A PATH ANALYSIS OF SOME PSYCHOLOGICAL VARIABLES ON VOTING BEHAVIOR

By

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Introduction

As sampling techniques became more and more refined through the forties and fifties, it became possible to study in detail the behavior of the individual American voter. The first modern study was a panel survey of residents of Erie County, Ohio, on the 1940 presidential election between Roosvelt and Wilkie. Each of 600 respondents was interviewed seven times between May and November in an attempt to measure changes in opinion as they happened, rather than as self-reports after the fact. The results were published in The People's Choice by Lazarsfeld, Berelson, and Gaudet (1948). A principal finding was that the campaign induced very little change. 69% of the respondents indicated the same voting intention (either Democrat, Republican, or undecided) throughout the survey, and only 5% changed their preference. The other 26% either became undecided, or started thus and later made up their minds (Lazarsfeld, et al. p. 102). These changes, what few there were, were also apparently little influenced by the mass media. For one, the amount of exposure to them by the respondents was fairly low; about half had not heard a speech nor read any newspaper or magazine messages concerning the campaign in its last busy days (Ibid., p. 121). Secondly, the campaign propaganda mostly reached those people most highly interested in the campaigns. Since these people tended to be the most highly partisan, the propaganda rarely reached those most vulnerable to it. So instead of the converting effect intended, the propaganda seemed mostly to reinforce preconceived notions and preferences. The phenomenon of selective exposure, by which people expose themselves more to those ideas which agree with their own than those that do not, was dramatically noticed (Ibid., pp. 82, 90).

The effects of individuals' social characteristics were first examined in this study as to their influence on the vote. Lazarsfeld and his colleagues created the Index of Political Predisposition (IPP) in order to categorize social differences. The Index recorded the responses to three variables: religion, social class, and residence (urban or rural). The maximum pro-Democratic predisposition was held by Catholic, working-class, urban residents; the maximum pro-Republican predispostion by Protestant, middle-class, rural residents. Individual voting behavior was closely associated with the results of the IPP. The proportion of respondents reporting a Democratic vote, at the 6 successive levels of the IPP were 83%, 70%, 56%, 39%, 27%, and 26%, respectively (Sears, in HSP vol. V, p. 317). Those individuals with politically contradictory predispositions, such as working-class Protestants, tended to vacillate in their preferences, making their choices relatively late in the campaign. They were described as being under "cross-pressures," and had markedly less interest in the election, paid less attention to the mass media, and were more dependent on personal influences than those respondents who stuck by early choices. The impression given by Lazarsfeld, et al. is that if these cross-pressured individuals voted at all, and there was a tendency for them not to do so, they did so randomly.

The same research group also performed a panel study of the 1948 presidential contest (Dewey - Truman) in Elmira, N. Y. (Berelson, Lazarsfeld, and McPhee, 1954). The analysis was in many ways more thorough than the previous study. With the central finding of the Erie study that voting is a highly partisan, fixed, social phenomenon, the researchers set out to determine how specific groups acted in election campaigns. The panel design was retained, although the number of interviews was decreased, and the analysis of the media sharply curtailed. Greater attention was paid to organized group life in the community -- activities of political parties, unions, families and voluntary associations. The 1948 findings were quite compatible with the 1940 findings. Among them were the following: 1. The higher the SES (socio-economic status), the more Republican the vote. 2. Protestants vote more Republican than Catholics. 3. Members of voluntary associations vote more Republican than non-members. 4. Most families are homogeneous in candidate choice. 5. The timing of the decision of candidate choice is variable: Low interest or high cross-pressure delay the decision. Curiously, Republicans decide earlier than Democrats, and they also turn out more regularly. 6. Political interest and activity vary directly with SES, level of education, and age, and inversely with amount and salience of cross-pressure. 7. The greater the amount of self-exposure to communication, the less the indecisiveness on political issues. 8. The majority of voters have chosen their preference by the end of the conventions, but most who have not shift in the direction of the prevailing vote in their social context. 9. Most voters disagreed with their party's nominee on at least one important issue.

Elmira, at least in 1948, was a community exhibiting substantial cleavage along class, ethnic, and political lines. The 1948 campaigns tended to increase a homogeneity of political attitudes within groups which was already salient before the candidates were nominated. The use, therefore, of demographic predictors of voting behavior has the disadvantage of potential variability in partisan implications over both time and region. In fact, when applied to national samples in both 1944 and 1948, the associations were not nearly so strong (Janowitz and Miller, 1952). The U. S. has never shown the clear SES distinctions in voting that mark many European nations, and different elections will tend to increase or decrease the saliency of one or more of the dimensions depending on their saliencies in the various campaigns. The 1960 Nixon-Kennedy race is a good example on this religious dimension.

Beginning in 1948 and continuing today, has come a great body of literature on voting behavior from the Survey Research Center at the University of Michigan. One of the questions on a 1948 Michigan survey asked respondents for their candidate preference in the Dewey - Truman race. After the election, the researchers culled through their data and found them at variance with the now infamous 1948 Gallup Poll, but substantially more correct. This success led to the gathering of nationwide data on all congressional and presidential contests since 1952. The Michigan theoretical basis was different from that of the Lazarsfeld group. Lazarsfeld was looking for an objective, vote-predictive instrument, such as the IPP, whereas the Michigan people denied its utility, especially considering the rare but not unpredictable radical shifts in voting patterns, in favor of a field theoretical approach emphasizing the indirect effects of social-psychological variables. They viewed the voting decision as a transformation of all possible inputs to the voting decision into specifically partisan attitudes, favoring one side or the other, which act as the field forces which eventually result in the propulsion of the individual to one partisan camp or the other.

The first study to employ a national sample, for the 1952 presidential election, examined three dimensions: party identification, issue orientation, and candidate orientation. The items used to measure these variables have been re-used in many subsequent surveys, including the one analysed in this paper. Party identification, "the sense of personal attachment which the individual feels toward the party of his choice" (Campbell, Gurin and Miller, 1954, pp 88-89), was measured with the following question: "Generally speaking, do you usually think of yourself as a Republican, a Democrat, an Independent, or what?" If the response was either of the two parties, the subsequent question was "Do you consider yourself a strong Democrat (Republican) or a not very strong Democrat (Republican)?" If the response was "Independent," the further probe was "Do you think of yourself as closer to the Republican or Democratic party, or neither?" A seven-point scale is thus extracted: Strong or weak identifier with either party, independent leaning toward either party, or truly independent. This measure correlated highly with the 1952 presidential vote. Its validity is further enhanced by more reports from "strong" party identifiers that they would readily support candidates from their own party whom they personally disagreed with on any number of issues than from "weak" identifiers or independents. The strong party identifiers also reported voting straight tickets more often, and had greater recall of past, especially their first, vote. (Ibid., pp 97-107).

Issue orientation was measured on two dimensions. "Issue partisanship" was defined as the extent to which a respondent took a consistent party line (Democrat or Republican) on four selected items, and the extent to which he perceived the policy difference between the two parties. Thus, a person who took the same policy positions as the

Democratic Party and who was aware of the differences between the parties on these issues would be classified as a strongly Democratic-issue partisan. If neither side were consistently favored or if party differences were not discriminated or incorrectly judged, he would be a weak (one side or the other) issue partisan. The second dimension, "extent of issue orientation," combined sensitivity to the party differences with the number of issues that the respondent had opinions about. A high rating implied a great deal of opinionation; a low rating, relatively few stands on partisan issues. Both of these dimensions correlated highly with 1952 candidate choice. However, a problem in reviewing the study is that almost all of the data are presented in percentage-table form. The correlations are thus never computed, but they do tend to stare you in the face.

Candidate orientation, the respondents' attitudes about specific candidates, was also measured on two dimensions: "partisanship" -- the extent to which comments about the candidates favored one over the other, and "orientation" -- based on the differential number of positive or negative statements made about each candidate. Both of these dimensions were also found strongly related to candidate choice. This study interpretted these dimensions as motivation activators. If a high degree of consistency was observed among them, a fairly strong prediction, in terms of precentage of respondents, could be made regarding candidate preference. If inconsistency or ambiguity were observed, no prediction could be made, and vacillation, late decision, or split-ticket voting would be inferred.

Campbell and Stokes (1959) refined this analysis by, among other things, determining the numerical correlations involved among these various dimensions with candidate choice. Party indentification was found to correlate +0.59 with candidate preference, and equally as important, the addition of all the other dimensions to the correlational, analysis accounted for only 11% more of the variance (multiple R = 0.68). Other high correlations were shown due to their associations with party identification, since the partial correlations, computed when all other variables including party ID, of these other dimensions with candidate choice were all greatly reduced. Thus, party identification was found to be far and away the most important determinant of voting behavior. This was found across all levels of time of decision and affect, that is, how much the respondent cared about the election or its outcome, and across all levels of educational attainment. The only group for whom party ID did not have significant predictive value were those individuals who decided at the last minute, and their choices did not correlate on any of the above dimensions. The significance of this data should not be be underestimated, as 1952 was a year marked by substantial party defection.

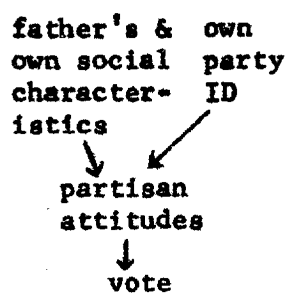
In another important Survey Research Center study (Campbell, et al., 1960), open-ended questions were employed, for example "Is there anything in particular that you like (don't like) about the Democratic (Republican) Party? What is that?" The same dimensions were again extracted, but the procedure here involved scoring the responses to these questions on the number of references to particular candidates, the differences in number of pro- one or the other party comments, etc., for a national sample in the 1956 presidential contest. The multiple correlation of all the dimensions on candidate preference was a very significant +0.71. 86% of those respondents with highly consistent ratings across dimensions made the predicted candidate selection.

Consistent with earlier findings, partisan attitudes were again found to be strong and stable predictors of the vote (multiple R = .79 for the 1956 election, .80 for the 1952 election) if the respondent had decided on his vote relatively far in advance of the election, but a relatively weak predictor (R = .27, for 1956, .29 for 1952) if the decision were made "within a few weeks of the election" (Campbell, et al., p. 79). Thus, party identification is seen not just as one of many partisan attitudes, as was originally suspected by the Michigan group, but as an antecedent of, and possibly an organizational mechanism for, voting behavior.

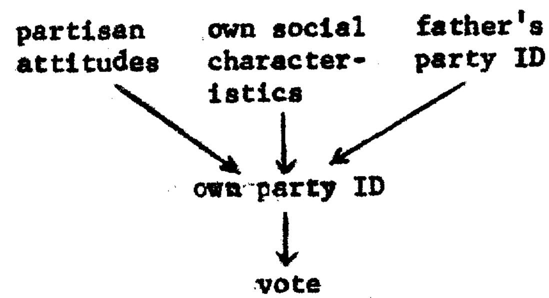
The test of causal influence is made with the technique of multiple regression analysis. Different (linear) models of causality or temporal ordering are posed, and the partial correlations implied are determined for each model. Because a model which does not include all possible links between dimensions (which would hardly clarify the situation) turns out to be algebraically over-specified, predicted correlations can be computed, and matched with those found in the data to test the goodness of fit of the specified model. The specification of linearity of regressor variables and causal inference make this technique isomorphic with Sewall Wright's original definition of path analysis (Borgatta, p. 5). As this technique is extensively employed in this paper, further explanation shall be left to the "Method" section.

Goldberg (1966) applied this technique to much of the data collected by the Michigan group, in order to examine three different models. These models are most easily visualized pictorially:

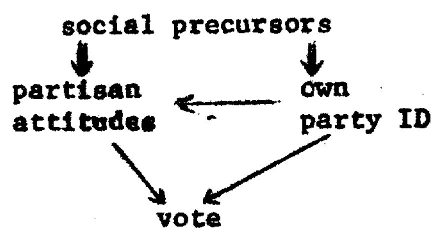
Model 1



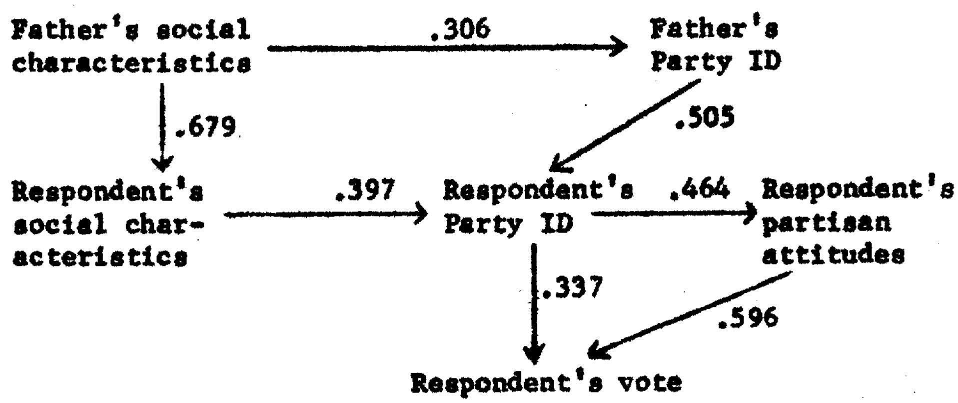
Model 2



Model 3



Model 1, the theory posed in the introductory chapter of The American Voter, is interpreted as the "attitude field taken to be the result of two causal streams, one consisting in the sociological conditioning of childhood and adult life, and the other consisting in affective conditioning to the party label" (Goldberg, p. 915). The prime shortcoming of this model is the absence of a direct link between party ID and vote, a significant finding of the Michigan surveys. In model 2, party ID is the final mediating variable, but the numerous inputs suggest necessary variation in party identification due to changes in partisan attitudes, an instability also not born out by the data. Model 3, in which the vote is a function of party ID and partisan attitudes directly, and all other factors indirectly (with these attitudes also a function of party ID), is the most theoretically satisfactory of the three, although it does not allow for the influence of the partisan attitudes on party identification -- that is party defections or re-alignments, however rare they may be. The most significant implication of this model is the indirect effect of everything but party ID and partisan attitudes on the vote. This model emphasizes the role of political socialization in effecting stable political loyalties over the translation of social characteristics into candidate choise inferred by the Lazarsfeld research. The complete model, whatever its merits and shortcomings, accounts for approximately 50% of the observed variance in candidate preference, an impressive result. All coefficients below are significant beyond the .01 level.



(From Goldberg, 1966)

Goldberg, however, only deals with sociological and demographic variables in his path analysis. The possible influence of the individual's psychological make-up - his feelings - is thus not considered. In this paper, however, some of these variables are examined. The effects of four personality variables: political alienation, locus of control, ego satisfaction, and trust; and two measures of status satisfaction: expected mobility and social prestige, are determined on subsequent political decisions. These variables index the individual's general feelings - his perceived personal power, his satisfactions and malaises. They were chosen specifically because the survey under discussion, not intentionally designed for this sort of analysis, did not contain any others. These variables are further detailed in the "procedure" section.

The technique of path analysis, while familiar to sociologists and geneticists, is less well known in experimental social psychological circles. The ancient art (it dates from the 20's) has been revived, and shall be explained in detail, for use in the analysis of a 1972 election survey. Specifically, it shall be applied to examine the effects, or to be more theoretically precise, the predictive value, of personality and status satisfaction as measured in the survey, on candidate choice in the 1972 presidential election. There are two important reasons for doing so. 1. The voting behavior research, since its inception, has completely ignored personality variables in its various surveys. 2. The importance of personality variables is theoretically justifiable in a voting behavior model, either as so-called "exogenous variables" (the uncaused causes in a path diagram) or as mediators of demographic variables, such as SES, on party identification, personal ideology and candidate choice. As such, they would be the salient expressions of the individual's social state, such as feelings of alienation or misanthropy, which would then actively influence his political decisions.

No specific directional effects were hypothesized. All possible psychological measures written into the survey were analyzed, since this research was intended to be basically exploratory in nature. If definite trends are noted, the implications of these trends should be followed up with studies better designed for this kind of analysis. It was considered inportant to find out if a largely unexplored area in voting behavior, the effects of psychological dimensions, indeed deserves this back-seat status.

Notice that the models are accepted or rejected on their empirical, rather than mathematical, merits. Path analysis cannot choose one model over another; it can only determine the significance (or non-significance) of any particular variables in the final structural equation predicted by the model, from which inferences can be drawn as to the model's theoretical validity. Since the significance of a variable in the structural equation is tested against the hypothesis that its coefficient is zero, non-significance implies that the variable is effectively dropped from the equation, and thus from the model. But is is the theoretical implication of this result which must be weighed in deciding whether the model should be accepted or rejected.

Path analysis is a fairly simple technique whose results, unlike many statistical manipulations, are easily visualizable. Its application can show the relative effects of the variables in a given model on each other, and thus demonstrate whether observed correlations can be explained by direct effects (causation), indirect effects, associations, or spuriousness (due to effects from a common cause). It is equally possible to sort out direct effects when no significant correlations are observed because of the operation of so-called "suppressor" variables.

Method

Path analysis is a linear multiple regression technique. That is, a given dependent variable is fit to the best n-dimensional straight line, where this dependent variable is a function of n independent variables. It is done in the following manner (for the detailed mathematics, see Appendix 1):

Some variables are chosen, the causes of whose variance are not considered. These are "exogenous" variables - "givens" in the problem. The rest, "endogenous" variables have their variance totally explained by other variables in the system. Thus, "residuals," error terms, must be postulated in order to explain all the variance in any endogenous variable. If they are not, each endogenous variable would have to be an exact linear function of some combination of endogenous and exogenous variables.

Path coeffecients are simply the beta-weights of each standardized independent variable. They thus represent the direct effects of each independent variable on the dependent variable in the equation from which they derive. Each of these equations is call a "structural equation" and one must be written for each endogenous variable.under consideration. Each structural equation will contain one or more residual, since the variance of each endogenous variable must be totally accounted for.

When a path diagram for a given model is drawn, straight single-headed arrows represent direct effects; curved double-headed arrows represent correlations among exogenous variables. When testing the model, it cannot be assumed that only the <u>postulated</u> direct effects occur. The structural equation for a model must contain all possible direct effects. When the data are inserted, whether one or more of these effects is significantly different from zero can be tested. If a significant difference is not obtained for a particular effect (path coefficient), it is not signifcantly (at what ever level is chosen) non-zero, the variable is therefore dropped (since its coefficient is zero) from the corresponding equation, and the arrow for this particular direct effect can be erased from the model.

Of course, such a test can only be performed if a given model yields exactly as many different structural equations as unknowns - path coefficients and correlations among residuals. (Simple correlations between variables are known from the data.) Then, the equations will produce unique solutions for the unknowns, and the hypothesis that some coefficient is zero for a significance test will add an equation (or subtract an unknown) and over specify the model. This overspecification can then be solved in terms of known simple correlations, and the accuracy of this result determined. However, because a model must specify all possible paths, it is never the case that there are as many paths as unknowns. (In fact, as new variables are inserted in a model, the number of paths will increase geometrically.) The problem is solved by assuming as many correlations among residuals to be zero as is necessary to reduce the number of unknowns to the number of equations, but not too many as to overspecify the model to begin with. This is referred to as an "assumption of uncorrelated errors."

By comparing the final result from this process with the simple correlations computed, one of four possible interpretations is possible for a given correlation: 1. It is due to a <u>direct effect</u>. If the path coefficient and simple correlation are nearly equal (the effects of residuals make exactness almost impossible). The correlation is the result of the direct effect of one variable on the other. This usually implies causation, but this must be justified theoretically. 2. It is due to an *indirect effect* of a mediating variable. This is true if the product of the coefficients of the paths to and from the mediator approximate the simple correlation between the two variables (which neglects the mediator). 3. It is due to the *effects of association*. This is mathematically identical to 2, except here both the mediating variable and one of the variables in the simple correlations are exogenous variables. Thus the "mediator" contributes to the simple correlation depending on its association (correlation) with the other exogenous variable under discussion. 4. It is due to a *spurious correlation*. This occurs when the two correlated variables are found directly effected by the same 3rd variable. The correlation is thus explained by this incidental association with the same variable, and is not indicative of any causal link. These four ways variables may be associated (in additive models - there are no interaction effects) cam be summed up pictorially. The thick arrows indicate the correlations under explanation:

1. direct effect: $x \Rightarrow y$

2. indirect effect:

$$\begin{tikzcd} & y \arrow[dr] & \\ x \arrow[ur] \arrow[rr, Rightarrow] & & z \end{tikzcd}$$

3. associative effect $\begin{tikzcd}[row sep=small, column sep=small] y \arrow[dr] \arrow[dd, bend right, leftrightarrow] & \\ & z \\ x \arrow[ur, Rightarrow] & \end{tikzcd}$

4. spurious correlation: $\begin{tikzcd}[row sep=small, column sep=small] & y \arrow[dd, Rightarrow] \\ x \arrow[ur] \arrow[dr] & \\ & z \end{tikzcd}$

When the insignificant paths are dropped from the model, and the simple correlations are interpreted from these paths, the model's empirical validity can then be determined. If the paths are all theoretically justified, then the data fit the model. Further, if the effects due to residuals are small, the model will have predictive value, since the contributions of arrors to the total variance will be small. A measure of this predictive value, the coefficient of determination (R^2), is readily computable from the values of the various path coefficients (see Appendix 1 for the mathematics).

Procedure

13 variables were culled from 27 questions of 168 asked in hour-long interviews with 841 people throughout the state of Wisconsin in a survey conducted immediately after the 1972 presidential election by the Wisconsin Survey Research Laboratory. These variables were then submitted to a path analysis in various combinations to examine the effects specifically of psychological variables as they influenced political ideology and reported candidate choice in the November, 1972 contest. The variables fall into four categories: Personality variables, social perceptions, SES variables, and political decisions.

Personality variables are measures of specific personal perceptions in the respondents' lives. The six statements

15. People like me don't have much say about what the government does.
16. Sometimes politics and government seem so complicated that a person like me can't really understand what's going on.
17. I don't think public officials care much what people like me think.
148. It isn't so important to vote when you know your party doesn't have any chance to win.
149. A good many local elections aren't important enough to bother with.
150. So many other people vote in the national elections that it doesn't matter much to me whether I vote or not.

could be agreed or disagreed with on a seven-point scale. An average of the scores on these six statements was taken as a measure of political alienation, assumed generalizable to some extent to other affect areas. The responses on each statement intercorrelated with all the others at the .20 level or better. If taken in two groups of three, the within group intercorrelations averaged .35 for the first, and .53 for the second. Originally, the first group was used as a measure of "political efficacy" in a Michigan study (Campbell, Gurin, and Miller, app. B). The second set derive from the same source as measuring "sense of duty to vote." Both were found significant predictors of voter turnout and sense of identity with the American political system (Ibid., pp 187-199, Dennis [1970] p 824). Finifter, in a Ph.D. thesis on political alienation, uses the above statements, and others, as measures of alienaion in a study of the predictive effects of political involvement on voting behavior. In this paper, the alienation measure from the above statements was examined with respect to candidate choice and political ideology. A very low average on the statements, signifying basic agreement with them, implies a highly salient sense of alienation from, or powerlessness in, the political process. A high average, basic disagreement, implies highly salient identity with, or perception of individual power in, the political system.

The three statements

71. Becoming a success is a matter of hard work; luck has little or nothing to do with it.

72. Many times I feel I have little influence over the things that happen to me.

73. There will always be wars, no matter how hard people try to prevent them.

again scored for agreement-disagreement on a seven-point scale, were taken from the Rotter Internal-External Scale, and measure locus of control, that is, the extent to which a person perceives himself as either his own master (total internal control, basic disagreement with the statements, a high average) or the pawn of forces beyond his control (total external control, basic agreement, a low average of the three items). There were two more Rotter items on the questionnaire, but they hardly intercorrelated with the others at all, all r's less than .10. The intercorrelations among the three chosen were surprisingly low for a standard psychological battery, averaging around .16.

The questions

55. Generally speaking, would you say that most people can be trusted, or that you can't be too careful in dealing with most people?

56. Would you say that most of the time, people try to be helpful, or that they are mostly just looking out for themselves?

57. Do you think that most people would try to take advantage of you if they got the chance, or would they try to be fair?

with permissible responses positive, negative, or don't know, derive from the Morris Misanthropy Scale (in Robinson, Measurement of Social

Psychological Attitudes) and measure trust in people. The three items were added, with "don't know" coded as zero, a trusting response -1, and a mistrusting response +1, forming a seven-point range in which a low score indicates a relatively great trust in people, and a high score relative mistrust.

The following three measures take the difference between responses to questions. This was done in order to achieve relative scores - comparisons by the individual with other people or other times. The absolute scores ~~will~~ be seen to be meaningless unless anchored with a comparison perception. The 1st of the following measures defines ego satisfaction - how the respondent feels he is doing, in general, with respect to those persons with whom he must often compares himself. How the individual feels is dependent on the comparison with his reference group. The next two measures have to do with status satisfactions rather than personal satisfactions. They concern comparisons in the entire community as opposed to specific individuals. It is assumed that these comparisons are indicative of the individual's true status in the community, although objective data to test this were not gathered on the survey. A measure of expected mobility indicates the amount and direction the individual's life, in general, has moved over a decade, and an index of prestige gives the difference between the amount of prestige a respondent feels he has and what he feels it ought to be. These three measures derive from questions inserted by Berkowitz and Dennis specifically for this survey.

Question 47, "Here is a picture of a ladder (with 10 rungs). Suppose we say that the top of the ladder represents the best possible life for you and the bottom represents the worst possible life for you. Where on the ladder do you feel you personally stand at the present time?" minus question 51, "Thinking of each of these kinds of people you most often compare yourself with (just asked in question 50), how good is the life most of the persons in each group lead in America today...use the ladder again to rate each group." was taken as the measure of ego satisfaction. Only the first response to question 51 was employed in the computation, since it was a rare respondent who came up with two responses to the question. A negative score on this dimension indicates a relative deprivation, a positive score relative gratification.

Question 49, "Where on the ladder (referring to the same ladder as in Q. 47) do you think you will be five years from now?" minus question 48, "Where on the ladder would you say you stood five years ago?" will measure expected total mobility in life over a ten-year period. Unfortunately, the survey did not include any questions with which to anchor this perception, such as in differential earnings or status over the decade 1962 to 1972. However, these questions ask about a best or worst "life" in general, so a correlation with the common indicators of social mobility will be assumed, since these are generally important in people's lives.

Question 85, "Where on the social presitge ladder do you think people like you ought to be?" minus question 84, "As you know, many people think that some groups have more social prestige than others. Let's look at the ladder again....Where on the social prestige ladder do you think most persons would place people like yourself?" indexed

<u>relative social prestige</u>, where a negative score is a prestige deprivation, and a positive score a prestige enhancement. This measure is probably correlated with general level of status in the community, since prestige is often interpreted in that sense, but again, there was no anchoring question available in the survey with which to correlate these perceptions.

<u>SES variables</u> measure differences in socio-economic status. <u>Social class</u> was extracted from

> 86. As you know, there's been some talk these days about different social classes. People often say that they belong either to the upper class, the middle class, working class, or lower class. Do you ever think of yourself as belonging in one of these classes?
>
> If "yes" response,
>
> 86a. Which one?
>
> If "depends" or "no" response,
>
> 86f. Well, if you had to make a choice, which one of these classes would you say you belonged to?

The classes were coded, from high to low, 1 through 4. Since path analysis is a regression technique, interval data are necessary. (This coding, and some that follow, may be a questionable interval scale, but I defend them as certainly close enough to reflect any effects present, although I will concede errors in the exact numbers.) <u>Level of education</u> comes from question 154, "What is the highest grade of school or year of college that you finished?" Where unspecified, a Ph.D. was assumed to have completed five years of post-graduate training, and a MA or MS two years. The coding was in years of schooling. Level of income is measured from question 168, "Just roughly, what was your total family income in 1971....considering all sources such as rents, wages, interest, and so on? (SHOW CARD 13)" Card 13 contained 13 categories for income placement, beginning with "A. Under $4000" and continuing by thousands through "H. $10,000 - 10,999." Then they progress by 3000's to the last possibility, "M. $25,000 or over." The coding of this question into interval data was done in 1000's of dollars per year from the initial amount in each category. An "A" response was assumed to be $3000/year, as it is difficult (speaking from experience) to live on much less.

The political decision variables rate the respondents' perception of political phenomena as they relate to him and those close to him. Respondent's ideology derives directly from

> 137. We hear a lot of talk these days about liberals and conservatives. I'm going to show you a seven-point scale, on which the political philosophies that people might hold are arranged from extremely liberal to extremely conservative. If you can, where would you place yourself on this scale?

Respondent's primary group's ideology, a measure of the ideology of those people closest to the respondent, was impossible to obtain for all possible members of this group in this survey. Question 145 "(Where would you place) most of your closest friends (on the same scale)" was adopted for this purpose as inclusive of enough individuals important to the respondent to adequately determine the ideology of his primary group. Party identification was measured (see Introduction), forming the identical seven-point scale. Reported candidate choice could be either Schmitz (American Party), Nixon (Republican Party), McGovern (Democratic Party), or "other," which was assumed to mean Spock (Peace and Freedom Party) or others to the left of him, such as Hall (Socialist Workers Party), a total of four codable responses. There was no measure on the survey of where, on an ideology scale, the respondent would place all these gentlemen. A 1 through 4 scale, in increasing order of leftness, was adopted for the candidate choice responses, and was later changed to a 1, 2, 4, 5 scale, since the dead center was not highly represented by any of the 1972 presidential candidates. This change made very little difference in the values of the path coefficients, and made no difference in the relative significance of the paths. It was assumed that this scale was certainly reflective enough of the political realities involved to use as a dependent variable in this paper.

In summary, the variables employed were these:

Personality variables	Status satisfactions	SES variables	Political decisions
alienation	expected mobility	social class	ideology
locus of control	social prestige	income	primary group's ideology
trust		level of education	party identification
ego satisfaction			candidate choice

Results

As this survey was not taken until after the November election, the results of the election could and did bias respondents' answers. A "halo" or "bandwagon" effect was quite marked in response to the candidate choice question, and its immediate predecessor as to whether the respondent voted or not. About 75% of the 841 respondents claimed to have voted, a figure approximately 20 points too high. Of this 75%, 63% said they voted for Nixon. The true figure for Wisconsin was 53%.

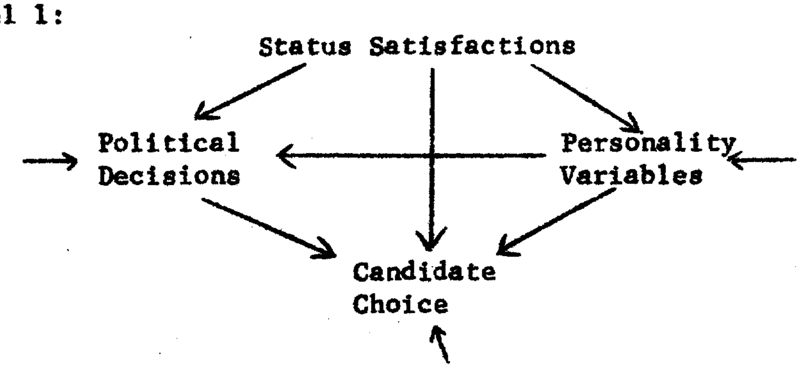
Another problem was that the survey was not designed for a regression analysis. It was possible on most questions to answer "don't know" or some other inappropriate response that could not be numerically coded. When this occurs, the rest of the data for that respondent must be skipped, and he is thus effectively dropped from the study. Path analysis builds a structural equation for a given dependent variable $y = \sum c_i x_i$. If one or more of the x_i's disappears, the equation becomes meaningless. The only data thus usable derived from the respondents who answered codably each of the 27 specific questions transformed into variables for this paper. Only 191 of the 841 respondents (23%) were so obliging.

Three different path models were constructed. The first, a "consistency model", took the respondents' social perceptions as givens, and then examined their effects on the personality variables and of both of these on political perceptions and candidate choice. Notice that this model does not employ any of the "hard" data. It is based completely on the respondents' perceptions of their social situations, and asks "given these, will individuals exhibit clear trends, manifested by significant correlations, on any of the psychological dimensions that might be reflective of these states, and carry any of these feelings and perceptions into the voting booth?" The second model adds social realities to this conceptualization. SES data are taken as exogenous variables here, in order to test whether the perceptions of model 1 contribute unique variance, or whether they can be explained as spurious correlations due to the common effects of SES.

Party identification was not examined in either of the above models, since: 1. Its effects on candidate choice have been fairly exhaustively researched, and 2. It was assumed that the contribution of these psychological variables would occur, if not directly on candidate choice, indirectly through the respondents' ideology, rather than party label, since indeology is not as closely linked to, or confounded by, specific political events, and should thus maintain a constancy of the same order as that of the psychological variables. The third model included all the variables to find the most predictive combination, that is , which variables accounted for most of the variance in 1972 presidential candidate choice.

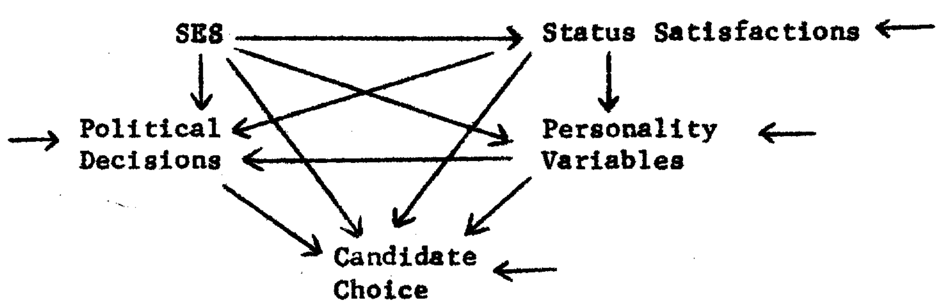
In the presentation of the various models, a diagram of the basic concpetual scheme is given, along with a table of standardized path coefficients, and the R^2's (the amount of variance accounted for) by each new variable added to the final structural equations. Since this research is basically exploratory in nature, all coefficients are presented, and underlined if significant at or beyond the .05 level. If a particular definite model had been envisioned, it would then have been proper to rewrite the analysis to consider only the significant paths, instead of all of them to see if any paths, marginally significant due to many small effects of insignificant paths, lose this marginal significance. The idea behind this research, however, was an explanatory one -- a definition and partition of variance -- and no particular model was considered especially theoretically justifiable to warrant such a test. When a coefficient is not significant (not underlined), no direct path between the two variables involved was observed.

Model 1:



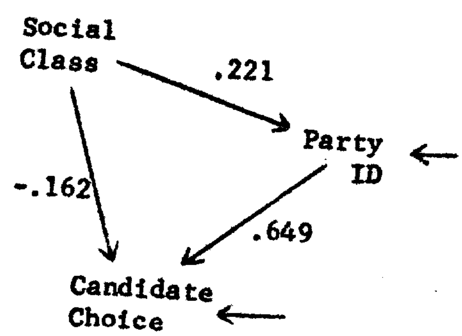
Insert Table 2 about Here

Model 2:



Insert Table 3 about Here

Model 3: (All coefficients are significant beyond the .01 level)



Discussion

Model 1 reveals that 1972 Wisconsin voters' status satisfactions do not have much influence on their subsequent voting behavior. Personal ideology is seen to be the single most important determinant of candidate choice, the negative path coefficient due to the arbitrary direction of the scale for candidate choice. This model only explains about 12% of the observed variance in voting, and most of this is explained by the ideology measure. Of course, party ID was not included here.

Primary group ideology accounts for a large amount (37%) of the respondents' own ideology. Thus, it is seen that a social influence causal chain model (for primary group ideology, own ideology, candidate choice) was adopted rather than an associative or self selective one (where personal ideology would be a determinant of the other two). Both theories may be maintained, from which a chicken or the egg argument quickly results. However, McClosky and Dahlgreen (1959) report significant influences by primary groups on party loyalities, and the Lazarsfeld Elmira study showed preponderant uniformity in the voting behavior of family members. Both of these suggest a social influence model over selection processes. It was considered preferable to view the respondents' primary groups' ideology as an effector, albeit indirect, of voting behavior, although this interpretation is certainly moot.

Notice also that in this model, and in model 2, that political alienation had no effects, direct or indirect, on candidate choice or personal ideology. The Michigan studies found that measures of alienation used related to voter turnout, and a significant correlation (.250) was found in this study between alienation and reported vote/did not vote. However, the influence of alienation on political behavior found by Lewin (1960), where a candidate's direct appeal to feelings of powerlessness in the electorate resulted in an upset in a Boston mayoralty race, were not observed here. George McGovern's "Come home, America" message, a soft-sell appeal to America's alienated millions, apparently failed.

Model 2 shows that the few small but significant contributions by locus of control, the most general and thus probably the most important psychological variable examined, are explained away by SES variables, level of education in particular. The spurious correlation reveals that more educated people feel more in control of their own lives. Trust, however, still maintains a small but significant effect on ideology. The negative sign on the coefficient implies that respondents with the most faith in others tended to be slightly more conservative than those who did not trust others. Those who were surprised by the relatively low importance of the Watergate scandal to Nixon supporters should note this, although the result may be due to demographic confounds - that is, rural regions tend to be more conservative, but also manifest a different life-style than the traditionally more liberal urban centers.

The addition of party identification in model 3 accounted for all the variance previously explained by ideology, and everything else, for that matter except for social class. The model, which curiously exhibits a suppressor effect of party ID on the other two (r = .020, see Table 1) also exhibits a rather surprising reversed effect of social class on candidate choice, in a model which accounts for 45% of the variance in the vote. This may be due to Nixon's and Schmitz's great appeal to the "hard hats" and their ilk during the 1972 campaigns. The model shows a growing schism between the new-found appeal of the more conservative candidates to the lower classes, and the more stable existing party loyalities, in which conservatism is associated with higher class standing. If George McGovern's candidacy is not perceived as a fluke or otherwise unrepeatable occurence in Democratic Party politics, which may very well be the case, this could be a harbinger of a radical political realignment taking place in America.

Table 1

Correlation matrix of variables involved.

No.	Name	1	2	3	4	5	6	7	8	9	10	11	12
1	Alienation	1.000											
2	Locus of control	.382	1.000										
3	Trust	-.398	-.298	1.000									
4	Respondent's ideology	.062	-.077	-.100	1.000								
5	Candidate choice	.073	.016	.111	-.311	1.000							
6	Primary group's ideology	.094	-.062	-.046	.544	-.252	1.000						
7	Ego satisfaction	.017	.041	-.089	-.018	.052	.107	1.000					
8	Mobility	.001	.099	-.024	-.086	-.035	-.130	.060	1.000				
9	Social prestige	.245	.213	-.255	.035	-.159	.143	-.010	-.085	1.000			
10	Social class	-.252	-.228	.184	.106	.020	.081	-.126	-.053	-.098	1.000		
11	Education	.288	.300	-.162	-.157	-.072	-.115	-.131	.091	.184	-.279	1.000	
12	Income	.274	.168	-.221	-.036	-.072	.043	.214	.101	.199	-.313	.396	1.000
13	Party ID	-.043	-.004	.104	-.374	.649	-.313	.052	-.068	-.154	.214	-.010	-.082

N=191

Table 2

Path coefficients for model 1.

	Status Satisfaction		Personality				Political Decision	← Indep. Vars.	
Dep. Variable ↓	expected mobility	relative prestige	alienation	locus of control	trust	ego satis.	prmy grp. ideology	r's ideology	R^2
Alienation	-.075	.232							.063
Locus of Control	-.071	.239							.065
Trust	.020	-.170							.030
Ego Satisfaction	.182	.091							.038
Primary group's ideology	-.147	.152	.027	-.097	-.020	.139			.061
R's own ideology	.008	.032	.043	-.104	-.107	-.010	.584		.375
Candidate Choice	-.009	-.045	-.051	-.005	.009	.030	-.045	-.300	.120

Table 3

Path Coefficients for Model 2.

Dependent Variable ↓	SES: social class	SES: level of ed.	SES: income	Status Satis.: Exp. Mobil.	Status Satis.: rel. prest.	Personality: alienation	Personality: lcs ctrl	Personality: trust	Personality: ego sat.	Political Decision: prmy. groups' ideol.	Political Decision: r's ideol.	← Indep. Vars. R^2
Expected Mobility	-.027	.174	.003									.039
Relative Prestige	-.041	-.020	.190									.039
Alienation	.071	.177	.147	-.140	.177							.143
Locus of Control	-.092	.170	.081	-.131	.178							.119
Trust	.032	.060	.120	.066	-.130							.054
Ego Satisfaction	-.029	-.155	.182	.171	.036							.068
Primary Groups' ideology	.126	-.165	.167	-.133	.115	.041	-.077	-.026	.088			.118
r's ideology	-.022	-.147	-.038	.041	.029	.082	.091	-.103	.027	.565		.389
Candidate Choice	.053	-.044	-.003	.006	-.053	-.014	-.018	.000	.039	-.068	-.300	.124

Appendix 1

Path variables will be examined in detail for simple two and three variable cases. This approach makes the processes under discussion easy to conceptualize, and generalization to more variables poses no further theoretical problems. The volume of computation involved quickly becomes overwhelming as more variables are added, but computer programs exist which eliminate the otherwise necessary pencil-pushing. These will also be commented upon. Consider the simplest case for a path analysis, the two variable case:

$$x \longrightarrow y \longleftarrow u$$

and its mathematical basis (throughout this paper, other than constants, capital letters will refer to raw scores, and small letters to standardized scores):

$$Y = a + bX + E$$

Then, $a = \bar{Y} - b\bar{X}$, and $\bar{Y} = a + b\bar{X}$, so in general

$$Y - \bar{Y} = b_{yx}(X - \bar{X}) + E \quad (-\bar{E}, \text{ but } \bar{E} \text{ is assumed} = 0.)$$

Dividing through the equation by σ_Y, and multiplying and dividing each term by the same quantity:

$$\frac{Y - \bar{Y}}{\sigma_Y} = b_{yx} \frac{(X - \bar{X})}{\sigma_Y} \frac{\sigma_X}{\sigma_X} + \frac{E}{\sigma_Y} \frac{\sigma_E}{\sigma_E}$$

Combining the proper terms yields

$$y = b_{yx} \frac{\sigma_X}{\sigma_Y} x + \frac{\sigma_E}{\sigma_Y} e$$

This equation is isomorphic with the path equation

1. $y = P_{yx}x + P_{yu}u$

Path coefficients are thus seen to be beta weights, or standardized regression coefficients. It should also be apparent that this derivation is equally valid in any number of dimensions, as long as all terms are linear in all dimensions. The general

$$P_{ij} = b_{ij} \frac{\sigma_j}{\sigma_i} .$$

The basic theorem of path analysis, whose generality shall be demonstrated (not quite a proof), states that

$$r_{ij} = \sum_q P_{jq} r_{qi}$$

This is easy to show in the three-variable case, so it must be assumed true for the time being. From equation 1 above, three equations can be derived using the basic theorem:

$$r_{yx} = P_{yx} r_{xx} + P_{yu} r_{ux}$$

$$r_{uy} = P_{yx} r_{xu} + P_{yu} r_{uu}$$

$$r_{yy} = P_{yx} r_{xy} + P_{yu} r_{uy} = 1.$$

These three equations, however, contain four unknowns: P_{yx}, P_{yu}, r_{ux}, r_{uy}. The system, therefore, has no unique solution. If, however, it is simply assumed that $r_{ux} = 0$, the problem disappears. This is called an assumption of uncorrelated errors. In more complex models, usually enough errors are assumed uncorrelated to allow for a unique solution to the system of equations, but not so many as to restrict or over-determine the values of the unknowns involved. The assumption that $r_{ux} = 0$ in the above system yields the solutions

$$r_{xy} = P_{yx}$$

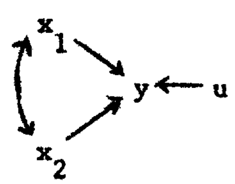
$$r_{uy} = P_{yu}$$

$$r_{yy} = P_{yx}r_{xy} + P_{yu}r_{uy} = P_{yx}^2 + P_{yu}^2 = 1.$$

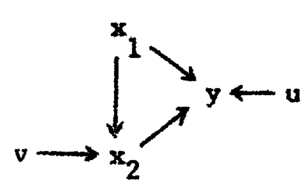
so, $$P_{yu} = \sqrt{1 - P_{yx}^2}$$

There are four possible models for three variables x_1, x_2, and y:

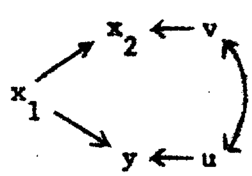
1.



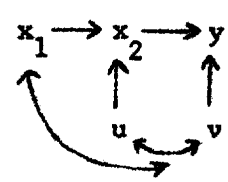
2.



3.



4.



In model 1, the assumption of $r_{u1} = r_{u2} = 0$ is necessary for unique solutions. The path equation for model 1 is

$$y = P_{y1}x_1 + P_{y2}x_2 + P_{yu}u.$$

If this equation is multiplied through by any of the contributors to the variance in y, say x_1:

$$x_1y = P_{y1}x_1^2 + P_{y2}x_1x_2 + P_{yu}x_1u,$$

and this must be true for all n observations on each dimension. So, summing each side over n observations and dividing each term by n:

$$\frac{\sum x_1 y}{n} = P_{y1} \frac{\sum x_1^2}{n} + P_{y2} \frac{\sum x_1 x_2}{n} + P_{yu} \frac{\sum x_1 u}{n}$$

which is recognized as

$$r_{1y} = P_{y1} r_{11} + P_{y2} r_{21} + P_{yu} r_{u1} ,$$

which is the result of application of the basic theorem. The generality of this demonstration should be clear, and may thus be taken as a proof, albeit informal, of the basic theorem. The resultant equations, where uncorrelated errors are assumed, are:

$$r_{1y} = P_{y1} + P_{y2} r_{21}$$

$$r_{2y} = P_{y1} r_{12} + P_{y2}$$

$$r_{yy} = P_{y1} r_{1y} + P_{y2} r_{2y} + P_{yu} r_{uy} = 1$$

$$r_{uy} = P_{yu}.$$

Solution for r_{yy} in terms of the various path coefficients yields

$$r_{yy} = 1 = P_{y1}^2 + P_{y2}^2 + 2P_{y1}P_{y2}r_{12} + P_{yu}^2,$$

which represents the partition of the variance in y due to the direct effects of x_1 and x_2, effects due to the association of each exogenous variable with the other, and the unexplained variance, respectively. The solutions can be extracted for the individual path coefficients:

$$P_{y1} = \frac{r_{y1} - r_{y2} r_{12}}{1 - r_{12}^2} ,$$

$$P_{y2} = \frac{r_{y2} - r_{y1} r_{12}}{1 - r_{12}^2} , \text{ and}$$

$$P_{yu} = \sqrt{1 - (P_{y1}r_{1y} + P_{y2}r_{2y})}.$$

P_{yu} is called the coefficient of alienation. The term inside the parentheses is recognized as $R_{y.12}^{2}$, where R is the multiple correlation coefficient, an index of the amount of n (in this case, n=2) dimensional cluster. This R is also referred to as the coefficient of determination, as R^2 gives the amount of variance accounted for by the variables in a particular model excluding the residuals.

The path equations representing model 2 are:

$$x_2 = P_{21}x_1 + P_{2v}v$$

$$y = P_{y1}x_1 + P_{y2}x_2 + P_{yu}u\ ,$$

for which it must be assumed that $r_{y1} = r_{u1} = r_{uv} = 0$. Application of the basic theorem to this set of equations gives:

$$r_{12} = P_{21}$$

$$r_{2v} = P_{2v} = \sqrt{1 - P_{21}^{\ 2}}\ ,\ \text{since } x_1 \text{ and } v$$

must explain all the variance in x_2.

$$r_{1y} = P_{y1} + P_{y2}P_{21}$$

$$r_{2y} = P_{y2} + P_{y1}P_{21}$$

$$r_{uy} = P_{yu} = \sqrt{1 - (P_{y1}r_{1y} + P_{y2}r_{2y})}.$$

Use of the basic theorem and subsequent solutions in terms of the path coefficients is rather tedious, even in these simple cases. A quick rule for the above, by which these equations can be deduced simply from the path diagram, runs as follows: 1. Locate the two variables for which the correlation is to be partitioned. 2. Trace and sum all possible causal paths found in the model between them (they may be identical, as in the case of r_{yy}), multiplying the coefficients (correlations for exogenous variables) together for each path found. 3. In tracing the paths, direction (determined by the way the arrows are pointing) may be changed only once, and only one curved double arrow may be passed through. All other paths are not permitted, and may not be added to the sum. For this rule I have yet to see any formal proof. It is apparently passed by word of mouth to each succeding generation of sociologists, and it always works. For example:

$$r_{yy} = P_{y1}P_{y1} + P_{y2}P_{y2} + P_{yu}P_{yu} + 2P_{y2}P_{y1}P_{21} ,$$

and no other paths get back to y without violating one of the above rules. The first three terms are simple forward and back steps, for which the appropriate coefficient enters multiplicatively each way. The last term represents the two (equivalent) ways of going around the chain and back to y, since arrow direction changes only once either way.

In this model, the total effect of x_1 on y, r_{1y}, is broken into the direct effect of x_1 on y, P_{y1}, and the indirect effect of x_1 on y, $P_{y2}P_{21}$, as mediated by x_2. Notice that this partition would be numerically equivalent to that in model 1 (where we have r_{12} instead of P_{21}). The interpretation for model 1, however, is a partition into direct effects and associative causes. Thus, path analysis does not help choose a model. The theory behind it must determine if the resultant partitions are meaningful. For the effect of x_2 on y in model 2, r_{2y} breaks down into the direct effect of x_2, P_{y2}, and the spurious effect, $P_{y1}P_{21}$, caused by the incidental dependence of both x_2 and y on x_1.

Models 3 and 4 are the basic models of association and causation. There are two important factors to notice in these models: 1. The errors need not be assumed completely uncorrelated, and in fact, some error correlations must be assumed to avoid restrictions on the solutions for the various path coefficients. 2. The mathematics involved in the two models are equivilent. No statistical technique can distinguish between them, and recourse must be directed to the two theories. If a field study has measured three variables among a sample; marijuana use, un-American attitudes, and heroin use, the theoretical argument becomes very familiar.

Examining model 3,

$$y = P_{y1}x_1 + P_{yu}u, \text{ and}$$

$$x_2 = P_{21}x_1 + P_{2v}v, \; r_{u1} = r_{1v} = 0,$$

from which derive

$$r_{1y} = P_{y1}$$

$$r_{12} = P_{21}$$

$$r_{y2} = P_{y1}P_{21} + P_{yu}r_{u2}$$

and $$r_{u2} = P_{2v}r_{uv} ,$$

so $r_{y2} = P_{y1}P_{21} + P_{yu}P_{2v}r_{uv}$.

Thus, r_{y2} breaks down into effects strictly due to the incidental dependence of both y and x_2 on x_1, the predicted (spurious) correlation in the model, and the possible extra due to correlated errors, which may be a factor.

$$r_{uv} = \frac{r_{y2} - P_{y1}P_{21}}{P_{yu}P_{2v}} = \frac{r_{y2} - r_{1y}r_{12}}{\sqrt{1 - r_{1y}^2}\sqrt{1 - r_{12}^2}}$$

and can be readily determined. If it is large, it may be necessary to change the model, since a large correlated residual implies correlations in the associated variables not predicted by the model.

For model 4,

$$x_2 = P_{21}x_1 + P_{2u}u$$

$$y = P_{y2}x_2 + P_{yv}v$$

$$r_{u1} = r_{v2} = 0,$$

from which we obtain

$$r_{12} = P_{21}$$

$$r_{2y} = P_{y2}$$

$$r_{1y} = P_{y2}P_{21} + P_{yv}r_{v1} ,$$

again, a partition of variance into components explained by the model, and due to correlated error, respectively. Also, analagous to model 3,

$$r_{v1} = \frac{r_{y1} - r_{y2}r_{12}}{\sqrt{1 - r_{y2}^2}} ,$$

comparable to r_{uv} in model 3. The value of r_{uv} in model 4 must not be assumed = 0, since

$$r_{2v} = 0 = P_{21}r_{1v} + P_{2u}r_{uv} ,$$

and without it, $P_{21}r_{1v}$ would have to be zero, implying $r_{1v} = 0$, which has just been shown not necessarily to be true, although if either are large, the model would need revision. In fact, we get

$$r_{uv} = \frac{-P_{21}r_{1v}}{P_{2u}}$$

The idea of a suppressor variable was introduced in the "Introduction" section (what better place?), and an example can easily be produced. For the case of model 1, for example, let $P_{y2} = a$, $P_{y1} = -ab$, and $r_{12} = b$. Then

$$r_{2y} = P_{y2} + P_{y1}r_{12} = a - ab^2 ,$$

but

$$r_{1y} = P_{y1} + P_{y2}r_{21} = -ab + ab = 0.$$

A direct effect of x_1 on y is observed, although there is no correlation between them.

The forementioned three-variable cases are the basis for all subsequent, larger models. The only added difficulty in them is the computational work. This can, however, be performed on a computer. Since a computer was indeed employed to analyze the data gathered for this paper, the workings of regression analysis programs for a path analysis will be briefly explained.

When the REGAN2 program (of the STATJOB series on the MACC Univac 1108) is asked to regress variable y on variables x_1 through x_n, it will find the best n-dimensional straight line through each n-dimensional data point, and solve for the coefficients of the x's. This is done for both standardized x's and unstandardized X's, yielding both standardized (ametric) and unstandardized regression coefficients. The standardized coefficients are the path coefficients under discussion, so the result at this point is all direct paths from each x_i to y. The program t-tests each coefficient P_{ij} at N - n df, where N is the total number of observations, against the hypothesis that $P_{ij} = 0$, and prints the significance level.

The test employs the necessary algebraic overspecification of any model for which all possible paths are not assumed. Consider the simple models discussed. Each results in an equal number of equations and unknowns. If a path P_{ij} is eliminated, an extra equation is obtained, namely $P_{ij} = 0$. In model 1, for instance, if P_{y1} is eliminated,

$$r_{1y} = P_{y1} + P_{y2}r_{12} = P_{y2}r_{12} ,$$

thus $P_{y2} = r_{1y}/r_{21}$.

so $r_{2y} = P_{y1}r_{12} + P_{y2} = r_{1y}/r_{12}$

or $r_{1y} = r_{2y}r_{12}$.

That would be the assumption of model 1 with P_{y1} missing, and the form that the t-test null hypothesis would take in the machine. A complete correlation matrix is also printed in the analysis, so that the computer's work can be checked if mistrusted. For each regression performed, the coefficient of determination is also computed, so the amount of variance accounted for by all the variables in each regression is known. To perform a complete path analysis on any given model, it is therefore incumbent upon the programmer to perform the regression of each variable on all others ordered either causally or temporally before it.

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