive Dissonance Theory. The Same Relationship Is Expected to Hold if Low Credibility Is Replaced With High Ego Involvement and High Source Credibility Is Replaced With Low Ego Involvement.



Second, ego involvement—the idea that the issue is personally important to the message recipient—is also expected to interact with discrepancy: The lower the involvement, the greater the persuasion (a main effect), and the extremum of the curve should occur at higher values of discrepancy the lower the involvement.

The logic for the effect of source credibility is straightforward: More credible sources should widen the latitude of acceptance and, as a result, induce more belief change. Greater ego involvement should result in "larger latitudes of rejection" because with high involvement "a person's own attitude acts as a stronger anchor" (Petty & Cacioppo, 1981, p. 107).

The evidence for the social judgment effects is not strong. For example, Eagly and Telaak (1972) found that it is the width of the latitude of acceptance, rather than the discrepancy level of the message, that determined the amount of change induced by a message: the greater the width, the greater the change. A study by Miller (1965) showed that the latitude of rejection did not increase for those highly involved with the relevant message issue as compared to control group members who were highly involved with an unrelated issue. Both these studies' findings are inconsistent with social judgment theory (see also Petty & Cacioppo, 1981). Thus, the social judgment approach lacks sufficient evidence of its validity. Eagly and Chaiken (1993) summarized this view by stating that "existing research provides little, if any, convincing evidence that the perceptual processes of assimilation and contrast covary with attitude change, let alone *precede* attitude change as the theory maintains" (p. 380, emphasis in original).

Cognitive Dissonance Theory

Both Aronson et al. (1963) and Bochner and Insko (1966) proposed that the theory of cognitive dissonance (Festinger, 1957) was relevant to understanding the effect of discrepancy on attitude change. Aronson et al. proposed that a discrepant message, assumed to be counterattitudinal, is a cause of dissonance. Furthermore, they suggested that there should be more dissonance when the message source is credible.

> Bochner and Insko stated that discrepancy causes dissonance that can be reduced in any of four ways: conformity to the communicator's [i.e., the source's] point of view, disparagement of the communicator, persuasion of the communicator that he is incorrect, and obtained social support. (p. 614)

Because laboratory studies are not amenable to the third or fourth of these ways of reducing dissonance, Bochner and Insko (1966) proposed that an individual must respond to a discrepant

message by being persuaded, by disparaging the source, or by some combination of the two. (Notice that this conclusion is not a requirement of theory but rather of the research design.) They then suggested that at low levels of discrepancy, belief change occurs, and that at high levels of discrepancy, disparagement occurs. Thus, they predicted the same curvilinear relationship that was predicted by social judgment theory, with disparagement and belief change treated as functional alternatives in response to a discrepant message: They predicted (1) the relationship between discrepancy and belief change is curvilinear, and (2) the extremum of the curve occurs at higher values of discrepancy the more credible the source; see Figure 6.4.

Cognitive Elaboration: Counterarguing

It seems reasonable that messages that are more discrepant induce more counterarguments, both as thoughts and as vocal disparagement of the communicator and the communication. Brock (1967) found empirical support for this relationship when considering subvocal counterarguments. This finding suggests that discrepancy causes processing through the central rather than the peripheral route (Petty & Cacioppo, 1986). The central route involves greater elaboration, indicated by a greater number of thoughts, which may be pro-attitudinal, counterattitudinal, or both. Because discrepancy is counter to one's beliefs, when an individual has the ability and motivation to think about a message, greater discrepancy → greater elaboration → more counterarguments → reduced belief change. The reduced effectiveness of the more discrepant messages may also be associated with the greater scrutiny that these messages receive as well as their perceived weakness, because arguments in messages that are incompatible with prior beliefs are judged to be weaker than arguments in messages compatible with one's beliefs (Edwards & Smith, 1996).

Two additional studies examined the relation of discrepancy to cognitive elaboration (see Kaplowitz & Fink, 1997). Kaplowitz and Fink (1991) manipulated discrepancy, measured the individual's belief, measured other evaluations (including manipulation checks), and finally assessed cognitive elaboration; they found that discrepancy and its effects were not related to elaboration. In a later study (Kaplowitz & Fink, 1995), in which participants indicated their belief continuously and then reported their thoughts, discrepancy was significantly associated with elaboration in terms of the number of counterarguments but not in terms of the number of pro-belief thoughts. In this 1995 study, participants considered their position repeatedly before reporting their cognitive responses, whereas in the 1991 study other measures intervened between the belief measure and the elaboration measure. Thus, it appears that when participants are directed to consider their belief as it is being formed, discrepancy increases cognitive responses at least with regard to counterarguments. However, based on a comparison of the 1991 and 1995 studies, it appears that this elaboration *reduces* the effect of discrepancy on belief change, suggesting that discrepancy is more effective if it serves as a peripheral cue. Given the procedural differences between these two studies, more research on this issue is needed.

Assuming that discrepancy does increase elaboration, the elaboration likelihood model predicts the same outcome as social judgment theory and the theory of cognitive dissonance: The relation between discrepancy and belief change should be an inverted-*U* shaped curve, as shown in Figure 6.4. On the other hand, if discrepancy or belief position serves as a peripheral cue, a discrepant message may be rejected without any need for elaboration. Kaplowitz and Fink's (1991) study found a large effect of discrepancy on belief change, but that study found no evidence of a downturn in belief position or of cognitive elaboration associated with discrepancy.

Is the Relation Between Discrepancy and Belief Change Nonmonotonic?

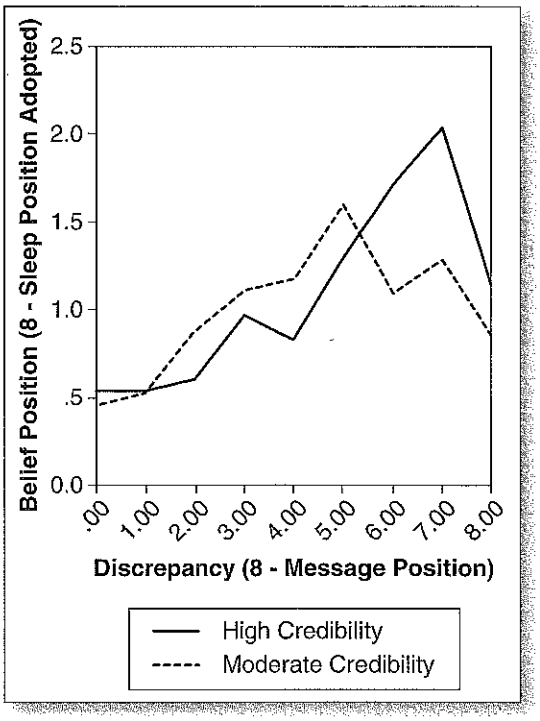
Bochner and Insko Redux

Bochner and Insko (1966) conducted an experiment that tested the functional form of the relationship of discrepancy to belief change using daily hours of sleep as the topic. Through a pilot study, P_0, the participants' initial position, was found to be 7.89 hours. Bochner and Insko's dependent variables were belief position ("For maximum health and well being, how many hours of sleep per night do you think the average young adult should get?") and two measures of disparagement: disparagement of the source and of the message. They manipulated three variables: message discrepancy, with nine levels (messages advocating 8, 7, 6, 5, 4, 3, 2, 1, and 0 hours of sleep); source credibility, with two levels (high vs. moderate); and the order in which the dependent variables were measured (belief then disparagement vs. disparagement then belief).

Figure 6.5. shows Bochner and Insko's (1966) results, combining data for the two different orders, which did not differ in their effects. The figure shows that messages attributed to the source with greater credibility were not more persuasive over all levels of discrepancy: For intermediate levels of discrepancy, the messages from the moderately credible source were more persuasive.

More important, the figure and its analysis shed light on the functional form of the relationship between discrepancy and belief change. These results, however, have often been misstated because the statistical analysis of the data appears inconsistent with what is shown in the figure: The statistical analysis reveals that the relationship is linear for discrepancy induced by the high credibility source, whereas the relationship is curvilinear and nonmonotonic for the discrepancy induced by the moderately credible source.

Figure 6.5 Bochner and Insko's (1966) Findings Relating Discrepancy to Belief Change



Although there were some significant findings regarding disparagement, it did not appear that disparagement acted simply as a functional alternative to belief change.

A Mathematical Integration: Laroche (1977)

Laroche (1977) created a mathematical model that incorporated source credibility, message discrepancy, and ego involvement in predicting belief change. Laroche's model requires that all variables are transformed to be between 0 and 1. Laroche's key equation is

$$y_{Eq} = D_p e^{-\gamma D_p}, \text{ with } 0 \le D_p \le 1.00, \quad 0 \le y \le 1.00, \gamma \ge 0, \tag{3}$$

where D_p is message discrepancy, $P_0 = 0$, and y_{Eq} = belief position at equilibrium. The parameter γ is a function of source credibility and noninvolvement.

The critical feature of Laroche's (1977) model is that, depending on the levels of credibility and noninvolvement, three different relations between discrepancy and belief position are possible: When $\gamma > 1.00$, there is a downturn in the graph (i.e., the relation is nonmonotonic); when $0 < \gamma < 1.00$, the curve is monotonic, decelerating with a positive slope; when $\gamma = 0$, the relation is linear. In other words, we can think of γ as a dial that changes the shape of the curve relating discrepancy to belief change. Greater credibility and greater noninvolvement reduce γ, thereby making the relation approach linearity. Using the results of prior studies, Laroche found that "γ was generally higher for low-credibility sources than for high-credibility sources and higher for conditions with high involvement than for those with low involvement" (Chung, Fink, & Kaplowitz, 2008, pp. 161–162).

Additional Evidence From Static Models

Aggregating Prior Studies

To investigate the functional form of the relationship between discrepancy and belief position, we can look at the average slope for different levels of discrepancy. Kaplowitz and Fink (1997) did just that, using their own prior research. In the works of Fink et al. (1983), Kaplowitz, Fink, Armstrong, and Bauer (1986), and Kaplowitz and Fink (1991), the relationship between discrepancy and belief position was a curve with a positive slope that decelerated; in other words, as discrepancy went up belief change went up, but the rate of change decreased. However, these differences in slope were relatively small. Furthermore, after reviewing other investigations, Kaplowitz and Fink (1997) concluded that there was little evidence for nonmonotonicity or boomerang effects (see Kaplowitz & Fink, 1997, pp. 83–85; cf. McGuire, 1985, p. 276); they speculated that "strong supportive arguments may increase the effectiveness of an extremely discrepant message from a mildly credible source and thus inhibit nonmonotonicity" (p. 84).

Positional Versus Psychological Discrepancy

Laroche's key equation (Equation 3, presented earlier) has discrepancy in two places, as a coefficient and as an exponentiated value: $y_{Eq} = D_p e^{\gamma D_p}$. Fink and colleagues (1983) created a variant of this model that incorporates two different aspects of discrepancy: *positional discrepancy*, which is the same as what was previously referred to as discrepancy, and *psychological discrepancy*, which is the "level of discrepancy between two positions as experienced by an individual" (Fink et al., 1983, p. 415). Using our notation, the model's key equation for the receipt of one message is:

$$P_1 = [w_0 P_0 + w_A \Delta(\psi) P_A] / [w_0 + w_A \Delta(\psi)],$$

where w_0 is the weight of the initial position (P_0), w_A is the weight of the message position (P_A), and $\Delta(\psi)$ is a discounting function that reduces the weight of the message as psychological discrepancy increases (compare with Equation 5). More specifically,

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

where $\gamma > 0$ and ψ is a positive monotonic transformation of measured psychological discrepancy. As psychological discrepancy increases, $\Delta(\psi)$ decreases, which reduces the impact of the message.

Psychological discrepancy reflects positional discrepancy as well as context effects. For example, holding positional discrepancy constant, the message environment can change a message's psychological discrepancy. Compare the following scenarios: (1) you are asked to give $100 to

your alma mater; (2) you are asked to give $1,000 to your alma mater, and then, after a moment, you are asked to give $100. The request for $100 that follows the $1,000 request should seem less psychologically discrepant than the single $100 request, and therefore it should be more effective.

Fink et al. (1983), using what was termed the *psychological-discrepancy-discounting model*, showed that the greater the psychological discrepancy, the less the effectiveness of messages with the same positional discrepancy, and that psychological discrepancy can be manipulated by the combination of messages that are presented to the receiver. Not all the model's predictions were supported, but many were. For example, it was found that the "psychological discrepancy of the moderate message is less when the extreme message precedes the moderate message than vice versa," resulting in "greater attitude change in the former condition" (p. 429).

More critical to the present discussion, the psychological-discrepancy-discounting model allows for nonmonotonic effects, and this model was found to be statistically superior to the linear discrepancy model.

Evidence From Dynamic Models

The theories and studies previously reviewed have been used to assess questions of *statics*, which is the study of forces in equilibrium rather than the movement toward equilibrium. Another way to examine the process activated by discrepant messages is to examine the changes over time or the movement from one equilibrium to another, the *dynamics* (see Eiser, 1994, for a general statement on dynamics, and for material related to the dynamics discussed next, see Fink & Kaplowitz, 1993; Fink, Kaplowitz, & Hubbard, 2002; Kaplowitz & Fink, 1996).

Kaplowitz, Fink, and Bauer (1983)

Kaplowitz et al. (1983), using a between-participants design, manipulated discrepancy and the amount of time respondents had to consider a message. The topic was the health service fee at the respondents' university, and the message advocated an increase in the fee. Participants, who were not in favor of a fee increase, were presented with a message that took no position on the fee, proposed a moderate increase in the fee, or proposed an extremely large increase in the fee.

Based on a dynamic model, the estimated equilibrium message effectiveness (i.e., change achieved divided by change advocated) was about 0 for the no position advocated message, whereas the moderately discrepant message was about 15% effective, and the extremely discrepant message was about 18% effective. Furthermore, it was estimated that the time to achieve 90% of the movement toward the equilibrium position was about 2 ¼ minutes. The trajectories were found to exhibit oscillation with a period of oscillation of about 13.5 seconds (s), and the amplitude of oscillation was greatest for the extremely discrepant message and much less and not that different for the no-position message and the moderately discrepant message.

The key findings of this study are that (1) greater discrepancy caused a greater change at equilibrium; (2) integrating a message takes time, and for these particular messages, it took well over two minutes; and (3) because of oscillations, the trajectories of messages with different discrepancies will likely cross prior to the achievement of equilibrium, which means that "if messages of different discrepancies cause oscillations which have different frequencies . . . one's conclusion as to which message was most effective may be determined by the time interval from message to measurement" (Kaplowitz et al., 1983, p. 247). If we do not control the time between a discrepant message and the belief measurement, we may misidentify the message that caused the greatest change at equilibrium.

Chung and Colleagues (2008)

Chung et al. (2008) gathered data by having participants, who were university students,

respond via a computer mouse, indicating their view approximately every 77 milliseconds (ms). Each participant responded to two topics: criminal sentencing, a topic relatively low in ego-involvement for university students, and a tuition increase, a topic relatively high in ego-involvement for them. For both topics, message discrepancy (with 3 levels) and source credibility (with 2 levels) were manipulated, and eleven time points for each individual, spread out over each individual's trajectory, were analyzed. Participants were not limited in the time that they took to consider the message that they received. For the criminal-sentencing issue, participants took from 8.55 s to 146.92 s, with an average of 48.48 s; for the tuition issue, participants took from 3.93 s to 151.23 s, with an average of 48.46 s. The relationship of discrepancy and belief position was found to be monotonic and positive in three of the four combinations of topic by credibility; nonmonotonicity was found only in the condition with the low-credibility source and the low-involvement message.

These data allowed the simultaneous testing of both Laroche's model, which is static (i.e., it relates discrepancy to the equilibrium belief position), as well as the dynamic model from Kaplowitz et al. (1983; referred to in Chung et al., 2008, as the *single-push with friction model*). The dynamic single-push with friction model predicts that over-time (i.e., the x-axis is time, not discrepancy), belief trajectories are positive and decelerating, and that trajectories associated with different levels of source credibility and discrepancy do not cross each other. (The possibility of oscillation was not included in this model.)

An alternative model, a *push-with-pullback model*, was proposed to represent two different possible ways for counterarguing to have an effect: First, discrepancy is associated with subvocal counterarguments (Brock, 1967; see also Cook, 1969; Toy, 1982), which occur after the discrepant message has been considered. Second, the Spinozan procedure (Gilbert, Krull, & Malone, 1990) may suggest that the recipient of a discrepant message may first entertain it as true before rejecting it. Both these processes—the generation of counterarguments and the rejection of discrepant information—should take time. Therefore, if counterarguing or the Spinozan procedure apply, we should find that after being presented with a discrepant message, (1) the early part of the over-time belief trajectory should move in the direction advocated by the message, and (2) then, when counterarguments have been generated sufficiently, the movement of one's belief should be in the opposite direction. Therefore, the push-with-pullback model proposes a nonmonotonic relationship between time and belief change, making the push-with-pullback model an alternative to the single-push with friction model.

Based on the analysis of the over-time data, no evidence of nonmonotonicity was found, which supports the single-push-with friction model rather than the push-with-pullback model. However, cognitive responses did play a role in some of the study's outcomes: There is evidence that in some conditions, the effects of source and of discrepancy increased over time, which may be due to cognitive responses.

Although the study by Chung and colleagues is complex, it analyzed the questions about discrepancy we posed earlier, and it provided a tentative answer about the shape of the discrepancy-belief change relation: With high involvement, the curve is monotonic; with low involvement and a high-credibility source, the curve is monotonic; and with low involvement and a low-credibility source, the curve is nonmonotonic. Furthermore, over-time data were not consistent with the idea that strong counterarguments create a downturn in the over-time movement to equilibrium.

Auxiliary Issues

Discrepancy or Disconfirmation?

At this point we note something that should be obvious, at least in retrospect: In almost all

the investigations concerning discrepancy, and in all the ones included here, messages that were greatly discrepant were also greatly surprising. Consider Bochner and Insko's (1966) messages: Some of them argued for 4, 3, 2, 1, or even 0 hours of sleep per night as appropriate for the average young adult; these messages are clearly surprising. What's more, the level of surprise correlates with the level of discrepancy. In other words, these two variables were confounded, and for all we know it may have been the surprise value, rather than the level of discrepancy, that accounted for the results of the studies that have been reviewed here.

Kaplowitz and Fink (1991), discussed previously, labeled a message's surprise value as its *level of disconfirmation*; they conducted two experiments in which manipulated discrepancy and manipulated disconfirmation were orthogonal. The topic of both experiments was criminal sentencing. One dependent variable was the number of years of imprisonment respondents recommended for a convicted armed robber (P_1). The second dependent variable was the comparative evaluation of the robber: "How bad is Defendant X?" In Experiment 1, a third independent variable was focus of attention: Respondents were directed either to focus on the source (the judge) or the reasons given for the sentence. In Experiment 2, a third independent variable was the size of the sample of defendants (3 vs. 100) previously sentenced by the judge. These additional independent variables were associated with hypotheses designed to tease out the role of cognitive elaboration.

In both experiments, discrepancy was found to directly and positively affect P_1 (the person's position after the message) and not comparative evaluation, whereas disconfirmation was found to directly and negatively affect comparative evaluation and not directly affect (Experiment 1) or weakly and negatively affect (Experiment 2) P_1. The proportion of variance directly explained by discrepancy in predicting P_1 (about 30%) was much greater than the proportion of variance that disconfirmation directly explained in predicting comparative evaluation (about 4%). Finally, the "effects of comparative evaluation on position [P_1] appear to require substantial cognitive elaboration" (Kaplowitz & Fink, 1991, p. 191), although the effects due to discrepancy did not. This study clearly shows that it is discrepancy rather than disconfirmation that accounts for the effects on belief position. However, a second process also occurs: Disconfirmation affects the evaluation of the focal object. Furthermore, disconfirmation's effect on comparative evaluation "appears to require thinking about one's expectancy regarding the source and about the disconfirmation of that expectancy" (p. 205).

Social and Psychological Factors Examined Over Time

The research that has been presented to this point has dealt principally with psychological processes: the perceptions, thoughts, and other cognitive activities related to processing discrepant messages. (We note that emotions, which may play a role, have not been the focus of our discussion.) But implicit social processes are clearly entwined with the psychological ones. For one thing, every study cited involved humans interacting with humans, even if the experimenter merely gave out questionnaires in a classroom; that human-to-human interaction undoubtedly has some effect. Second, recall the two responses that Bochner and Insko (1966) described as "unavailable": arguing with the message source against the position of the message and obtaining social support. In responding to messages outside of the lab, both of these behaviors are clearly social and generally available (see Smith & Fink, 2010).

To incorporate potential social processes, Kaplowitz et al. (1986) conducted an experiment using panel data at two points in time. The study replicated Fink and colleagues (1983) research, which gathered data immediately after respondents read the messages: The 1986 study used the same topic (a tuition increase) at the same

university, and five of the experimental conditions appear in both the 1983 and 1986 studies. Kaplowitz et al. (1986) asked participants the same question, both immediately and four to eight days after the initial response, about the tuition increase that they (the participants) would propose. The second, later data gathering was disguised in several ways and seemed to be part of a different study. In addition, after the initial (time 1) data were collected, the participants were debriefed about the deception involved in that part of the study.

The time-1 results were essentially identical to Fink and colleagues' (1983) results: The rank order correlation of the means of the five conditions that were in common across these two studies was 1.00, and the Pearson correlation was .89. This replication was successful.

More important for our current discussion is what was found at time 2. There was a dramatic change in the relative effectiveness of the experimental conditions. The six time-1 conditions that had messages advocating a tuition increase of some amount (i.e., excluding a no-position control condition) were initially ordered (from most change to least change; E = extreme, M = moderate) *E/E* (i.e., two messages, the first and the second extremely discrepant), *E/M, M/M, M/E, E,* and *M.* At time 2, the messages formed two clusters: The most-change cluster consisted of messages in which the first or only message was *M;* the least-change cluster consisted of messages in which the first or only message was *E.* Note that the message that was most effective at time 1 became one of the least effective messages at time 2, and the message that was least effective at time 1 became one of the most effective at time 2.

Although the processes involved were not directly assessed, the data analysis allowed the authors to make a reasonable interpretation of what took place over time. Summarizing the relevant results (Kaplowitz et al., 1986, pp. 525–526):

- Forgetting affects the long-term effectiveness of messages.
- Recipients of the moderately discrepant message received more messages in the days between time 1 and time 2. These messages could be external (from others) or internal (based on the recipient's cognitive elaboration); furthermore, these messages supported a belief position that was greater than P_0.
- Recipients of the extremely discrepant message received messages in the days between time 1 and time 2 that supported a belief position that was less than P_0.
- The more discrepant message "was *either* remembered better *or* produced fewer delayed messages" (italics in original; pp. 525–526). There is reason to believe that the former explanation was more plausible.

In other words, over time, forgetting, thinking, and social processes—such as arguing with the communicator's position and seeking social support—changed the initial response and changed it dramatically. This study clearly shows that a complete understanding of discrepancy of beliefs requires data over longer times—at least several days—to understand the interplay of the cognitive and social processes that may be at work.

Remaining Questions and Future Research

Discrepancy and Oscillation

The first study that examined oscillation of beliefs and discrepancy has already been discussed: the study by Kaplowitz and colleagues (1983), which used a between-participants design. Since that study, oscillation studies have used within-participant designs, relying on participants making decisions between belief alternatives, such as whom to recommend for college admission (McGreevy, 1996; Wang, 1993; this research has been reviewed in Fink et al., 2002).

The relevance of oscillation for modeling discrepancy is clear: If different discrepant messages induce oscillations of different amplitudes or phases, conclusions about their relative effectiveness have a good chance of being incorrect.

If the process has not yet reached equilibrium, results reflect the belief that exists at the moment of measurement. For example, Chung and Fink (2008, based on McGreevy's, 1996, data) examined the number of belief changes induced by univalent versus mixed-valence messages. Using a computer mouse, participants continuously reported their belief while reading a message (message-receipt phase; average time = 126.41 s), and after receipt of the message, they continuously reported their belief while making their decision (postmessage phase; average time = 59.22 s). During the postmessage phase, the mixed-valence message was found to cause more changes in belief than did the univalent message, and these temporary beliefs could be mistaken for equilibrium values.

Future research needs to examine the trajectories and impacts of discrepant messages on oscillation. The current models of over-time effects have been only partially successful in capturing the processes at work.

Cognitive Responses, Cognitive Dissonance, and Discrepancy

Cognitive Responses

Related to the analysis of discrepancy and oscillation is the role of cognitive responses. When a trajectory of beliefs indicates oscillation, are there accompanying thoughts that are associated with that change? Given the findings of Chung and Fink (2008), it seems likely that that thinking is associated with oscillation. To further examine this question, research needs to be conducted that interrupts a participant to find what, if any, thoughts are being considered while the participant is moving the computer mouse—indicating a change in belief position—in one direction or another. It may be that cognitive responses direct the movement toward a new belief position, but it is also possible that the position, arrived at by some dynamic cognitive algebra (Anderson, 1974), forms the cognitive response. Himmelfarb (1974), supporting the linear discrepancy model (referring to it as information integration), raised this same issue with regard to apparent resistance effects in persuasion: "Resistance effects cannot simply be inferred from differences in the overall attitudinal response" (p. 413). The relationship between belief trajectories and cognitive responses needs to be determined.

The elaboration likelihood model (ELM; Petty & Cacioppo, 1986) suggests that "a given variable may play different roles in the persuasion process" (O'Keefe, 2002, p. 161). The roles that source credibility and discrepancy play in discrepancy models are not fully resolved. In the studies that have been reviewed, discrepancy appears to have induced central processing in some research and peripheral processing in other research. On one hand, it seems that discrepancy causes beliefs almost automatically, as if a response to a cognitive algebra mechanism: Note that Kaplowitz and Fink's (1991) finding that focus of attention (source vs. reasons) and alleged size of the behavioral sample on which the expectations of the source's position were based had little effect on the relation between discrepancy and P_1. On the other hand, the psychological-discrepancy-discounting model has a role for psychological discrepancy, which may seem to suggest elaboration and resistance could also be associated with levels of attention or other factors (Fink et al., 1983). In addition, a relationship between discrepancy and counterargument production has been found (e.g., Brock, 1967; Kaplowitz & Fink, 1995), but this relationship does not seem integral to the relationship between discrepancy and belief position. Research to clarify the role of cognitive elaboration in discrepancy processes would be valuable for formulating a more complete model of discrepancy and belief change.

Cognitive Dissonance

If, as Aronson et al. (1963) and Bochner and Insko (1966) proposed, dissonance is caused by receipt of discrepant messages, the stress or tension associated with dissonance should be present

after receipt of such messages, and greater discrepancy should cause greater dissonance. Furthermore, misattribution of stress should eliminate associated belief change (Drachman & Worchel, 1976; Fazio, Zanna, & Cooper, 1977; Pittman, 1975; Zanna & Cooper, 1974) as well as the oscillations that could indicate dissonance and regret (Walster, 1964). Research to clarify the role that dissonance plays in discrepancy is long overdue.

The analysis of social processes needs to be more carefully investigated. Long-term effects due to messages that differ in discrepancy need to incorporate the two "laboratory unavailable" responses to dissonance mentioned by Bochner and Insko (1966).

Involvement

Laroche's (1977) model included involvement as a key factor. Chung et al. (2008) used two topics that differed in level of involvement, and some important differences in model parameters between these topics were found; however, the topics differed in many unspecified ways, so that conclusions concerning the differences due to involvement must be tentative. Given the extensive research on and theory regarding involvement and belief change (e.g., Freedman, 1964; Johnson & Eagly, 1989) and given the intriguing findings in Chung et al. (2008) experimentally manipulating involvement seems to be a necessary next step to clarify its role in the discrepancy-belief change process.

Methodological Wish List

Measurement

The next steps in theory construction regarding discrepancy will benefit from significant improvements in methodology. The discrepancy models in the sciences, some of which were briefly mentioned earlier, rely on conventional, agreed-on measurement rules, which are lacking in belief-change research. Furthermore, the scales that form the basis for the International System of Units (ISU; meter, kilogram, second, ampere, kelvin, candela, and mole) all have a lower bound of zero and have, in principle, no upper bound (although in practice there may be an upper bound); other scientific quantities are defined in terms of these fundamental units. The need addressed here is not just to create more reliable measures but measures that have greater precision and that can be used to derive other measures within a specified theoretical framework (see Torgerson, 1958).

Following this logic of scientific measurement, Woelfel and Fink (1980) examined cultural and cognitive processes using distance (in their case, psychological and cultural distance), time, and related concepts to formulate theory. The study of discrepancy of beliefs, with discrepancy considered as a distance, can readily be studied using equations that are tied to fundamental measurements, such as those of distance and time. The recommendation here is to create and utilize a *system* of measures, rather than separate scales (typically measurement by fiat; Torgerson, 1958), that is tied to theory.

Dynamic Models and Longitudinal Designs

Dynamic models are best for explicating processes, which are typically written as mathematical equations. Longitudinal research designs (e.g., panel studies, time-series designs, pooled cross-sectional time-series designs) used to estimate dynamic models are generally not applied to the study of belief change, but they can be and should be; Chung and colleagues' (2008) work is an exception. To understand process, we must see it unfold over time. Static models can only get us so far.

Multidimensional Models

Finally, we note that a message can induce change in concepts that are unmentioned in the

message as well as change along dimensions other than the belief-position dimension. A multidimensional framework can examine both of these kinds of changes (see Dinauer & Fink, 2005; Woelfel & Fink, 1980). By focusing almost exclusively on belief position, we have not seen the whole picture, which a multidimensional analysis can provide.

Conclusion

Studying the effect of discrepant messages on belief change would have seemed, at the onset, to be an easy and straightforward task. After years of considering this issue, and after different researchers, theories, and models have been brought to bear on it, there have been advances with regard to the shape of the relationship, the factors that do and do not play a role, as well as the temporal parameters of the process. There are significant questions that remain, and, alas (or hooray!), more research is needed.

References

Anderson, N. H. (1974). Cognitive algebra: Integration theory applied to social attribution. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 7, pp. 1–101). New York, NY: Academic Press.

Anderson, N. H., & Hovland, C. (1957). The representation of order effects in communication research. In C. Hovland, W. Mandell, E. H. Campbell, T. Brock, A. S. Luchins, A. R. Cohen, et al. (Eds.), *The order of presentation in persuasion* (pp. 158–169). New Haven, CT: Yale University Press.

Aronson, E., Turner, J. A., & Carlsmith, J. M. (1963). Communicator credibility and communication discrepancy as determinants of opinion change. *Journal of Abnormal and Social Psychology, 67,* 31–36.

Bar-Meir, G. (2011). *Basics of fluid mechanics.* Chicago, IL: Bar-Meir. Retrieved from www.potto.org/FM/fluidMechanics.pdf

Berlo, D. K. (1960). *The process of communication.* New York, NY: Holt, Rinehart, & Winston.

Bochner, S., & Insko, C. A. (1966). Communicator discrepancy, source credibility, and opinion change. *Journal of Personality and Social Psychology, 4,* 614–621.

Brock, T. C. (1967). Communication discrepancy and intent to persuade as determinants of counterargument production. *Journal of Experimental Social Psychology, 3,* 296–309.

Chung, S., & Fink, E. L. (2008). The cognitive dynamics of beliefs: The effect of information on message processing. *Human Communication Research, 34,* 477–504.

Chung, S., Fink, E. L., & Kaplowitz, S. A. (2008). The comparative statics and dynamics of beliefs: The effect of message discrepancy and source credibility. *Communication Monographs, 75,* 158–189.

Cook, T. D. (1969). Competence, counterarguing, and attitude change. *Journal of Personality, 37,* 342–358.

Corman, S. R. (1996). Cellular automata as models of unintended consequences of organizational communication. In J. H. Watt & C. A. VanLear (Eds.), *Dynamic patterns in communication processes* (pp. 191–212). Thousand Oaks, CA: Sage.

Danes, J. E., Hunter, J. E., & Woelfel, J. (1978). Mass communication and belief change: A test of three mathematical models. *Human Communication Research, 4,* 243–252.

Dinauer, L. D., & Fink, E. L. (2005). Inter-attitude structure and attitude dynamics: A comparison of the hierarchical and Galileo spatial-linkage models. *Human Communication Research, 31,* 1–32.

Drachman, D., & Worchel, S. (1976). Misattribution of dissonance arousal as a means of dissonance reduction. *Sociometry, 39,* 53–59.

Eagly, A. H., & Chaiken, S. (1993). *The psychology of attitudes.* Fort Worth, TX: Harcourt, Brace, Jovanovich.

Eagly, A. H., & Telaak, K. (1972). Width of the latitude of acceptance as a determinant of attitude change. *Journal of Personality and Social Psychology, 23,* 388–397.

Edwards, K., & Smith, E. E. (1996). A disconfirmation bias in the evaluation of arguments. *Journal of Personality and Social Psychology, 71,* 5–24.

Eiser, J. R. (1994). Toward a dynamic conception of attitude consistency and change. In R. R. Vallacher & A. Nowak (Eds.), *Dynamical systems in social psychology* (pp. 197–218). New York, NY: Academic Press.

Fazio, R. H., Zanna, M. P., & Cooper, J. (1977). Dissonance and self-perception: An integrative view of each theory's proper domain of application. *Journal of Experimental Social Psychology, 13,* 464–479.

Festinger, L. (1957). *A theory of cognitive dissonance.* Evanston, IL: Row, Peterson.

Fink, E. L., & Kaplowitz, S. A. (1993). Oscillation in beliefs and cognitive networks. In G. A. Barnett & W. Richards (Eds.), *Progress in communication sciences* (Vol. 12, pp. 247–272). Norwood, NJ: Ablex.

Fink, E. L., Kaplowitz, S. A., & Bauer, C. L. (1983). Positional discrepancy, psychological discrepancy, and attitude change: Experimental tests of some mathematical models. *Communication Monographs, 50,* 413–430.

Fink, E. L., Kaplowitz, S. A., & Hubbard, S. E. (2002). Oscillation in beliefs and decisions. In J. P. Dillard & M. Pfau (Eds.), *The persuasion handbook: Theory and practice* (pp. 17–37). Thousand Oaks, CA: Sage.

Flay, B. R. (1978). Catastrophe theory in social psychology: Some applications to attitudes and social behavior. *Behavioral Science, 23,* 335–350.

Freedman, J. L. (1964). Involvement, discrepancy, and opinion change. *Journal of Abnormal and Social Psychology, 69,* 290–295.

Gilbert, D. T., Krull, D. S., & Malone, P. S. (1990). Unbelieving the unbelievable: Some problems with the rejection of false information. *Journal of Personality and Social Psychology, 59,* 601–613.

Himmelfarb, S. (1974). "Resistance" to persuasion induced by information integration. In S. Himmelfarb & A. H. Eagly (Eds.), *Readings in attitude change* (pp. 413–419). New York, NY: Wiley.

Hovland, C. I., & Weiss, W. (1951). The influence of source credibility on communication effectiveness. *Public Opinion Quarterly, 15,* 635–650.

Hunter, J. E., Levine, R. L., & Sayers, S. E. (1976). Attitude change in hierarchical belief systems and its relationship to persuasibility, dogmatism, and rigidity. *Human Communication Research, 3,* 299–324.

Jaccard, J. (1981). Towards theories of persuasion and belief change. *Journal of Personality and Social Psychology, 40,* 260–269.

Johnson, B. T., & Eagly, A. H. (1989). The effects of involvement on persuasion: A meta-analysis. *Psychological Bulletin, 106,* 290–314.

Kaplowitz, S. A., & Fink, E. L. (with Mulcrone, J., Atkin, D., & Dabil, S.). (1991). Disentangling the effects of discrepant and disconfirming information. *Social Psychology Quarterly, 54,* 191–207.

Kaplowitz, S. A., & Fink, E. L. (1995). [Message discrepancy, source credibility and the trajectories of attitude change]. Unpublished raw data.

Kaplowitz, S. A., & Fink, E. L. (1996). Cybernetics of attitudes and decisions. In J. Watt & C. A. Van Lear (Eds.), *Dynamic patterns in communication processes* (pp. 277–300). Thousand Oaks, CA: Sage.

Kaplowitz, S. A., & Fink, E. L. (1997). Message discrepancy and persuasion. In G. A. Barnett & F. J. Boster (Eds.), *Progress in communication sciences* (Vol. 13, pp. 75–106). Greenwich, CT: Ablex.

Kaplowitz, S. A., Fink, E. L., Armstrong, G. B., & Bauer, C. L. (1986). Message discrepancy and the persistence of attitude change: Implications of an information integration model. *Journal of Experimental Social Psychology, 22,* 507–530.

Kaplowitz, S. A., Fink, E. L., & Bauer, C. L. (1983). A dynamic model of the effect of discrepant information on unidimensional attitude change. *Behavioral Science, 28,* 233–250.

Knight, R. D. (2007). *Physics for scientists and engineers: A strategic approach* (2nd ed., Vol. 2). Boston, MA: Addison Wesley.

Laroche, M. (1977). A model of attitude change in groups following a persuasive communication: An attempt at formalizing research findings. *Behavioral Science, 22,* 246–257.

Latané, B., & Nowak, A. (1994). Attitudes as catastrophes: From dimensions to categories with increasing involvement. In R. R. Vallacher & A. Nowak (Eds.), *Dynamical systems in social psychology* (pp. 219–249). San Diego, CA: Academic Press.

Lave, C. A., & March, J. G. (1993). *An introduction to models in the social sciences.* Lanham, MD: University Press of America.

McGreevy, S. E. (1996). *Cognitive oscillations, need for closure, and the social influence process: The roles of cognition and motivation during decision making.* Unpublished doctoral dissertation, University of Maryland, College Park.

McGuire, W. J. (1985). Attitudes and attitude change. In G. Lindzey & E. Aronson (Eds.), *The handbook of social psychology* (3rd ed., Vol. 2, pp. 233–346). New York, NY: Random House.

Miller, N. (1965). Involvement and dogmatism as inhibitors of attitude change. *Journal of Experimental Social Psychology, 1,* 121–132.

O'Keefe, D. J. (2002). *Persuasion theory and research* (2nd ed.). Thousand Oaks, CA: Sage.

Pacanowsky, M. (1976). Salt passage research: The state of the art. *Journal of Communication, 26*(4), 31–36.

Petty, R. E., & Cacioppo, J. T. (1981). *Attitudes and persuasion: Classic and contemporary approaches.* Dubuque, IA: Wm. C. Brown.

Petty, R. E., & Cacioppo, J. T. (1986). *Communication and persuasion: Central and peripheral routes to attitude change.* New York, NY: Springer-Verlag.

Pittman, T. S. (1975). Attribution of arousal as a mediator in dissonance reduction. *Journal of Experimental Social Psychology, 11*, 53–63.

Saltiel, J., & Woelfel, J. (1975). Inertia in cognitive processes: The role of accumulated information in attitude change. *Human Communication Research, 1*, 333–344.

Shannon, C. E., & Weaver, W. (1949). *The mathematical theory of communication.* Urbana, NY: University of Illinois Press.

Sherif, C. W., & Sherif, M. (Eds.). (1967). *Attitude, ego-involvement, and change.* New York, NY: Wiley.

Sherif, C. W., Sherif, M., & Nebergall, G. (1965). *Attitude and attitude change: The social judgment-involvement approach.* Philadelphia, PA: Saunders.

Sherif, M., & Hovland, C. I. (1961). *Social judgment: Assimilation and contrast effects in communication and attitude change.* New Haven, CT: Yale University Press.

Smith, R. A., & Fink, E. L. (2010). Compliance dynamics within a simulated friendship network I: The effects of agency, tactic, and node centrality. *Human Communication Research, 36*, 232–260.

Torgerson, W. S. (1958). *Theory and methods of scaling.* New York, NY: Wiley.

Toy, D. (1982). Monitoring communication effects: A cognitive structure/cognitive response approach. *Journal of Consumer Research, 9*, 66–76.

Van der Maas, H. L. J., Kolstein, R., & van der Plight, J. (2003). Sudden transition in attitude. *Sociological Methods and Research, 32*, 125–152.

Walster, E. (1964). The temporal sequence of post-decision processes. In L. Festinger (Ed.), *Conflict, decision, and dissonance* (pp. 112–128). Stanford, CA: Stanford University Press.

Wang, M.-L. T. (1993). *The cognitive effects of stereotype modification.* Unpublished doctoral dissertation, University of Maryland, College Park.

Woelfel, J., & Fink, E. L. (1980). *The measurement of communication processes: Galileo theory and method.* New York, NY: Academic Press.

Zanna, M. P., & Cooper, J. (1974). Dissonance and the pill: An attributional approach to studying the arousal properties of dissonance. *Journal of Personality and Social Psychology, 29*, 703–709.

Zimbardo, P. G. (1960). Involvement and communication discrepancy as determinants of opinion conformity. *Journal of Abnormal and Social Psychology, 60*, 86–94.