A modified proportional change model of attitude change by group discussion

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Abstract

The data of two experiments of dyadic group discussion have been reanalysed. An extended proportional change model was designed to explain the actual process of attitude change. The model is defined by two parameters. The first represents the impact of single pro-arguments and single con-arguments on the attitude or decision preference. The second describes the resistance to further change that increases with the distance from the initial position. It was hypothesized that the first parameter should be higher and the second lower, with a similar partner than with a dissimilar one. The prediction was confirmed for the first parameter only. A comparison of the extended proportional change model to related models concludes the report.

INTRODUCTION

The impact of persuasive argumentation has been studied, with exceptions (Anderson, 1959; Hoffman and Maier, 1964), by measuring the attitude before confronting and after confronting the subject with the information in question. The usual way to test the difference between the various experimental conditions is an analysis of covariance, performed on the final preference scores and using the initial preference scores for covariate control. This approach, however, obviously prevents a deeper understanding of the persuasion process.

Being interested specifically in just that process a research group at the University of Augsburg designed a series of experiments on group discussion in which each participant in the discussion or observer of the discussion rated his attitude toward the discussed topic (decision alternative) continuously after each argument, thus generating a time series of preference.

The focus of interest was how emotional responses to the source of information affect the persuasion process. For this purpose the emotional response of the receiver of the message to the source of the message was varied experimentally either by making the subject believe his partner would have the same values or quite different ones, or by introducing a simulated partner, who answered the
subject's arguments with a friendly remark or an unfriendly one, before presenting the counterargument.

There are various methods of data analysis which take the whole set of repeated measures into account in some way or another. An analysis of variance of differences in trends can be applied if all variances and all correlations between the repeated measures are the same, i.e. if the variance–covariance matrices have compound symmetry (Winer, 1971, p. 533). However such is not the case with our data; as the length of time between the repeated measurements increases, the correlation decreases; further, the correlations are higher within the set of measures taken after the subject's own argument and within the set of measures taken after the opponent's arguments than are the correlations between the two sets of measurement.

To apply a multivariate analysis of variance to the set of repeated measures would be less objectionable, because it does not presuppose variance–covariance matrices with compound symmetry. Another choice would be to compute a correlation matrix over subjects for the whole set of repeated preference measures in order to determine the factor structure of this matrix; to calculate factor scores for each individual; and to apply multivariate analysis of variance on these factor scores. As the correlation matrix suggests (not shown here), four factors probably would have emerged: The preference measures taken after the early arguments loading high on one factor; the later ones loading high on a second factor; the preference scores after the subject's own arguments loading high on a third factor; and the preference scores after the opponent's arguments loading on a fourth factor. Obviously a multivariate analysis of variance of original repeated measures or of factor scores reveals more about the process of persuasion and how this process is modified by emotional responses than an analysis of the final scores alone.

A different approach was chosen by Schuler and Peltzer (1975). For each subject they calculated a nonparametric correlation coefficient, Kendall's $\tau$, between the time order of arguments and the series of preference scores assessed immediately after each argument. The correlation coefficients indicate the degree to which a person was influenced by the series of arguments, and they have been used by Peltzer and Schuler as the dependent variable on which they applied an analysis of variance.

While these methods use the whole set of repeated measures, they deal only with global effects of the process. What is needed is a model representing the process itself.

**THE PROCESS MODEL OF PROPORTIONAL CHANGE**

Among the various possible ways of formalizing this process of attitude change, an extended proportional change model seems especially to be useful. The purpose of this article is to show that the proportional change model (French, 1956; Anderson and Hovland, 1957), extended by including the distance between initial position and position at time $t$, is theoretically sound and empirically valid as a model of influence process in group discussion.

The original proportional change model (French, 1956; Anderson and Hovland, 1957) assumed that the amount of change produced by an argument is proportional to the distance between the attitude expressed through the arguments, and the attitude held by the recipient of the message. This assumption may have been adequate for an experimental situation in which many people holding inter-individually varying attitudes were exposed to just one discrepant message. However, if there is a longer series of arguments making a person abandon his initial position and move step by step towards the arguments' position, the situation is different. Subjective experience of members of the research team, interviews of experimental subjects, as well as results of previously performed experiments suggested a modification of the proportional distance model by taking into account that the resistance to further change may increase with the distance from the initial position. To predict the process of attitude change, the extended form of the model adds to the message discrepancy the distance of a person's initial stand and his stand at time $t$.

\begin{align*}
x_t - x_{t+1} &= b_1(x_t - s_t) + b_2(x_n, x_{t+1}) \\
2\Sigma X Z &= b_1\Sigma X^2 + b_2\Sigma X Y \\
2\Sigma Y Z &= b_1\Sigma Y X + b_2\Sigma Y^2
\end{align*}

A partial derivation results in the following equation for estimating the $b$-coefficients.

For simplifying the notation we define

\begin{align*}
x_t - x_{t+1} &= Z \\
x_t - s_t &= X \\
x_t - x_0 &= Y
\end{align*}

the model takes then the form

\[ Z = b_1X + b_2Y \]

(For theoretical reasons the model does not allow for an additive constant.)

For a least square solution the following function has to be minimized.

\[ (Z - b_1X - b_2Y)^2 = \min \]

A numerical example may be helpful in clarifying the psychological interpretation of the model. Assuming an eleven point preference scale with 0 as the lowest score and with 10 the highest score, the process of attitude change of a subject exchanging pro-arguments and con-arguments with his partner may be represented as a sequence of numbers over the time series $t = 0$ (starting position) to $t = 8$ (final position). The subject generates pro-arguments; the partner offers con-arguments. For simplicity of representation it may be assumed that each of the subject's arguments has the scale value of 9; i.e., strongly in favour of the issue, while each of the opponent's arguments is assumed to have the scale value of 1.
The least square estimates of the parameters are in this case $b_1 = 0.300$ and $b_2 = 0.035$.

The Equation 1 can be transformed into

$$x_{t+1} = (1 - b_2)x_t + b_1s_t - b_2(x_t - x_0)$$

From that it becomes clear that $b_1$ represents the average relative weight the subject puts on each argument in combining the scale value $x_t$ of his preference at time $t$ with the scale value $s_t$ of the respective argument to form a new preference $x_{t+1}$. Since $b_1$ and $b_2$ are partial regression coefficients, this interpretation implies holding constant the distance from the initial position $x_t - x_0$. The larger $b_1$, the larger are the steps of the subject moving forward and backward, with larger steps resulting from the more distant argument. The parameter $b_2$ is a kind of elasticity coefficient; the product $b_2(x_t - x_0)$ represents the forces that tend to pull the subject back to his initial position. The coefficient $b_2$ attenuates the effect of the opponent's argument and strengthens the effect of the subject's own arguments.

Exchanging pro-arguments and con-arguments each with constant scale value in a regular sequence must lead to an equilibrium state defined by (a) a specific equilibrium point somewhere between the person's initial position and the average scale value of the arguments, and (b) a span of oscillation around this point. The equilibrium point of an indefinitely long series of pro-arguments and con-arguments is equal to the average scale value of the arguments if the coefficient of resistance $b_2$ is zero. With $b_1$ increasing, the movement toward the equilibrium point becomes faster, and the oscillation span around this point becomes larger. With $b_2$ increasing, the equilibrium point is closer to the initial position of the subject. In terms of proportional changes within the equilibrium state, the relative width of the step forward is equal to the relative width of the step backward toward the initial position, is $b_2$ equals zero. As $b_2$ increases the proportional distance moved forward is smaller than the proportional distance moved backward.

In testing the validity of the model, all pro-arguments were set equal to 9, and all con-arguments were set equal to 1. However this does not exhaust the potential of the model. A still better fit of the model could be achieved either by (a) substituting these scale values by using empirically estimated values, or (b) weighting the arguments according to their persuasiveness.
ting and receiving a series of arguments selected from the set of pro-to neutral arguments, or neutral to con-arguments. The subject's task was to rate his decision preference after considering the arguments one by one. Thus each subject created a series of preference ratings following the regularly alternating exchange of pro-arguments and con-arguments.

Since the model rests on the assumption that the preferences are measured on an interval scale, we may take a closer look at the instructions and scale format. The subjects were asked to estimate the implicit overall weight of arguments supporting their position relative to the overall weight of arguments opposing their own position, and to indicate their preference on an 11-point graphic scale extending from 0:100 to 100:0, with 50:50 corresponding to the indifference point dividing pro-attitude from con-attitude. This instruction should prompt the subjects to consider carefully the pro-arguments and con-arguments while scaling their preferences. Although there were some persistent doubts concerning the level of measurement of this scale, we used it in all of our experiments in order to obtain comparable results.

Obviously, the graphic intervals do not correspond to the number ratios. Therefore, the subjects may have experienced some conflict concerning whether to use the graphic interval scale or the numerical ratio scale. If they really were able and willing to form a ratio of weights and to indicate this ratio on the scale, disregarding the graphic intervals, we were not able to rely on the graphic scale values in analyzing the preference change. Corresponding to a model that in psychophysics has proven useful (Stevens, 1975), an appropriate preference interval scale would have been

\[
\frac{X}{100 - X} \text{ rather than } \frac{X}{100 - X} \text{ or } 0 < X < 100.
\]

That we were right to base most of our data analyses on the graphic scale recently has been confirmed by Stehle (1977). He compared the scale of Figure 1 with a verbally anchored graphic scale finding them essentially equivalent. So we may assume that the graphic scale used here is a kind of interval scale.

The three factors of the experiment 1 (Peltzer and Schuler 1976) were similarity of the partner (manipulated by feeding back to the subject a value profile that was similar or dissimilar to his own); friendliness of the partner (a partner introducing most of his arguments with friendly or unfriendly remarks); and the order of arguments (the discussion opened by subject or partner).

Experiment 2 (Schuler and Peltzer, 1975) was designed to test the \( 2 \times 2 \times 2 \) combination of the partner's similarity, the partner's competence (a partner allegedly having reached a higher or lower score than the subject on a person perception test), and the expectation of a personal encounter in the near future.

We will restrict the reanalysis of the data to the main effect of similarity, which is common to both of the experiments. The questionnaire used for manipulating perceived similarity asked for attitudes towards central values not related to the decision problem. The effect on the partner's attractiveness proved to be rather strong.

### RESULTS

The hypotheses were tested by estimating the parameters of the model for each experimental condition and performing an analysis of variance with coefficients \( b_1 \) and \( b_2 \) as the dependent variables and with experimental conditions as the independent variable. As the within class correlations between \( b_1 \) and \( b_2 \) were close to zero in both experiments, we were able to apply separate univariate analyses of variance to \( b_1 \) and \( b_2 \).

It was necessary to exclude from the analysis 16 subjects (7 in the first experiment, and 9 in the second experiment) whose parameters \( b_1 \) and \( b_2 \) could not be estimated because their attitudes did not change. Also excluded were four subjects (two in each experiment) whose \( b_1 \)-coefficients were more than 3.5 standard deviations from the mean value. They might have misunderstood the instruction rating the convincingness of the arguments instead of indicating their decision preferences. Three subjects (two in the first experiment and one in the second) actually moved away steadily from their partner's position, although the estimates of the \( b_1 \)-coefficients turned out to be positive. The mean square of differences between empirical values and values estimated by the model was extremely high in these cases.

Analyses of three levels of aggregation were performed on individual preference series (aggregation level 1); on averaged preference series of randomly selected dyads sharing the same initial position (aggregation level 2); and on averaged preference series of all subjects sharing the same initial position (aggregation level 3). Such an averaging procedure was meant to reduce the error variance, although we were aware of possible systematic individual differences in responding to the pro-arguments and con-arguments. By comparing the three levels of aggregation we also may obtain some information about that problem.

The results for individual cases (aggregation level 1) are presented first; those for the averaged curves of dyads (aggregation level 2) are presented second; and those

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**Table 2. Subjects in experiment 1 and experiment 2**

<table>
<thead>
<tr>
<th></th>
<th>(a) Experiment 1</th>
<th></th>
<th>(b) Experiment 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>Similar</td>
<td>35</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Dissimilar</td>
<td>34</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

A: Number of reanalysed cases; B: Number of subjects without attitude change; C: Number of subjects whose \( b_1 \)-coefficient is more than 3.5 standard deviations above the mean; D: Number of subjects who steadily moved away from the partner's position showing an extremely poor fit of the data to the model.
for the averaged curve of all persons having the same initial position (aggregation level 3) are presented third.

**Analysis of data on aggregation level 1**

Both F-ratios were not significant, but performing a $2 \times 2$ (experiment by similarity) unweighted means analysis of variance resulted in a significant main effect for similarity ($F_{1.136} = 3.71; p < 0.05$, one-tailed). The sum of squares due to differences between experiments and experiment by similarity interaction was negligibly low, so it was combined with the error sum of squares. As predicted (hypothesis 1) the coefficient $b_1$ is higher with a similar partner than with a dissimilar one. The magnitude of the effect is rather low, since only 2 per cent of the variance ($\hat{\omega}^2 = 0.02$) are explained by similarity (Winer, 1971, S. 429).

Hypothesis 2 obviously has not been confirmed.

**Analysis of data of aggregation level 2**

Within each treatment combination (initial position × similarity × experiment) the subjects were grouped randomly into dyads, if there were an even number of subjects, or into dyads and one triad, if the number were odd. For each dyad or triad the series of preference scores were averaged. The two experiments had to be combined in a $2 \times 2$ analysis of variance (initial position × similarity), in order to have at least two observations in each cell.

Looking at the Tables 6(a) and 6(b) it can be seen that the subject's initial position had no influence at all on the $b_1$-coefficient; also there is no interaction between similarity and initial position. The effect of similarity was not significant, but one may notice that for every initial position the average value of $b_1$ was higher with a similar partner than with a dissimilar one.

As shown in Table 7 and contrary to hypotheses 2, there was also a tendency to higher $b_2$-coefficients with a similar partner than with a dissimilar one.
Analysis of data on aggregation level 3

On this aggregation level the preference series of all subjects sharing the same initial position within an experiment were averaged. Only those initial positions which existed in both experimental conditions (similar and dissimilar) were taken into consideration. This did not apply to extreme initial positions or to indifferent ones. That is the reason for the different number of analysed cases in Tables 4 and 5 as compared to Table 8. The number of subjects on which the average was taken varied from three to 16. For each averaged series of preferences the coefficients \( b_1 \) and \( b_2 \) were calculated (cf. Table 8).

Table 8. Averaged curves of all subjects sharing the same initial position

<table>
<thead>
<tr>
<th>Experiment 1</th>
<th>Experiment 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial n</td>
<td>b_1 b_2 n b_1 b_2</td>
</tr>
<tr>
<td>9</td>
<td>0.045 0.221 4 0.076 0.147 9</td>
</tr>
<tr>
<td>8</td>
<td>0.076 0.421 7 0.063 0.085 8</td>
</tr>
<tr>
<td>7</td>
<td>0.134 0.464 7 0.058 0.332 7</td>
</tr>
<tr>
<td>6</td>
<td>0.051 0.274 10 0.040 0.345 6</td>
</tr>
</tbody>
</table>

In seven conditions out of eight the \( b_1 \)-coefficient was higher with a similar partner than with a dissimilar one (the one-tailed probability under \( H_0 \) is for the binomial test \( p < 0.035 \)). The \( t \)-test for correlated observations (pairs matched according to initial position and experimental design) also was significant, (one-tailed, \( p < 0.05 \)). Corresponding to the results with individual cases and dyad averages, there was no significant difference in the \( b_2 \)-coefficient.

Comparison of the modified proportional change model with alternative models

The modified proportional change model (hence called model 3), was chosen for theoretical reasons. Does it fit the data at least as well as a simpler but theoretically less meaningful model, that may be called model 2?

\[ x_t - x_{t+1} = b(x_t - s_t) + a \]

The parameters of this model were estimated from the data on aggregation level 3 only (Tables 8 and 9).

Table 9. Parameters \( a \) and \( b \) of model 2 in experiment 1; aggregation level 3.

<table>
<thead>
<tr>
<th>Initial position</th>
<th>Similar</th>
<th>Dissimilar</th>
<th>Similar</th>
<th>Dissimilar</th>
</tr>
</thead>
<tbody>
<tr>
<td>n b</td>
<td>n b</td>
<td>n a</td>
<td>n a</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>0.043</td>
<td>4 0.071</td>
<td>5 -0.065</td>
<td>4 -0.052</td>
</tr>
<tr>
<td>8</td>
<td>0.095</td>
<td>7 0.058</td>
<td>16 -0.178</td>
<td>7 -0.008</td>
</tr>
<tr>
<td>7</td>
<td>0.163</td>
<td>7 0.072</td>
<td>11 -0.158</td>
<td>7 -0.070</td>
</tr>
<tr>
<td>6</td>
<td>0.057</td>
<td>10 0.050</td>
<td>3 -0.017</td>
<td>10 -0.050</td>
</tr>
</tbody>
</table>

\( n \), number of aggregated processes

Again as in model 3 the parameter \( b_1 \) was higher in seven conditions out of eight with a similar partner than with a dissimilar one. Contrary to what was expected, the parameter \( a \) was lower in six conditions.

It was also of some interest to see how the simple proportional change model (called model 1)

\[ x_t - x_{t+1} = b(x_t - s_t) \]

compared with model 3.

It was not surprising that the respective \( b \)-parameters of models 1 and 2 were of about the same size and differentiate in the same way between the similar–dissimilar conditions. However, a closer look at the goodness of fit of these models reveals some differences.

In order to compare the goodness of fit of the models, the estimated parameters of the three models were used in predicting the sequence of preferences, beginning with the initial position, but without taking into account the further empirical preference scores. The residual sum of squares was used as measure for goodness of fit. Table 12 presents this measure for each of the experimental conditions.

Table 11. Parameter \( b \) of model 1 in experiment 1 and 2

<table>
<thead>
<tr>
<th>Initial position</th>
<th>Similar</th>
<th>Dissimilar</th>
<th>Initial position</th>
<th>Similar</th>
<th>Dissimilar</th>
</tr>
</thead>
<tbody>
<tr>
<td>n b</td>
<td>n b</td>
<td>n a</td>
<td>n a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>0.035</td>
<td>0.065</td>
<td>9 0.109</td>
<td>0.055</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>0.077</td>
<td>0.058</td>
<td>8 0.078</td>
<td>0.055</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>0.155</td>
<td>0.066</td>
<td>7 0.107</td>
<td>0.035</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>0.057</td>
<td>0.049</td>
<td>6 0.064</td>
<td>0.037</td>
<td></td>
</tr>
</tbody>
</table>

\( n \), number of aggregated processes

The usual \( F \)-test for significance of a variable added to a regression equation was not applicable here, since the measures taken at time \( t \) were correlated with the measures taken at times \( t + 1, t + 2 \), etc. We know of no other significance test which could be applied here. The residual sums of squares therefore are purely descriptive. In addition to the numerical comparison of the parameters and the residual sum of squares of the three models the averaged time series of preferences estimated by the three models may be displayed graphically (Figure 2a, b).
Figure 2(a) Comparison of goodness of fit of the three models based on data of the aggregation level 3: experimental condition 'similar'. The aggregated time series of preference were averaged over the four initial positions and the two experiments. (b) Comparison of goodness of fit of the three models based on data of the aggregation level 3: experimental condition 'dissimilar'.
DISCUSSION

First a discussion of the results with comments on the comparison of the various models is presented, followed by an interpretation of the results of model 3.

Generally, models 2 and 3 seem to be superior to model 1. However, adding a parameter always improves the models fit to the data sample, even if there is no better fit to the data population. Although there is no way of testing the significance of the difference, it may be assumed that the improvement in goodness of fit from model 1 to model 2 and model 3 exceeded this chance effect. The obvious reason for the better fit of the models 2 and 3, compared to the model 1, is the fact that the former allow for some kind of accentuation of one alternative or the other. This becomes evident by rewriting the models in the following form:

model 1: \[ x_{t+1} = (1 - b)x_t + b s_t \]
model 2: \[ x_{t+1} = (1 - b)x_t + b s_t - a \]
model 3: \[ x_{t+1} = (1 - b_1 - b_2)x_t + b s_t + b s_0 \]

The possibility of stressing one side (with the additive constant \( a \), is a feature of model 2. A similar feature is found in model 3 with the term, \( b s_0 \), which also is an additive constant for each individual sequence of preferences. In addition model 3 has an affinity to the information integration models (Anderson, 1971; Anderson and Graesser, 1976). This becomes clear if we define

\[ 0 < b_1 < 1; \quad 0 < b_2 < 1; \quad 0 < b_1 + b_2 < 1 \]

\( x_{t+1} \) is then a weighted average of \( x_t, s_t \), and \( x_0 \). Actually all coefficients of the aggregation level 3 (Table 8) and most of those of aggregation level 2 and 1 (the means and standard deviation of the coefficients are shown in Tables 3, 5, 6, and 7) conform to these restrictions. But there remains a difference in the common averaging models, that is, the separation of \( x_t \) and \( x_0 \). A strict averaging process model would be what we may call model 4

\[ x_{t+1} = \left( w_o x_0 + \sum_{i=t}^j w_i s_i \right) / \left( w_o + \sum_{i=t}^j w_i \right) \]

\( w_o \) weight of initial preference
\( x_0 \) initial preference
\( x_{t+1} \) preference at time \( t+1 \)
\( w_i \) weight of the argument \( i \)
\( s_i \) scale value of the argument \( i \)
\( t \) time series

It is the separation of \( x_t \) from \( x_0 \) in model 3, which gives rise to the elasticity effect that is not present in model 4. Model 2 with its additive constant, \( a \), does not represent an averaging process of information integration. Looking for a psychological interpretation of the constant, \( a \), one could think of a plus or minus (depending on the sign of \( a \)) that is given to the partner for some reason, e.g., for his pleasant-unpleasant appearance or behaviour, or for the global attractiveness or popularity of his stand on the issue. One could relate independent measures of these variables to the coefficients, \( a \), in order to test the validity of such an interpretation, if one would be interested in analyzing this model in greater detail.

We take now a closer look at the fit of model 3. As shown in Table 2, the model was applicable in 138 cases out of 160. One especially would like to know how the three subjects in the condition 'dissimilar partner' who steadily moved away from the opponent's position (group D in Table 2) perceived the experimental situation. We may speculate that these subjects disliked their opponent so much that perceiving his stand and his demand prompted them to increase their distance from his position. If this were so, it would contradict the model, according to which change in both directions must be proportional to the distance of the subject's position, to the partner's, or to the subject's own argument, if the distance from the subject's present position to the subject's initial position is neglected.

An inspection of preference sequences on aggregation level 1 (individual cases) suggests that with some subjects the proportional change toward the position of the partner's arguments is different from the proportional change toward the position of the subject's own argument. The model's fit is poor in these cases. On the higher aggregation levels this difficulty disappears: pro-arguments and con-arguments elicit about the same proportional change.

There are nine cases with a negative \( b_2 \)-coefficient (two with a similar partner and seven with a dissimilar partner). These subjects obviously did not integrate the information of the arguments; rather, they answered the demand of the argument by a counter-reaction. The problem with these nine cases is not a poor fit to the model; actually on the average the residuals are not higher than those of the cases that show a positive \( b_2 \)-coefficient. It is rather the apparent absence of information integration that bothers us. Assuming that the influence of issue information would outweigh possible tendencies to withdraw from a dissimilar opponent we had expected smaller but nevertheless positive \( b_2 \)-coefficient in the dissimilar condition than in the similar one. It was this theoretical reasoning as well as a preference for simplicity that made us choose such a model. What is the meaning of a negative \( b_2 \)-coefficient? Since the \( b_2 \)-coefficient is the same for the distances in both directions, this kind of 'boomerang-effect' would follow the opponent's argument as well as the own argument. For all subjects in a position below 9 this would mean an alternating sequence of a rather big step away from the opponent's position following his argument and a small step back toward the own initial position following the own argument although the latter is assumed to be more extreme than the initial position. Consequently at the end of the discussion the subject's position is more extreme than at the beginning. An inspection of the averaged curve of the nine cases showing a negative \( b_2 \)-coefficient (not presented in the paper) suggests this interpretation: if a person answers the opponent's argument with a counter-reaction he tends to return to his initial position after the next own argument.

Another problem occured with those 13 subjects whose data give rise to a negative \( b_2 \)-coefficient. Contrary to the prediction, the resistance to further change decreased as the distance of the subject's position at time \( t \) relative to his initial position increased. Why does the behaviour of these subjects contradict the theory? In future experiments an extensive postexperimental interview could provide some hints about how to explain these individual differences.

The psychological interpretation of \( b_2 \) as a force pulling the subject back to the
initial position is also open to question. It is necessary to measure this tendency more directly. The increasing resistance to further change in the direction of the opponent's position could be explained in several ways:

1. The later arguments of the opponent are less convincing, (a) because they repeat information that already was comprised, at least in part, by the antecedent arguments; or (b) because the opponent selects the stronger arguments at the beginning of the discussion, leaving the weaker ones for the end.

2. The opponent, arguing stubbornly against the subject's position, increasingly is devalued; as a consequence, the subject increasingly becomes resistant to the opponent's demand. This may be true mainly with a similar partner, whose stubbornness seems especially to be frustrating to some of the subjects, as the changes from initial to final liking rating (not shown here) suggest. Actually, in the first experiment the $b_2$-coefficients tended to be higher with a similar partner than with a dissimilar one. In this experiment the effect of partner similarity was combined with partner friendliness. A similar but unfriendly partner persistently opposing the subject's view may be assumed to be especially disappointing to the subject. There are some hints in the data (not presented here) which support this post hoc hypothesis.

Summarizing the results of data analysis on aggregation level 1 we nevertheless can say that most of the individual preference-curves were represented by the model in an acceptable manner. When the discrepancy between estimated curve and empirical curve is large, the kind of deviation gives reference to potential explanations and further modifications of the model.

The analysis on aggregation levels 2 and 3 did not give much additional information. As expected, the averaged time series of preferences conformed well to the theory. On aggregation level 2 there were only three preference curves with negative $b_2$-coefficients, all in the condition 'dissimilar partner'.

It may well be that the model's validity is restricted to discussions dealing with topics that are not heavily loaded with value preferences, and where emotional reactions therefore are rather weak. In the case of a controversy on central values integrating information on the issue probably will be less salient than comparing the own position with the other's stand and reacting to his demand. The limits of the model will be tested by applying it to other kinds of decision problems.

Although the influence of partner similarity on the sequence of preferences was described more precisely by the extended proportional change model than by analysis of variance of global effects, there are, nevertheless, a lot of questions referring to the psychological interpretation of the change model and its implications which must be answered by future research. One way to a better understanding of the model will be to clarify the theoretical concepts and to develop valid measures of these explanatory concepts. This will be a difficult task, even if we restrict our search to the question of how social emotional responses modify the influence process in a group discussion.

What we need is to separate the different modes by which social emotional responses affect the perception of the other's stand, the other's demand, and the integration of the other's information on the issue transmitted by his arguments.

 Including a separate parameter for the opponent's attractiveness probably would improve the model's fit especially to those change processes than cannot be explained by concepts of information integration. Such a parameter could more clearly indicate how attractiveness affects the relevance of the other's stand for social comparison and the readiness to give in to his demand, besides the influence of information integration. The extended model could be formalized in the following way:

$$x_{i} - x_{i+1} = b_1(x_i - s) + b_2(x_i - s) + b_3 + v_i,$$

The variables $x_i, v_i$, and $s$ are defined as in model 3. In addition to these variables $v_i$ is to indicate the emotional value of the speaker at time $t$.

Looking for further theoretical clarification of the process of attitude change by group discussion, one may also reconsider the concepts and statements of the social judgment theory (Sherif and Hovland, 1961).

Referring to this theory, Whitaker (1967), assumed and presented some empirical evidence that the relation between communication discrepancy and the amount of change generated by the communication can be presented by an inverted U-shaped function, the amount of change first increasing, then decreasing with message discrepancy. We did not find such a function in our data. There was no main effect of extremity on the parameters of model 3 (cf. Tables 6 and 7). The data supported the prediction of proportional change. This means that the amount of change in absolute terms increased with message discrepancy. The theory behind this assumption has been criticized for the ambiguity of its central concepts, i.e., the latitude of acceptance, the latitude of rejection, and ego involvement (Rüttiger, 1974, 102–111; Irle, 1975, 288–294). Nevertheless, it may be worthwhile to include improved measures of these concepts in the future research.

Several experiments by Zaleska (1978) showed that subjects participating in an unrestricted group discussion were especially resistant to changing their position, if this position had a high frequency in the population in which the subjects belonged. It would be interesting to know whether this is also true if the discussion is restricted to an equal number of pro-arguments and con-arguments, the way our experiments were constructed. The extended proportional change model also is expected to be sensitive in testing such a hypothesis.

REFERENCES


**Behavioural style and group cohesiveness as sources of minority influence**

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**Abstract**

Behavioural style and group cohesiveness were tested as sources of minority influence under conditions in which rejection of the minority from the group was possible and under conditions in which it was not. Female subjects (N = 120) were led to believe that they were interacting as a group and that they held a majority position on a relevant issue. The influence agent, ostensibly one of the group members, advocated a minority position throughout their interaction. Three variables were manipulated: group cohesiveness (high or low), behavioural style of the deviate (high or low consistency) and opportunity for rejection of the deviate from the group (possible or not possible). It was predicted that the deviate would be more influential under high cohesiveness than under low cohesives conditions and that she would be most influential when she was highly consistent and there was no opportunity to reject her. Although both hypotheses were confirmed, unexpected minority influence effects were also found.

**Introduction**

Social influence research has been focused almost exclusively on one form of influence—conformity, the influence of the group on the individual and the majority on the minority (cf. Allen, 1965). Recent research on innovation, however, has turned the conformity question around and asked how individuals and active minorities can influence the majority (Moscovici, 1976; Moscovici and Faucheux, 1972; Moscovici and Nemeth, 1974). This new research has called into question previous models of social influence processes because they are seemingly unable to account for influence produced by relatively powerless minorities. By considering the minority influence research in light of traditional explanations of

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