

Predictive Analysis: The Delphi Method

The Delphi Method is one of several analytic techniques used to make estimates or predict future human behavior or human conditions.

The Delphi Method takes its name from the legend of the Oracle at Delphi in ancient Greece. According to the legend, those wishing to gain a glimpse into the future would gather in a special chamber deep within a temple dedicated to the god Apollo located in the coastal town of Delphi. The crowd would listen to “the Pythia,” a woman, obviously in an entranced state, perched on a three-legged stool, who channeled prophetic messages from the deity through the temple’s priests. The priests translated the Pythia’s otherwise unintelligible utterances. Thus, the ancient priests were the “experts” in interpreting the Pythia’s messages about the future. (Note: Recent scientific investigation reveals that the Pythia’s entranced state could have been due to gaseous emissions along tectonic fault lines in the Delphi region—whether the oracle could see the future is another matter.)

The Delphi Method of estimation or prediction is also based on asking the “experts” about the future. Its central assumption offers that the collective judgment and wisdom of several experts is better than the estimates and predictions of any one expert. Developed originally by the RAND Corporation, the Delphi Method is a technique for eliciting and combining judgments systematically from a group of experts.

The basic Delphi Method begins with a series of first round questions asked individually of experts on the subject. The experts submit their judgments. The results of the first round judgments are then tabulated and the results sent back to the experts for modification. In essence, the experts are asked in the second round to reevaluate their original judgments in light of the average estimates calculated in the first round. This procedure of reevaluation is continued for several rounds until a fairly high degree of consensus is reached, or until the experts no longer modify their previous estimates.

The Delphi Method questions are commonly transmitted as part of a mail survey. Following normal procedures for constructing survey questions, the researcher must ensure that questions provide good operational measures of the concepts they are trying to estimate or predict. If possible, it is best to use interval or ordinal measured questions to facilitate returning measures of central tendency (mode, median, mean) to the experts in subsequent rounds. The use of Likert, Guttman, or other scales for question answers is common. In the second round of the survey, the experts are normally given only the measures of central tendency for the answers to the questions in the first round, and asked to explain in detail when their second round judgments (answers) differ substantially from the first round’s measures of central tendency. This same procedure, asking for details of why subsequent judgments differ widely from the previous round’s measures of central tendency, is also used in following rounds—however, in the third and following rounds the reasons given by experts when their answers vary from the central tendency are included in the package returned to the experts. Most Delphi’s require at least three

rounds, however, five to six rounds are not uncommon. In most Delphi surveys the expert participants are not aware of the identities of other experts in the study.

Another technique for administering a Delphi survey is through a modified focus group. Here, the experts are allowed to interact face-to-face in the combined focus group sessions where the issues and answers to surveys are discussed. However, even with this technique, the actual survey questions should be answered by the experts in private. It is also possible to administer Delphi surveys through the Internet, or using the Internet for answering questions combined with use of chatrooms or bulletin boards for expert discussion. For near-real-time Delphi surveys, the researcher can use spreadsheet software to immediately evaluate Internet answers and provide immediate feedback to live discussion chatrooms.

The major advantage to use of the Delphi Method is that it permits the researcher to obtain an objective consensus of expert judgment on the subject under study. It also makes the rationale underlying a specific estimate or prediction explicit for everyone.

The main weakness of the Delphi Method is that a truly perspicacious expert's judgment might be lost when a consensus that actually represents a range of judgments is presented. Therefore, it is important to include judgments outside the consensus in footnotes or appendixes, as appropriate. Another weakness is that in face-to-face Delphi sessions, "Group Think" problems such as bandwagoning may occur. For example: some experts may be swayed more by the rhetoric or strength of personality of one expert and tend to discount the validity of other expert arguments.

The Delphi Method is just one of several techniques for generating estimates or predictions. Before deciding which method to use, the researcher must first know the type of human behavior or human condition they are trying to estimate or predict. Some may be short-term, unique behaviors (coups, terrorist attacks, war starts, policy adoptions, etc.)—which are appropriate for Delphi use. Continuous behaviors, those once started that normally have a predictable sequence of events or set process, require other techniques. Finally, recurring cyclical behaviors, i.e., occurrences just short of inevitable, also require other techniques. Table 1 provides a summary of predictive techniques applicable to differing behaviors. Rational Choice methodology (summarized in a separate class handout) is another method that may be used in predictive analysis.

After Table 1 you will find an article entitled "**The Delphi Technique and Its Uses In Social Science Research**" which provides additional information on using the Delphi Method.

Table 1: Summary of Predictive Analysis Methods

Predictive Analysis Technique	Type Behavior Being Predicted		
	Short-term, Unique Behavior (coups, terrorist attacks, war starts, policy adoptions, etc.).	Continuous Behavior (once started normally have a predictable sequence of events or set process).	Recurring, Cyclical Behavior (occurrence is just short of inevitable).
Extrapolation, Trend Analysis			X
Mathematical techniques (statistics: OLS, Logit, etc.)			X
Bayesian Analysis	X		X
Formal Modeling (Rational Choice, Gaming, Chaos-Complexity-Catastrophe theories)	X		X
Probability Diagrams, Decision Trees	X	X	X
Cybernetic Models, Systems Analysis (flow charting, linear programming, etc.)		X	
Delphi Method	X		
Alternative Futures (hypothesized or alternative scenarios, thought experiments, simulations, risk and threat analyses, etc.)	X	X	
Cognitive- Psych (psycho-history, psycho-linguistic, motivational models, etc.)	X	X	
Analytic Hierarchy Process	X		
Lockwood Analytic Method for Prediction (LAMP)	X		

The Delphi Technique and Its Uses In Social Science Research

An updated revision of Strauss, H. J. & Zeigler, L. H. (1975). The Delphi Technique and its uses In social science research. *Journal of Creative Behavior*, 9, 253-259.

Note: This article gives some basic information on the Delphi technique, but most of the applications mentioned involve using the technique several times in order to achieve understanding of an issue. In the Psyc 413 Lab Project we'll only be using it once because of the lack of time. Notice how the multiple iterations allow for much deeper analysis of the participants' views.

In spite of its conjuring images - soothsayers, Greek gods, and the like - the Delphi technique is a rather simple and straightforward technological innovation. Named by its RAND Corporation innovators after the greatest of all Greek oracles, Apollo's Delphic Oracle, the Delphi technique is a method for the systematic solicitation and aggregation of informed judgments from a group of experts on specific questions or issues. This paper is a discussion of the technique: its uses, its misuses, and its future.

Generally, there are three types of Delphis: numeric, policy, and historic. The goal of the *numeric* Delphi is to specify a single or a minimum range of numeric estimates or forecasts on a problem. The goal of the *policy* Delphi is to define a range of answers or alternatives to a current or anticipated policy problem. And, the goal of the *historic* Delphi is to explain the range of issues that fostered a specific decision or the identification of the range of possible alternatives that could have been poised against a certain past decision.

According to Turoff (1970), there are four possible objectives or secondary goals, for any Delphic exercise, namely:

1. To explore or expose underlying assumptions or information leading to differing judgments;
2. To seek out information which may generate a consensus of judgment on the part of the respondent group;
3. To correlate informed judgments on a topic spanning a wide range of disciplines;
4. To educate the respondent group as to the diverse and interrelated aspects of the topic.

A Delphic exercise can encompass any one or combination of these objectives. Indeed, the Delphi technique can be used as a means for soliciting interpretations, predictions, or recommendations.

Regardless of objective or goal, all Delphis hold a number of characteristics in common:

1. All Delphis use panels of experts for obtaining information or data. (Delphis are founded on the old premise that two heads are better than one.)
2. All Delphis are conducted in writing.

3. All Delphis systematically attempt to produce a consensus of opinion, as well as--and sometimes more importantly--identify opinion divergence.
4. All Delphis guarantee the anonymity of both the experts and identification of the expert's statements throughout the exercise.
5. In extended use of the technique, Delphis use iteration and controlled feedback to converge on consensus or divergence. Participants are permitted to review and revise their statement after reading the statement of their peers, as well as evaluate all statements, reducing intentional and unintentional "noise" within the exercise, i.e., irrelevant, nonproductive and potentially frustrating communication.
6. Extended Delphis are conducted in a series of rounds between which a summary of the results of the previous round is communicated to and evaluated by the participants. The second and successive rounds often produce "a narrowing of the initial spread of opinions and shifting of the median If no consensus emerges, at least a crystallizing of the disparate positions usually becomes apparent" (Gordon, 1971).
7. As Enzer *et al.* (1971) observe, Delphis are usually better than other methods for eliciting and processing judgmental data, since they a) maintain attention directly on the issue, b) provide a framework within which individuals with diverse backgrounds or in remote locations can work together on the same problems, and c) produce precise documented records.

Perhaps the most common and basic Delphic exercise is the **numeric Delphi** which solicits quantitative estimates of dates, amount, or values, e.g., the size of the world population in 1990 or the year in which computers will have the complete built-in capacity for self-repair.

An example will illustrate: In 1964 Robert Ament (1970) conducted a long-range forecasting study utilizing the numeric Delphi. This study solicited estimates from a panel of scientists and technicians on scientific breakthroughs in physical and biological technologies, world population growth, innovations in automation, progress in space, new weapon systems, and the causes and preventions of war. The Delphi was repeated in 1969. Though the panels were composed of different sets of experts, Ament found both panels' forecasting behaviors to be quite similar: in both the 1964 and 1969 surveys, the length of the quartile range was about equal to the distance into the future of the median forecast. In spite of five years between forecasts, he found a) a relative consistency of the forecasts, b) a shift to earlier median dates of many of the biological forecasts and to later dates of several space forecasts, and c) a similar forecasting behavior, at least in terms of the spread of opinion, as a function of median time in the future. Ament's data are typical of those produced in the numeric Delphi.

Policy Delphis, unlike numeric Delphis, produce verbal rather than numeric data. Policy Delphis are most commonly used to supplement or to stimulate the committee approach. "Its goal in this function is not so much to obtain a consensus as it is to establish all the differing positions advocated and the principal pro and con arguments for those positions. It allows the utilization of larger numbers of people than can effectively be employed by the committee approach Once the Delphi has been accomplished, a small workable committee can utilize the results to formulate the required policy" (Turoff, 1970). Thus, policy Delphis can operate as precursors to committee activity.

The **historic Delphi**, which the authors have developed and dealt with extensively, is a relatively new Delphic approach (Strauss, 1973; Strauss & Zeigler, 1974). In developing this Delphi variation, we wanted to examine systematically the great political philosophers of the past and apply their wisdom and logic to a solution of contemporary and anticipated societal problems. We selected ten classical political philosophers as our foci for study, namely, Plato, Aristotle, Hobbes, Machiavelli, Swift, Burke, Rousseau, Locke, Marx and Freud.

The Delphi was a simulation of sorts. Our panels of experts--usually well-published university professors--were asked to be surrogates for the classical political philosophers for whom they claimed their expertise. Thus in our historic Delphi we used ten different panels, corresponding to the ten classical political philosophers, composed of six experts per panel. A questionnaire was prepared consisting of 42 three part problem statements. Each problem statement reflected a different issue confronting contemporary Western society, e.g., issue areas like crime and violence, civil rights, welfare, and race relations. (For the most part, areas of inquiry were suggested by Schultze *et al.* (1972), Helmer (1972), and Little & Gordon (1971).) At the head of each page, a problem statement was presented, followed by a standard three-part query, each portion requiring a short written response from the expert. Part one of each statement followed the following pattern: "In general, what was political philosopher "x's" view on problem statement "y"?" Part two: "Based on your knowledge of political philosopher "x," how would he have reacted to the problem statement in his own time? And part three: "If alive today, how would political philosopher "x" resolve this problem?" The same questions were presented to the experts in each panel.

After receipt of the completed questionnaires, we prepared the second iteration. In this second round, the responses of each expert panel were collated into a multiple choice format, which resulted in ten summary questionnaires for each of the ten different panels. Each questionnaire consisted of an anonymous multiple choice listing of the responses of each of the experts for their respective panel. In other words, each of the ten new questionnaires was a composite of all the panel's responses from the previous round.

The experts were then asked: On a five-point scale from strongly agree to strongly disagree, to what extent do you agree or disagree with each response? Hence, in this second round, each expert was able to evaluate the answers of his peers, which were listed anonymously, as well as was given the opportunity to reevaluate and revise his own response made in the previous round.

The careful reader will note that these three questions are structured in a way which parallels Guttman's (1959) three basic facets: subject's behavior, referent, and referent's intergroup behavior. These data are thus susceptible to facet design and technique which can be used to examine the belief-behavior universe of a particular philosopher or group of philosophers.

The product of this academic exercise was the development of a range of options or solutions to the specific contemporary problems. Each set of options was advocated by each group of experts in light of their respective philosophers. Our historic Delphi, thus, produced a distinct group of options for the solution of contemporary and anticipated problems--all based upon our philosophical heritage.

In designing the historic Delphi, we attempted to develop a fresh and meaningful approach to policy and political analysis based upon our philosophical heritage. Second, we wanted to resurrect a massive body of knowledge and political philosophy and legitimately use it for the resolution of present and anticipated societal problems. Third, and finally, we attempted to develop a format in which students of political science--future policy problem-solvers and policy-makers--could better understand political philosophy, placing it in a new and relevant context and, as important, force them to think about and apply that new-found knowledge to contemporary and future society.

Though at first glance the Delphi technique might look rather intriguing or appealing to the social science researcher, there are some problems and limitations that should be pointed out. As Enzer et al. (1971) observe:

1. Delphis are usually slow and time-consuming. If the Delphi is carried out through the mails with a large panel, each round could take several months. If it is conducted in a conference environment, the preparation of rounds and collation of responses could be matter of hours.
2. It may lack the stimulation provided by face-to-face encounters. Nobody can deny that a successful "brain-storming" session often produces a momentum and enthusiasm which can stimulate new, creative ideas. On the other hand, as Janis (1972) points out, such sessions can work against long-term success.
3. The intermediary (or the respondents themselves) may misunderstand the brief written inputs of the panel members.
4. The technique's theoretical foundations may be misunderstood by the participants.
5. The panel of experts could be too homogeneous or like-minded, thus producing a skewed data set.

Sackman (1974) goes further in articulating the problems of the Delphi technique, as used in its conventional (numeric) vogue. In this well-developed polemic, Sackman argues that Delphi practitioners have few professional standards on which to base their empirical findings. He concluded with a series of ten statements which point out Delphi's general failings, as well as specific areas for further Delphi methodological research:

1. The Delphi's concept of the expert, and its claim to represent valid expert opinion, is scientifically untenable and overstated.
2. Delphi claims of superiority of group over individual opinion, and of the superiority of remote and private opinion over face-to-face encounter, as well as their counter statements, are unproven generalizations.
3. Delphis consensus is specious consensus.
4. Delphi questions are likely to be vague.
5. Delphi responses are likely to be ambiguous.
6. Delphi results probably represent compounded ambiguity.
7. Delphi is primarily concerned with transient collections of snap judgment opinions of polled individuals from unknown samples, which should not be confused or equated with coherent predictions, analyses, or forecasts of operationally defined and systematically studied behaviors or events.

8. Delphi anonymity reinforces unaccountability in method and findings.
9. Delphi systematically discourages adversary process and inhibits exploratory thinking.
10. Delphi has been characterized by isolation from the mainstream of scientific questionnaire development and behavioral experimentation, and has set an undesirable precedent for interdisciplinary science in the professional planning of policy studies community.

The Delphi technique and its variants are still in the developmental and refinement stage. One of Delphi's greatest virtues lies in its simplicity: advanced mathematical skills are not necessary for design, implementation, and analysis of a Delphi project. A current need is that of a creative project designer who is aware of the problems of Delphi technology as it stands today.

In the social sciences Delphi has the potential for being used and molded in many varied ways. It can be used as committee output, input, or designed as a committee evaluation tool. In terms of forecasting its uses are varied. Moreover, Delphi can be developed into a rather simple tool for the examination of the effectiveness of policy processes, as well as a vehicle for the formulation, development, and assessment. Based on this view we see greater utilization and more imaginative and creative uses for the technique and its methodology.

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