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RESEARCH METHODOLOGY: SOME ILLUSTRATIVE STUDIES

E. E. DAVIS

Talk given to ESRI Research Assistants

Wednesday, 30 October 1974

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Introduction

The two previous speakers in this series, Dr. Kennedy and Professor O'Connor, have covered both the practical and theoretical aspects of Research Methodology extremely well. In my comments I will focus on some illustrative studies which may help to exemplify some of these points.

Dr. Kennedy, in his talk of two weeks ago, focussed on the "Nuts and Bolts" of the organisation of research, without dealing directly with questions such as objectivity, causality, creativity, inspiration, induction, and deduction. We all know that he is quite capable of dealing with these latter "exciting intellectual questions", as revealed in his Discourse given to the Royal Irish Academy (Kennedy, 1973) and his other publications. However, I could not agree more with Dr. Kennedy in stressing the importance of the "Nuts and Bolts" of the organisation of research. I would definitely agree with his statement that "far more people go astray because of ignorance or neglect of the more mundane matters".

Dr. Kennedy made many valuable suggestions in his talk, the importance of any one of which, or indeed all of which, I could reiterate and re-emphasise. I should just like to pick out one suggestion, because it is so seemingly obvious on the one hand, and yet, on the other hand, I find it so difficult to impress upon young Research Assistants and Post-Graduate students doing research; Dr. Kennedy passed on a "useful hint" given to him

by Abdul Khan "who, in turn, got it from no less a man than Ragnar Frisch, the first joint winner of the Nobel Prize in Economics, namely, to put a date on every sheet of paper in your files particularly where you have recorded data". This same point (along with many others) was impressed upon me by the eminent philosopher - logician, Susan Langer, under whom I had the privilege of studying. She, in turn, got it from her mentors, Alfred North Whitehead and Bertram Russell. I might add that, in addition to a date, other indentifying information should always be placed on any research materials. As I mentioned, obvious though this point is, it seems difficult to impress its importance upon young researchers. Frequently, for the young Research Assistant, the study he or she is working on is the first (or at most second) major study with which he or she has been involved. Thus, since there are only one or two studies in his immediate field of vision, it seems obvious that it will be possible to identify any piece of research material correctly a few months or even a year later. The researcher with 10-20 years or so of research experience, who has conducted perhaps a couple of dozen or more studies, comes to appreciate fully the importance of this procedure. But I cannot impress upon you too strongly the necessity for learning these habits at the very beginning of your research career: otherwise, you will become hopelessly disorganised after three or four years and, your ability to benefit in your current research from your previous research experience will be greatly diminished.

Professor O'Connor, in his talk to you last week, dwelt on the "exciting intellectual matters of objectivity, causality, creativity, inspiration, induction and deduction". He gave a very useful example of the practical application of the scientific method in a field study, namely the National Farm Survey with which he was involved. I think that presenting concrete examples of studies is one of the best ways of illustrating the procedures involved in general research methodology. What I should like to do, therefore, is to very briefly review the general processes of induction

and deduction and their relationship to the scientific method and then present some selected studies from my own discipline, that of social psychology, which may, I hope, provide some further examples which will illustrate the use of induction, deduction and the scientific method.

Induction vs. Deduction and the Scientific Method

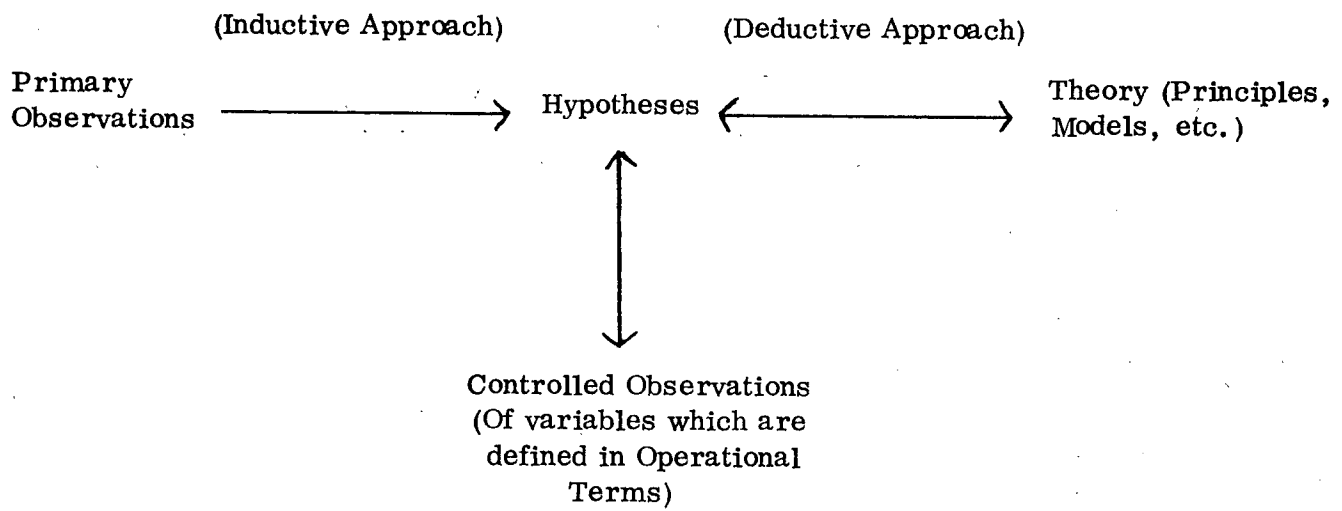
As Professor O'Connor pointed out in his talk, the central concern of the modern scientific method has to do with hypotheses and the testing of hypotheses. Although, as Professor O'Connor points out, some kinds of research (e.g. more descriptive research) do not seem to fit into the classical mould of what has come to be accepted as the modern scientific method, such research basically involves hypothesis testing, even if the hypotheses are implicit in nature.

As I see it, the inductive method and the deductive method, which Professor O'Connor has described so well, are merely two alternative approaches to the formulation of scientifically testable hypotheses. Although I think that the differentiation between inductive and deductive processes is a useful heuristic distinction, it would be quite wrong to consider these two approaches as in any way mutually exclusive. On the contrary, I feel that, although different researchers (or different research problems) may emphasise the one approach more than the other, in practice no useful hypothesis is arrived at without involving both approaches, either explicitly or implicitly.

Figure 1 may serve to illustrate, in a very simplistic way, the relationship that I see between induction, deduction, and hypothesis formulation.

In the inductive approach one starts off with a series of primary observations of phenomena and gradually organises these observations

FIGURE 1



into some kind of formulations which, in the terminology of the modern scientific method, are referred to as hypotheses. According to Kerlinger (1973) these are two criteria for "good" hypotheses: "One, hypotheses are statements about the relations between variables. Two, hypotheses carry clear implications for testing the stated relations. These criteria mean, then, that hypothesis statements contain two or more variables that are measurable or potentially measurable and that they specify how the variables are related. A statement that lacks either or both these characteristics is no hypothesis in the scientific sense of the word (p. 18)". In order to test the statements about the relations between variables contained in hypotheses it is necessary to engage in controlled (as opposed to informal or primary) observations of the variables, whereby it is essential that the variables be carefully defined in operational terms, that is to say, the means by which the variables are to be measured must be explicitly specified in terms of observable operations. The observations must also be controlled so as to ensure that the observed relationships are explainable in terms of the stated hypotheses, as opposed to being possibly determined by extraneous factors (cf. Campbell and Stanley, 1963).

The inductive approach, although it did not originate with Sir Francis Bacon, is frequently associated with Bacon's name, because he was one of the advocates of this approach and is regarded as the founder of what has become known in the history of science as the school of British Empiricism. In 20th Century psychology this approach is prominently exemplified by the work of B. F. Skinner (1940).

Scientific research is basically empirical in nature, in the sense that hypotheses are tested by means of controlled observations. However, when the inductive approach is pursued in the extreme, in the

sense of merely making large numbers of primary observations (e.g. collecting a lot of data without guidelines), without any clear view of hypothesis formulation or testing, this procedure is often referred to as empiricistic, a term which has a rather negative connotation. However, the use of the inductive method alone is rather pointless from the viewpoint of modern scientific method. As Cohen (1956) has stated "there is ... no genuine progress in scientific insight through the Baconian method of accumulating empirical facts without hypotheses or anticipation of nature. Without some guiding idea we do not know what facts to gather ... we cannot determine what is relevant and what is irrelevant (p. 148)".

There is nothing wrong with a predominantly inductive approach as long as it is associated with the modern scientific method of hypothesis formulation and testing. However, even the researcher who does take this approach usually ends up, over time, testing a number of related hypotheses. There is a natural tendency, then, to think in terms of certain generalisations which might give a kind of cohesion to the inter-related hypotheses which have been tested. Such generalisations may result in the development of principles, models, etc. - in other words some form of theory, whether highly complex and formal, or rather simple and general in nature. Kerlinger (1973) gives a following general definition of theory: "a theory is a set of inter-related constructs (concepts), definitions, and propositions that present a systematic view of phenomena by specifying relations among variables, with the purpose of explaining and predicting the phenomena (p. 9)". Thus, even when one starts with an inductive approach and proceeds through the stage of hypothesis formulation and testing, one usually arrives at some kind of theory. However, although the building of formal theories and models may be an ultimate aim in science, one must be wary of the premature development of formalised theories and models. No theory or model is "correct" for all time and in all circumstances. One must constantly derive hypotheses from

the theory or models which can be tested against empirical reality. Dr. Kennedy, in his paper earlier in this series, correctly warned against the "excessive emphasis on formal theorising to the neglect of the empirical foundation". He goes on to state that "far too much effort goes into derivation of the formal properties of models, based on assumptions that have not been validated, rather than first establishing the empirical validity of the assumptions (p. 12)". However, this criticism may apply more to the field of economics than to some of the other social sciences. In particular, social psychology is often criticised for being too empirical and paying too little attention to the building of more systematic theories and models. I shall return to this point later when I attempt to illustrate the relationship between theory, hypotheses, and empirical data, on the basis of some illustrative studies.

The deductive approach starts with theory (principles, models, etc.) and deduces hypotheses, which are then empirically tested. One will note, however, that this still involves empirical (though not empiricistic) research, since the hypotheses which are deduced from the theory must be empirically validated. Depending upon whether the hypotheses are confirmed or disconfirmed, the theory may be modified, new hypotheses derived and tested, and this process continues, as is illustrated by the two-way directionality of the connecting arrows in Figure 1. In psychology, this type of deductive method is most prominently associated with the work of C. L. Hull (1943) and is referred to as the hypothetico - deductive approach.

Of course, just as there is no such thing as a purely inductive approach, in the sense that any observations which we make are made within the framework of some general view of reality (or implicit theory), similarly there is no such thing as a purely hypothetico - deductive approach.

Obviously, we never start off with full blown theories, principles, models, etc.; rather, we arrive at these through some sort of observations, no matter how casual.

In summary then, the distinction between the inductive and the deductive approach may be a useful heuristic distinction, but in practise we all use some combination of these two approaches, even though our basic orientation may lean somewhat more in the one rather than the other direction.

Some Illustrative Studies

I should now like to end this more abstract discussion of research methodology and devote the remainder of my talk to a presentation of some research findings from a series of inter-related studies by myself and colleagues which will, I hope, illustrate the relationships and complex interplay between the processes of induction, deduction and hypothesis testing. Of necessity, I will have to present some actual findings (which may or may not be of intrinsic interest to you), but my main purpose is to illustrate the thought processes and research processes which I and my colleagues went through in carrying out these studies.

First of all, I shall have to give you a brief background to the development of a problem which we sought to resolve. Contrary to a great deal of past research findings, showing that white American subjects (Ss), in general, manifested a rather large degree of racial prejudice, Rokeach, Smith and Evans (1960) presented findings from which they concluded that social acceptance or rejection was largely determined by the perceived similarity or dissimilarity of the beliefs of the other persons, rather than by their racial or ethnic membership. A number of other researchers of the Rokeach school (e.g. Rokeach, 1961; Byrne and Wong, 1962; Byrne and McGraw, 1964; Stein, Hardyck and Smith, 1965) presented data supporting this proposition. Apart from the large body of research referred to above, indicating the importance

of racial prejudice for white American Ss, Triandis and his colleagues (e.g. Triandis and Triandis, 1960; Davis, 1964; Triandis, Davis and Takezawa, 1965; Davis and Triandis, 1965), in research conducted around the same time, and utilizing completely similar subject populations (i. e. white American student Ss), consistently found an overwhelming race effect as the determinant of social acceptance or rejection. In particular, Triandis (1961) and Rokeach (1961) both manipulated race and belief simultaneously and arrived at seemingly contradictory results (although there was a far from perfect consistency in the manner in which they operationalised their variables).

Obviously a problem existed. How could two responsible groups of researchers come up with such seemingly contradictory findings in a large number of studies? In terms of Figure 1 it seemed time to shift from left to right, as it were. That is, we had collected a lot of empirical data (observations); the problem was that these data seemed to lead to contradictory interpretations. It seemed time to look at the theory, or implicit models, involved, with a view toward developing a more adequate model. We therefore resolved to develop a model which would satisfactorily explain the seemingly contradictory empirical evidence, then derive appropriate testable hypotheses from the model (deduction), and then collect the data necessary to confirm or disconfirm these hypotheses and, thus, test the model.

To begin with, we had to ask ourselves the question of what implicit model was involved in the research about which there was this controversy. To our surprise, we realised that all that had really been asked was the simple question of what characteristics of the stimulus (that is the person being responded to) was determining a given response (e. g. social acceptance or rejection). Put in this way, we realised that we were dealing with a simple Stimulus - Response (S - R) model of the sort characteristic

of the early behaviourist school of the 1920's. Thinking about the matter further, we were surprised to realise how much psychological research, including social psychology research, relied upon this simplistic model. Those familiar with the history of psychology will recall that this early S - R model was soon replaced by taking into consideration characteristics of the Organism, in what is known in the field as the S-O-R model (e.g. Tolman 1958). However, even this model seemed to us to be too simplistic. In particular, our knowledge of the multi-dimensionality of attitudes of acceptance or rejection led us to consider the importance of the nature of the response continuum on which the subject is responding to the stimulus. For example, Triandis and Triandis (1962) had white student Ss rate the stimulus "Negro Physician" on a number of scales. In their ratings of this stimulus on Semantic Differential Evaluation Scales (e.g. good-bad), roughly 90% of the Ss rated the stimulus on the positive side of the neutral point; on the other hand, approximately 75% of the same Ss rated the same stimulus on the negative (or rejecting) side of the neutral point on statements measuring the behavioural component of attitudes, such as "would exclude from my neighbourhood". Thus, we decided that at the very least any given response was a function of the characteristics of the subject (S), the characteristics of the stimulus (St.) and the nature of the response continuum (R. C.). Or, put in symbolic form:

$$R = f (S, St, R. C.)$$

Exhibit A illustrates this relationship in terms of a cube of data upon which any given response is dependent. Thus, although the characteristics of the stimulus person being responded to certainly constitutes an important class of independent variables, the other two parameters of subject characteristics and response continua also constitute sets of independent variables upon which the response will be dependent. We could easily measure the effect of various stimulus characteristics, such as race and belief, by simply having subjects respond to stimulus persons who varied in all possible combinations

of these stimulus characteristics, thus forming a factorial design permitting the use of analysis of variance as a means of determining the extent to which various stimulus characteristics determine the responses. However, what hypotheses could be made about subject characteristics and response continua which would allow the model to explain seemingly contradictory findings concerning the amount of variance controlled for by various stimulus characteristics in different studies?

Based on a great deal of evidence which we had from a number of studies (essentially an inductive process) we formulated the following two hypotheses, which, if they could be independently verified, would allow the model to explain the seemingly contradictory findings. First, we hypothesised that there were two kinds of subjects, namely those who would, in general, respond primarily on the basis of race, and those who would, in general, respond primarily on the basis of belief. Of course, we saw these as idealised subject types and realised that there would be mixed types as well. Second, we hypothesised that, if a number of response continua were ranked on a dimension from less intimate to more intimate, for all subject types, race would assume more importance in determining the variance in the response, as the response continuum became more intimate.

Just about this time we were preparing a large pre-test of attitudes towards a broad spectrum of racial and other issues, in preparation for a series of studies on black-white negotiations (Davis and Triandis, 1965; 1971). We decided, therefore, to collect this data in such a manner as to permit us to test these hypotheses and, thus, the viability of the model which we had put forth. However, in addition to the conventional statistical techniques which we had at our disposal, we needed a sensitive procedure for isolating

Exhibit A

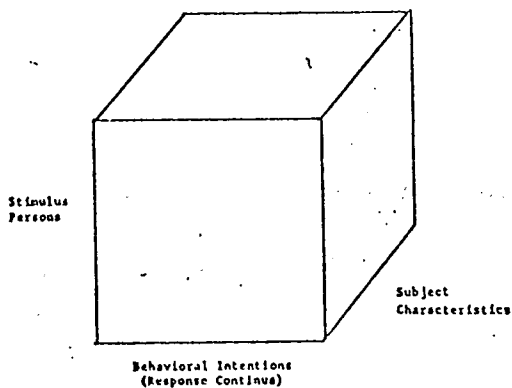


FIG. 1. Schematic representation of the relationship between subjects, stimulus persons, and behavioral intentions.

Excerpt from: Goldstein, M. and Davis, E. E., Race and belief: A further analysis of the social determinants of behavioural intentions. Journal of Personality and Social Psychology, 1972, 22, 346-355.

idealised subject types to test our first hypothesis. We were familiar with the then recent work by Tucker and Messick (1963) for factor analysing an individual differences matrix. We also knew that Professor Tucker was working on more advanced factor analytic techniques for isolating idealised subject types. With his assistance we were able to develop the programme which we needed - a programme which has since come to be known as two-mode factor analysis.

In the tradition suggested to you earlier by Professor O'Connor, we prepared in advance a complete blank table before collecting our data, to ensure that we would have all the results which we needed to adequately test our hypotheses. This table is represented in Exhibit B. (Triandis and Davis, 1965). A careful inspection of this table would reveal that our hypotheses were, indeed, confirmed and the model which we had put forth was capable of encompassing the otherwise seemingly contradictory findings. However, since this table, containing complete results, is a bit difficult to read we prepared simplified excerpts which are presented in Tables 3a and 3b in Exhibit C.

Table 3a is designed to illustrate the differential effects of race and belief for different subject types. For Ss who are High on Factor II (Race Rejectors), race controls almost four times as much variance as belief on the least intimate response continuum of Formal Social Rejection. This ratio increases dramatically as one moves to the intermediate response continuum of Friendship Rejection and then to the more intimate response continuum of Social Distance. For Ss who are High on Factor V (Belief Rejectors) on the other hand, belief controls more than four times as much variance as race on Formal Social Rejection. In line with the tendency for race to control more variance as the response continuum becomes more intimate

TABLE 2

SUMS OF SQUARES AND PERCENTAGES OF VARIANCE CONTROLLED BY STIMULUS FACTORS FOR DIFFERENT SUBJECT TYPES AND DIFFERENT RESPONSE CONTINUA

Response continuum and source	df	Subject type													
		Pure high II (N = 25)		Pure low II (N = 26)		Neutrals (N = 27)		Pure high V (N = 25)		Pure low V (N = 25)		Mixed high II and high V (N = 19)		Mixed low II and low V (N = 17)	
		SS	%	SS	%	SS	%	SS	%	SS	%	SS	%	SS	%
Evaluation	1	4	.0	0	.0	2	.0	8	.0	136	.4	1	.0	111	.2
Sex	1	136	.5	66	.1	16	.0	65	.2	815	2.7	985	1.6	81	.1
Race	1	10	.5	40,461	63.7***	11,094	32.3***	3,428	9.6***	11,295	35.5***	31,467	51.0***	58,101	86.4***
Belief	1														
Formal social rejection	1	634	.9	105	.2	0	.0	79	.1	288	.4	97	.1	17	.0
Sex	1	21,799	29.3***	24	.0	1,040	4.2*	1,601	2.8*	1,190	1.8*	17,480	22.0***	6	.0
Race	1	5,576	7.5***	18,294	33.2***	856	3.5*	6,986	12.3***	38,088	57.5***	26,263	33.0***	54,560	77.9***
Belief	1														
Subordination	1	406	.6	1,617	2.0	104	.3	1,225	1.7	1,540	2.5	783	1.2	1,118	2.6
Sex	1	13,366	21.1***	848	1.1	1,896	6.1**	703	1.0	528	.8	16,113	24.1***	74	.2
Race	1	528	.8	2,850	3.6*	118	.4	946	1.3	7,140	11.5***	2,100	3.1*	5,188	12.0*
Belief	1														
Friendship rejection	1	1,352	1.3	0	.0	118	.3	66	.1	128	.2	47	.0	265	.8
Sex	1	48,050	44.4***	58	.2	4,004	10.4***	8,911	13.7***	2,964	5.3**	53,250	47.6***	1	.0
Race	1	882	.8	1,789	6.9**	7	.0	1,953	3.0*	7,442	13.4***	4,054	3.6**	8,736	24.7***
Belief	1														
Social distance	1	221	.3	183	1.0	1	.0	41	.1	40	.1	72	.1	48	.3
Sex	1	48,485	68.4***	2,925	15.2***	7,490	24.5***	25,855	43.9***	8,791	31.7***	42,278	63.4***	134	.9
Race	1	808	1.1*	126	.7	80	.2	1,836	3.1**	907	3.3*	2,686	4.0***	786	5.4*
Belief	1														
Marital rejection	1	24,931	22.8***	71,114	48.4***	31,104	27.0***	47,740	36.6***	37,923	34.1***	26,184	28.2***	58,972	56.9***
Sex	1	27,542	25.2***	10,991	7.5***	21,841	18.9***	25,178	19.3***	20,686	18.6***	23,575	25.4***	3,145	3.0**
Race	1	964	.8*	1,080	.7	0	.0	986	.8	1,458	1.3*	1,177	1.3*	3,145	3.0**
Belief	1														

Note.—F ratios (omitted here) were calculated by dividing the mean squares for main effects by the mean square error. The F ratios were tested for significance with 1 and N-8 df and the levels of significance are shown next to the percentages of variance.

*p < .05.
**p < .01.
***p < .001.

DETERMINANTS OF BEHAVIORAL INTENTIONS

Exhibit B

-11 a -

Exhibit C

TABLE 3
PERCENTAGES OF VARIANCE FOR RACE AND BELIEF
AS A FUNCTION OF SUBJECT TYPE

Subject type	Response continuum					
	Formal social rejection		Friendship rejection		Social distance	
	Race	Belief	Race	Belief	Race	Belief
High II	29.3	7.5	44.4	.8	68.4	1.1
Neutral	4.2	3.5	10.4	.0	24.5	.2
High V	2.8	12.3	13.7	3.0	43.9	3.1

TABLE 4
PERCENTAGES OF VARIANCE FOR RACE AND BELIEF
AS A FUNCTION OF RESPONSE CONTINUUM

Response continuum	Subject type			
	Mixed highs		Neutrals	
	Race	Belief	Race	Belief
Evaluation	1.6	51.0	.0	32.3
Formal social rejection	22.0	33.0	4.2	3.5
Subordination	24.1	3.1	6.1	.4
Friendship rejection	47.6	3.6	10.4	.0
Social distance	63.4	4.0	24.5	.2
Marital rejection	25.4	1.3	18.9	.0

Excerpt from : Goldstein, M. and Davis, E. E., Race and belief: A further analysis of the social determinants of behavioural intentions. Journal of Personality and Social Psychology, 1972, 22, 346-355.

(moving from left to right), race controls very significant amounts of variance even for Belief Rejectors. However, it will be noted that on each dimension race controls more variance for Ss' High on Factor II (Race Rejectors) than for Ss' High on Factor V (Belief Rejectors), thus confirming our first hypothesis. A more complete inspection of Table 2 (Exhibit B) reveals that this pattern is quite consistent.

Table 3b is designed to illustrate the effect of the increasing intimacy of the response continuum in determining the amount of variance controlled for by race. For purposes of illustration we have taken as examples of subject types Mixed High's (i. e. Ss who were high on both factors) and Neutrals (i. e. Ss who were neither high nor low on either of the two factors). When the six response continua are ordered from least intimate to most intimate, it can be seen that, for both of these subject types, the per cent variance controlled for by race increases in a direct linear fashion. The effect of race in determining Marital Acceptance vs. Rejection is much higher than it appears here; since the stimulus persons were described also in terms of sex, sex obviously determined most of the variance of this response continuum. However, when sex is partialled out, race controls almost all of the remaining variance on this continuum. These findings would seem to confirm rather clearly our second hypothesis.

To make sure that these findings were not artifacts of some kind, Goldstein and Davis (1972) replicated and extended these findings some years later, using Ss from a different part of the country, somewhat different response continua and different belief variables. Table 1 from this study (Exhibit D) shows a very similar pattern. As may be seen from this Table, when one moves from the least intimate response continuum (Factor 1) to the most intimate response continuum (Factor III), race controls increasing

Exhibit D

TABLE 1
 SUMS OF SQUARES AND PERCENTAGES OF VARIANCE
 CONTROLLED BY RACE AND TWO BELIEFS ON THREE
 RESPONSE CONTINUA: COMPARISON OF SUB-
 JECTS WITH HIGH LOADINGS ON EACH OF THE
 TWO SUBJECT FACTORS

Source	df	Subject type			
		"Pure high ones": belief rejectors (n = 15)		"Pure high threes": race rejectors (n = 15)	
		SS	%	SS	%
Factor I: Acquaintance acceptance-rejection					
Race	1	1.20	.48	17.13	14.87**
United Nations issue	1	.09	.04	3.56	3.09
Income issue	1	27.40	10.93**	1.63	1.42
Factor II: Friendship acceptance-rejection					
Race	1	3.33	1.04	133.71	35.52***
United Nations issue	1	.63	.19	8.18	2.17
Income issue	1	33.43	10.41**	6.53	1.74
Factor III: Social distance					
Race	1	36.29	13.23**	396.05	76.94***
United Nations issue	1	.30	.11	11.20	2.18*
Income issue	1	30.67	11.18**	1.34	.26

Note.—*F* ratios (omitted here) were calculated by dividing the mean squares for main effects by the mean-square error. The *F* ratios were tested for significance with 1 and *N* - 8 degrees of freedom, and the levels of significance are shown next to the percentages of variance.

* *p* < .05.
 ** *p* < .01.
 *** *p* < .001.

Excerpt from Goldstein, M. and Davis, E. E. Race and belief: A further analysis of the social determinants of behavioural intentions. Journal of Personality and Social Psychology, 1972, 22, 346-355.

amounts of variance, especially for Race Rejectors. Similarly, on any given response continuum, race controls more variance for Race Rejectors and belief controls more variance for Belief Rejectors. In addition to replicating the earlier findings by Triandis and Davis (1965), the Goldstein and Davis (1972) study investigated other factors which I will not go into here.

The foregoing has been an attempt to illustrate the complex interplay between inductive and deductive approaches to hypothesis formulation. However, whether arrived at inductively or deductively, it is the formulation and empirical testing of hypotheses which is the cornerstone of the modern scientific method.

The question of when it is better to focus on the collection of more data in order to arrive at the formulation of the hypotheses to be tested, or whether to focus on models or theories from which to deduce hypotheses, is a difficult one and requires a great deal of judgement. Obviously, it depends very much on the problem one wishes to solve. For instance, in the situation with which Triandis and I were faced, where we had numerous published studies, and even more numerous unpublished sets of data, all pointing in the direction of the importance of race as a determinant of social acceptance or rejection on the part of white Americans, it seemed rather pointless to just go on collecting more data. When one group of researchers is repeatedly coming up with findings which seem to contradict those of another group of researchers it is not very likely that one will convince either the colleagues with whom one disagrees, or one's colleagues in general, by arguing that, whereas they may have x number of publications supporting their point of view, we have x + 3 publications supporting our point of view. The "weight of evidence" should not be confused with the weight of one's data (in the literal sense of the word).

It was obviously necessary to have a fresh look at the implicit models underlying the conflicting data. When we did this, we found that the simple S - R model was inadequate, and that a more complex model was necessary in order to explain the data. On the other hand, while the model was moderately complex, we did not attempt a grandiose theory to explain all possible social psychological phenomena. In the later study (Goldstein and Davis, 1972), replicating the original study, we recognised the possibility of more complex models when we stated that "dimensions other than the three just mentioned should be considered (e. g. situational variables, the effects of social norms, etc.). Thus, a more complete model would involve an n-dimensional space with each 'dimension' being, in turn, multi-dimensional. However, in the context of the present discussion, the three-dimensional model suggested in Figure 1 would seem to be the minimal level of complexity required, given available information, to deal with the questions raised by the Rokeach - Triandis controversy. Any attempt to state flatly that either race or belief is 'the' most important determinant of social acceptance or rejection, thus taking into account only the characteristics of the stimulus person - but ignoring the other two parameters - would seem to be a misleading and unnecessary oversimplification (p. 348)". Later we stated simply that "the model presented by Triandis and Davis and the present authors while not claiming to constitute a theory in any strict sense, does permit the explanation of the more generalised set of behaviours (p. 354)".

A related question which is difficult to answer in any blanket fashion, but one which, rather, requires judgement, has to do with the complexity of analytical techniques which one should use. Again, this obviously varies from situation to situation, depending upon the problem with which one is faced. I would agree with Dr. Kennedy that one should not be 'enamoured of techniques for techniques' sake" and that one should not use "a sledge hammer to crack a

nut". However, in the case which I have been describing, it was only the availability of rather sophisticated and newly developed statistical techniques which made possible the development and testing of a model capable of explaining and encompassing otherwise seemingly contradictory findings.

On the other hand, there are many examples where important advances can be made by the use of rather simple techniques. I would just like to illustrate this by briefly describing one further study relating to the race-belief controversy in which a simple analysis of variance design was used.

Goldstein and I noted that most of the later studies supporting the belief hypothesis followed the basic paradigm of the Stein, Hardyck and Smith (1965) study. Thus, we decided to look at this study more carefully. It immediately became quite obvious that their operationalisation of "belief" was quite different from the one which we used. Whereas we had defined "belief" in terms of the stand on a particular controversial issue which was attributed to the stimulus person, Stein, Hardyck and Smith (1965) equated "belief" with "values". Some of these values included such items as "be intelligent...", "be concerned about other people...", "be honest and trustworthy", etc. As we later noted (Davis and Goldstein, 1974) "such items and, to a greater or lesser extent, the remaining items, suggest something very much like attributed personality characteristics (cf. Anderson, 1968) rather than belief variables. The question that arises then is whether these authors' Ss were responding to attributed personality characteristics or belief characteristics, in addition to the attributed race characteristics. It was the purpose of the present study to seek to clarify this question (p. 2)". Specifically we had postulated that when Ss were presented with information concerning race, belief, and personality characteristics of stimulus persons, the following hypotheses would hold: (a) the attributed personality characteristics would control an over-

riding amount of the variance; (b) of the remaining variance, the attributed race of the stimulus person would be of significantly greater importance than would attributed belief; and (c) race would become more important as the response continuum became more intimate. The means for testing this hypothesis was, as mentioned before, the use of a simple $2 \times 2 \times 2$ analysis of variance design. Results obtained are contained in Exhibit E, which reproduces Table 1 from Davis and Goldstein (1974). As may be seen by an inspection of the F ratios in this table, the hypotheses put forward were verified. Thus, it was possible to make a further contribution to the resolution of this controversy by the use of rather simple statistics.

Finally, I should like to just mention one further study, currently under way in Ireland, which illustrates not only methodological issues, but the relationship between applied research and theoretical implications. The research directs itself to the very applied problem of "Some Determinants of Middle-Management Attitudes and Behavioural Intentions Relevant to Joint Management-Worker Decision-Making Boards" (Davis and Lydon, in preparation). The applied relevance of such a study is apparent to anyone familiar with the general problems of industrial democracy, but takes on even greater salience in the light of the recent announcement by the Minister for Labour, Mr O'Leary concerning the establishment of such joint management-worker boards in semi-State bodies and the imminent emergence of such developments in industrial organisations. Though this development is well advanced in most EEC countries, it is a relatively new phenomenon in Ireland, but one which will probably develop rapidly in the very near future. Although the topic of this study is highly applied in nature, it also has some theoretical implications. In particular, Davis (1975, in press) has shown that status is by far the most important determinant of social acceptance or rejection in an Irish sample (cf. Exhibit F). Thus, we have hypothesised that status will play a similar role

Exhibit E

Table 1.

Summary of Analysis of Variance Results for 3 BD Factors

Sums of Squares and F Ratios for Main Effects of Race, Personality, and Belief.

Source of Variance	df	Factor I Acquaintance Acceptance vs. Rejection		Factor II Friendship Acceptance vs. Rejection		Factor III Social Distance	
		SS	F	SS	F	SS	F
Race	1	14.57	9.39**	17.12	10.20**	138.69	95.51**
Personality	1	602.33	388.25***	1351.6	805.50***	976.14	672.21**
Belief	1	1.87	1.21	2.37	1.41	.96	.66
Residual	300	1241.1		1342.4		1161.7	

- * = significant at the 0.05 level.
- ** = significant at the 0.01 level.
- *** = significant at the 0.001 level.

Excerpt from Davis, E. E., and Goldstein, M., Attributions of Race, Belief and Personality Characteristics as Determinants of Behavioural Intentions, Paper read at the 82nd Annual Convention of the American Psychological Association, New Orleans, La., 3 September 1974.

Table 5a

Summary of Analysis of Variance Results for Design 1.

Sums of squares and F ratios for main effects based on the dependent variables of composite scores of 8BD factors

(N = 44)

Excerpt from Davis, E. F. A Study of the Structure and Determinants of the Behavioural Component of Social Attitudes in Ireland, Dublin, Economic and Social Research Institute, Paper No 89, August 1975.

Source of Variance	df	Factor I Intimate Social Acceptance <u>vs.</u> Classical Social Distance		Factor II Marital-Sex Attraction <u>vs.</u> Rejection		Factor III Benevolent Concern <u>vs.</u> Lack of Concern		Factor IV Deference with Anxiety <u>vs.</u> Non-Deference		Factor V Respect <u>vs.</u> Non-respect		Factor VI Public Social Acceptance <u>vs.</u> Public Social Distance		Factor VII Subordination <u>vs.</u> Superordination		Factor VIII Belief Acceptance <u>vs.</u> Rejection	
		SS	F [§]	SS	F	SS	F	SS	F	SS	F	SS	F	SS	F	SS	F
Nationality	1	4.63	2.14	.08		4.87	1.62	.01		4.22	3.50	3.79	3.93*	.63		3.62	2.76
Sex	1	3.52	1.63	154.96	30.49***	7.06	2.35	1.43	1.11	.65		1.17	1.21	4.45	2.29	.94	
Religion	2	22.16	5.13**	11.16	1.10	2.58		.97		5.03	2.08	3.13	1.62	2.37		1.29	
Status	1	336.31	155.71***	158.42	31.17***	44.34	14.96***	35.01	27.10***	125.30	103.71***	118.80	123.02***	738.33	380.19***	.02	
Residual	1032	2228.9		5245.3		3094.1		1333.0		1246.7		996.56		2004.2		1355.2	

* = significant at the 0.05 level

** = significant at the 0.01 level

*** = significant at the 0.001 level

§ F ratios less than 1.00 omitted.

as a determinant of the behavioural intentions in an Irish sample as race does rather consistently in white American samples which we have studied. Furthermore, this study was so designed as to directly test the hypotheses which were confirmed by Davis and Goldstein (1974), with the difference that we were using an Irish sample and using status instead of race. Thus, a study which is of a very applied nature can also have important theoretical implications.

Summary

I have tried, briefly, to review some of the basic principles involved in research methodology, in terms of what has come to be known as the modern scientific method. Obviously, a more complete treatment of this very complex and intriguing area would require much more space than is available here. I can only refer you back again to some of the more standard texts (e.g. Cohen and Nagle, 1934; Kerlinger, 1973).

In addition, I have tried to illustrate the manner in which the processes of induction, deduction and hypothesis testing interact in a complex interplay in actual research by trying to retrace for you the thought processes and research processes which I and some of my colleagues went through in conceptualising and carrying out a series of interrelated studies on a particular issue which bears on one of the fundamental questions of social psychology, namely the bases "on which human beings express social acceptance or rejection of their fellows" (Goldstein and Davis, 1972, p. 355). Finally, I have tried to illustrate the difficulties in deciding on research strategies and statistical techniques and have also sought to show the very close relationship between applied research and the theoretical implications which such research can have for fundamental questions in a given discipline.

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