APPENDICES

APPENDIX ONE

The Documentary Coding Method
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The rules for the derivation of cognitive maps from documentary material are set forth in this manual for coders. These are the rules used in the three empirical studies by Axelrod, Ross, and Bonham and Shapiro. The high level of intercoder reliability achieved by these coding rules is discussed in Chapter 4.

This coding manual is useful not only for explaining what has already been done, but also for showing future researchers exactly how cognitive maps can be derived from documentary sources. Many such projects are suggested in Chapter 10, and a variety of suitable source material is cited in Appendix 5.

The coder's job is one of encoding.[1] The coder must scrutinize an assigned primary resource text in an effort to record all cause-effect relationships within the text into a more formal body of relationships. To accomplish this, the coder must be provided with a comprehensive set of decision rules appropriate for the solution to any problems that might arise. Before presenting these decision rules it might be helpful to set the coder's job in its total context. Coding is the first step in the process of building a cognitive map. The cognitive map is used to analyze the assertions of

[1] These coding rules are the direct descendants of the original rules developed by Robert Axelrod and the more extensive coding instructions written under his supervision by Jeffrey Hart. I learned those rules as a coder for the Eastern Committee Project (Chapter 4), and wrote a second version while serving as Matthew Bonham's research assistant. The present revised edition I wrote during the period I was research assistant to Robert Axelrod. This final set of rules differs principally by the addition of some directions for special cases and by providing what, I hope, are more easily understood explanations based on new examples. I would like to thank Professor Bonham for his editorial help and to acknowledge Professor Robert Axelrod, Stan Bernstein, and especially Stuart Ross for their invaluable criticism and advice on this latest effort.

All new material is marked for identification.

a given decision maker. The end product of the analysis is a cognitive map. This map is a graphic representation of the decision maker's views on a given subject (or subjects) about which he has expressed verbal or written opinions. Its most basic building block is the "relationship," which is one statement having a subject, or cause concept, related positively or negatively to an object, or effect concept. Because each different relationship is connected to others by matching common cause or effect variables until all relationships are depicted graphically, the coder's accurate account is important for a correct representation of the speaker's viewpoint.

The presentation and resolution of all possible relationship variations that the coder might face is best approached in terms of sample problem case studies.[2] Even so, a general explanation of the nature of the coder's job and the way in which he should approach the text is important.

The most successful coder is the one who has internalized a dual outlook. That is, he is at once perceiving the text structurally and by content. As stated, the sentences, phrases, or paragraphs that are of interest to the coder are those that assert a causal relationship. In other words, a given subject "A" affects, either positively or negatively, a given object "B." In English grammar, the simple sentence structure paralleling this relationship is Subject/Verb/Object. In coder terminology the most basic structure is: "Cause Concept/Linkage/Effect Concept." The most simple sentence type, for example, would be, "Nuclear escalation harms world peace." It is asserted that the cause concept, "nuclear escalation," has a negative linkage to, or "harms," "world peace," the effect concept. In this case the structure of the sentence itself serves as the guide to the coder's transcription of the relationship. As this example illustrates, the coder must keep the basic structure, "Cause Concept/Linkage/Effect Concept," in mind at all times when examining a text in order not to miss a single relationship. This is important, for the validity of the project rests upon a successful account of *all* relationships. Of course, not all sentences or relationships are this straightforward, but all sentences that contain some relationships are variations of the simplest type.

The basic form of a relationship is, as stated, "Cause Concept/Linkage/Effect Concept." The cause concept and the effect concept must be represented as variables, which have the potential to take on different values. For example, "the amount of British strength" is a valid cause or effect concept, since such strength can be great or small. An entity such as "Britain" is not a valid concept, since it can take on no other values.

[2] No sample sentences are taken from documentary material. Neither are they paraphrased from the materials used in any of the studies in *Structure of Decision*.

In coding concepts as variables, the alternative values of the variables (for example, "great" and "small") need not be specified if they are clearly understood. When the other values of a concept variable are not clearly implied by its formulation, they must be explicitly included in the description of the variable, as in "buying food" (rather than buying luxuries).

In a few cases no structural analysis will insure a correct coding of the relationship. Some relationships are implicit in the phrase, sentence, or group of sentences. These cases are those in which the phrase, sentence, or sentences do not constitute relationships in a grammatical, structural sense. These situations present the most difficult types of coding problems. They are best approached by content analysis. In content analysis the critical question to ask is, "Does the thrust of the phrase, sentence, or sentence group imply a relationship?" A simple example is, "The most dangerous thought by the Ukrainian people is revanchism." There is no structural relationship; nevertheless, the implication is that "revanchism" is bad for the Ukraine. Thus, a relationship must be coded.

A coder must attempt to maintain the original language as faithfully as possible. At times, this effort may involve rather extended writing of concepts; nevertheless, it is important that the coder list the entire concept, complete with adjectival or adverbial clauses, so that its meaning may not be distorted later.

The importance of maintaining the original language is equaled by the need to reflect the speaker's statements in kind and number. Thus, if the speaker states a relationship two or more times, the coder should also. If a document includes contradictory statements, they must each be recorded. Moreover, refutations of relationships are not recorded as relationships. If the speaker, for example, states a relationship and then terms it spurious, the relationship is from his view invalid and not, therefore, codable. If, however, after such a refutation the speaker then asserts the correct view of the relationship as he perceives it, this should be recorded. A good rule to follow in these cases would be, "Denotation rather than interpretation."

If a speaker agrees with an assertion made by someone else, a

judgment must be made by the coder. If the coder believes that the assent indicates the speaker takes on the assertion as his own, it is coded as an assertion of the speaker. "Yes, I think so too," would be so coded. A passive "uh-huh" or "O.K." may simply indicate acknowledgement. These ambiguous passive assents must not be coded unless they are in response to a question requesting or demanding explicit agreement with the assertion, such as "You agree this is true, don't you?"

With regard to structural assertions, the language of the original sentence is almost always easily preserved. For example, "The existence of a peaceful, strong, and unanimously supported Swiss foreign policy is of great benefit to the current Swiss position in world affairs." The structure of the sentence itself is such that the coder has no trouble denoting both cause and effect concepts exactly as they have been stated by the writer. The cause concept is, "The existence of a peaceful, strong, and unanimously supported Swiss foreign policy." The effect variable is, "the current Swiss position in world affairs."

Some assertions may require coders to paraphrase the original words in order to achieve the form, "Cause Concept/Linkage/Effect Concept." A simple example of this sentence type would be, "We know the decisive importance of mutual trust in international affairs." The sentence, once again, structurally establishes no direct cause-effect relationship; yet, from a contextual viewpoint we see that "mutual trust" carries a decisive importance for international affairs. Thus, the relationship is: "mutual trust/decisive importance for/international affairs." Such paraphrasing, maintaining as much of the original language as possible, presents no necessary inaccuracy between coders because the relationship has been denoted. Moreover, the process by which these initial concepts are ultimately merged into broader categories of variables guards against comparative inaccuracy. This process will later be explained.

The chief danger of content analysis is that a coder may, in his search for assertions, impute his own assumptions into coding to create assertions. The danger of overzealously creating relationships that have no basis in the text is twofold. First, it immediately introduces coder bias and text distortion. Second, it opens the door to comparative coder incongruence. This problem becomes increasingly dangerous when the coder becomes familiar with the speakers' viewpoint. When this is the case, the coder may see a

relationship where there is none, simply because he is familiar with the cause-effect relationship that he has seen a number of times previously. In this instance, he must be careful not to code spurious implications. Once again, the rule, "Denotation rather than interpretation" applied. Moreover, because of the dangers involved in searching for the elusive assertion, a rule of thumb in content analysis is never to paraphrase an assertion that must be drawn from more than a few sentences. Do not, certainly, look for assertions by linking paragraphs.

When a coder wishes to analyze a large text, one of several pages or more, he should set up his clerical techniques in detail and in advance. Without a system of abbreviations and clear, well constructed coding sheets, he will soon be lost in his notes. Good preparation saves later backtracking.

There are eight types of structural relationships, as well as numerous special cases of relationship problems. In the following pages, abstract and concrete examples will be presented, followed by a step-by-step resolution.

Before examining the eight types and special cases, a word about linkages is useful. Thus far, we have presented only two types of linkages, "plus" and "minus." Nevertheless, there are five other symbols that may be of use to more rigorous coders, for all linkages do not fit comfortably into a simple plus-or-minus world. They are:

⊕ will not hurt, does not prevent, is not harmful to
⊖ will not help, does not promote, is of no benefit to
a may or may not be related to, affects indeterminately
m effects in some non-zero way
0 does not matter for, has no effect on, has no relation to.

Occasionally, a speaker will not actively promote or discourage a policy. When he speaks in this passive manner he asserts that a given policy is "not bad" without saying "it is good," and vice versa. The general linkages of "⊕" and "⊖" are useful in these cases. When the relationship exists, but has an indefinite linkage, the symbol "a" is applicable. Finally, when the cause and effect are unrelated, according to the speaker, the symbol "0" is useful. Sample sentences might be as follows:

"The Mayor's labor policy would not hurt his political support."

the Mayor's labor policy	/⊕/	Mayor's political support

"Violent picketing would not be beneficial to the negotiations."

violent picketing	/⊖/	negotiations

"The Mideast War will affect trade negotiations in ways not yet forseen."

Mideast War	/a/	trade negotiations

"We can be sure that adoption of the new rules will affect the outcome of the meeting; whether it is good or bad is not known."

adoption of new rules	/m/	outcome of the meeting

"These new tariff laws will have no effect on the American economy."

new tariff laws	/0/	American economy

Each of these additional symbols allows the coding of a greater variety of phrasings; each may occur in any of the simple or complex linkage structures outlined in this text.

SIXTEEN CASE STUDIES

A. SIMPLE CAUSE CONCEPT/SIMPLE LINKAGE/ SIMPLE EFFECT CONCEPT

Sample sentence: "Our present topic is the militarism of Germany, which is maintaining a state of tension in the Baltic Area."

1. The first step is the realization of the relationship. Does a subject affect an object?

2. Having recognized that it does, the isolation of the cause and effect concepts is the second step. As the sentence structure indicates, "the militarism of Germany" is the causal concept, because it is the initiator of the action, while the direct object clause, "a state of tension in the Baltic area," constitutes that which is somehow influenced, the effect concept.

3. The linkage, which indicates the nature of the relationship, must be established. If the relationship is one that negatively influences the effect concept, the relationship receives the linkage indication, "minus." If, on the other hand, it is positive, the linkage is denoted by the sign, "plus." In this case, the linkage words, "is

maintaining," indicate a positive relationship, "plus." Thus the final relationship is coded as follows:

the militarism of Germany	/+/	maintaining a state of tension in the Baltic area

B. SIMPLE CAUSE CONCEPT/SIMPLE LINKAGE/ COMPLEX EFFECT CONCEPT

Sample sentence: "The development of international cooperation in all fields across ideological frontiers will gradually remove the hostility and fear that poison international relations."

1. This example is illustrative of a double object, single subject relationship. In such situations, the object must always be coded separately; that is, the list of coded concepts must contain no double effect relationships.

2. The causal concept is "The development of international cooperation in all fields across ideological frontiers," because it is the initiator of the relationships.

3. The effect concepts seem to be "hostility" and "fear." However, as has previously been mentioned and should now be recalled, all concepts must be rigorously denoted, including all adjectival and adverbial clauses. In this case, the adjectival clause modifying both fear and hostility is, "that poison international relations." Because the clause adds greater information to the total concept's meaning, it must be included as a clause of both "fear" and "hostility" concepts. Thus, the two effect concepts are "fear that poisons international relations" and "hostility that poisons international relations." With regard to adverbial and adjectival clauses modifying concepts, it is a good practice for the coder to include all such clauses regardless of his personal opinion of their relevance. By this method, all concepts will be more likely to retain their original, full meaning.

4. The linkage is, as the verb structure indicates, "will gradually remove." Because "remove" indicates taking away something over time, the linkage is a negative one and is indicated by "minus."

5. Thus, finally, there are two distinct relationships to be coded in this case. They are as follows:

the development of international coopera-	/−/	hostility that poisons international relations

tion in all fields across ideological frontiers		
the development of international cooperation in all fields across ideological frontiers	/−/	fear that poisons international relations

6. It should be noted that, as has been done above, the cause concept should be rewritten for each relationship as part of good clerical practice.

C. COMPLEX CAUSE CONCEPT/COMPLEX LINKAGE/SIMPLE EFFECT CONCEPT

Sample sentence: "We note the success we have achieved in our endeavors to safeguard Finland's security, not by the dangerous expedient of relying on military means, but by gaining the confidence of the great power which is our neighbor, by maintaining friendly relations with all countries near and far, by dissociating ourselves from the conflicts of interests and tensions between others and by adhering faithfully to all obligations undertaken."

1. The first aspect the reader notices is that a contrast is being set up through the sentence structure. In such cases there will always be two linkages, one positive, the other negative. The words, "not by relying on" and "but by" set up this contrast in the sample sentence and their linkages are therefore, "minus" and "plus," respectively.

2. How many subjects, cause concepts, are there? To what linkages are they connected? "Relying on military means" is linked by "not by," and thus it carires a negative value. The other cause concepts are "gaining the confidence of a great power which is our neighbor," "maintaining friendly relations with all countries near and far," "dissociating ourselves from the conflicts of interest and tensions between others," and "adhering faithfully to all obligations undertaken." Each of these concepts is linked structurally to "but by" and their linkage is, thus "plus."

It should be noted that "by" and other such words precede cause concepts rather than effect concepts. "By," "from," "because of," and other words and phrases of this type create structural reversals in sentence structure. The diagrammed sentence will always carry the noun clause which follows these words as the subject of the

sentence, the initiator of the action. The coded phrase also carries these noun phrases as the cause concepts as well. In grammar, as in coding, this is done in order to maintain the logic of the relationship in the sentence.

3. There is only one effect concept among these multiple cause concepts, which is, "the success we have achieved in our endeavors to safeguard Finland's security."

4. Because none of the cause concepts is meaningfully or structurally dependent upon another for maintenance of the stated relationship, the relationships are all coded separately. Thus, the final coding is as follows:

military means	/−/	the success we have achieved in our endeavors to safeguard Finland's security
gaining the confidence of the great power which is our neighbor	/+/	the success we have achieved in our endeavors to safeguard Finland's security
maintaining friendly relations with all countries near and far	/+/	the success we have achieved in our endeavors to safeguard Finland's security
dissociating ourselves from the conflicts of interests and tensions of others	/+/	the success we have achieved in our endeavors to safeguard Finland's security
adhering faithfully to all obligations undertaken	/+/	the success we have achieved in our endeavors to safeguard Finland's security

D. EITHER/OR RELATIONSHIPS

Sample sentence: "Either the Soviet Union pursues the policy of detente with the United States or it must obtain guarantees for its security by a continuation of the Cold War."

1. Either/or assertions automatically indicate two relationships. Thus, the coder must look for several concepts. It is not always necessary for the coder to look for the cause concepts first, the

linkages second, and the effect concepts last. He or she may look for each in whatever order seems most appropriate. In this sample sentence, for example, let us look for the effect concepts first.

2. What is the object or effect concept? In cases that are not clear-cut, such as this one, the question to ask is, "What is receiving the action?" In this sentence it is "guarantees for its security." As will be explained, no pronouns are to appear in concepts; thus, the correctly coded effect concept is, "guarantees for the Soviet Union's security." We already know that because this is an "either/or" type of sentence that two relationships exist. Is there then a second effect concept? Because none is readily apparent, the coder may leave the search for the present and later, having isolated the cause concepts, see if other effect concepts are necessary for recording the coded relationships.

3. The subject concepts are not immediately clear, either. In this situation, the question to ask is, "What is affecting 'guarantees for the Soviet Union's security?' " In this case we realize that there are two optional alternatives in the phrases, "either the Soviet Union pursues the policy of detente with the United States" and "or by a continuation of the Cold War." Although, in a crude sense, these may be construed to be concepts as they are written, they do not constitute properly phrased concepts in the ideal sense. In this case, as in all cases involving unsatisfactory concepts, a paraphrasing or revision of the original structure to achieve the more easily recognized cause concept form is necessary. Thus, "either the Soviet Union pursues the policy of detente with the United States" is changed to form the more appropriate cause concept, "Soviet Union's pursuit of detente with the United States." Likewise, "or by a continuation of the Cold War" is changed to "Soviet Union's continuation of the Cold War."

4. The linkages in the original sentence, "it must obtain" and "by continuing," are both positive in meaning. Thus they constitute "plus" relationships. They are positive because they indicate that the implementation of either cause concept will have a positive effect on "guarantees for Soviet security."

5. All "either/or" relationships present a situation of exclusiveness between the relationships; the relationships are therefore independent of one another for their individual meanings. That is, for the linkage relationship to maintain, it is not necessary that both cause concepts act on the effect concept jointly. Examples of other interdependent cause concepts will be presented later; nevertheless, a simple example, at this point, may help to explain the differences between independent and interdependent cause concepts. Interdependent cause concepts are those for which a joint application is a prerequisite to affect the stated relationship on the coder's sheet. This statement means that together "A" and "B" will affect in a given way "C," but separately applied, neither will insure that same effect on "C." A sample sentence will illustrate. "Together, our neutral policy as well as other nations' confidence in it will maintain India's independence." Separately, the cause concepts do not necessarily insure maintenance of Indian independence. The coder must therefore be careful to code such examples jointly.

Independent "either/or" relationships, on the other hand, imply that the relationships are definitely distinct and must be coded as two separate relationships. Thus, the final coding of the sentence is as follows:

Soviet Union's pursuit of detente with the United States	/+/	guarantees for the Soviet Union's security
Soviet Union's continuation of the Cold War	/+/	guarantees for the Soviet Union's security

E. PROBABILITY RELATIONSHIPS

Probability relationships may occur in any sentence type; they differ only in that they indicate a probable positive or probable negative relationship. Key words to look for in probability relationships lie in the linkages that directly precede the cause or effect concepts. Some examples of words that indicate probability are: "likelihood," "little likelihood," "unlikely," "apt to," "liable to," "chance of," "chance that," "chance for," "probability that," "will probably," "might," "may," "could," as well as variations of these types. The coder should note, however, that words such as "should," "must," and "will have to" are not probability indicators, because they only express a desire that the relationship will maintain, not the probability that it will.

Sample sentence: "Russian shipment of arms to Portugal is apt to increase the chance of war on the Iberian peninsula."

1. The cause variable is "Russian shipment of arms to Portu-

gal." It is related to the effect variable, "the chance of war on the Iberian peninsula."

2. There is a single linkage between these concepts. It is indicated by the word "increase." The direction of the relationship is positive. The relationship is qualified by the probability indicator, "apt to." This qualification does not alter the direction but only the likelihood of the relation. The coding system allows the coding of direction. Probability modifiers do not affect the coding of the direction of the relationship when they indicate only increasing or decreasing possibility of application of the relationship. Such variation is not captured in the coding of assertions. The final coding is as follows:

Russian shipment of arms to Portugal	/+/	chance of war on the Iberian peninsula

Sample sentence: "Neutrality in the present stage of arms technique offers small states in an unfavorable geographical position a better chance of survival in a general war, than does an alliance with one of the nuclear, great powers, which offers less."

1. What are the effect variable and linkage? That is, what is being influenced in this sentence and how? Clearly, "offers" indicates a positive relationship to "survival in a general war," the effect concept. However, the coder should ask himself whether or not there is a phrase or word in the sentence that modifies the concept and in so doing adds meaning. In this case, "small states in an unfavorable geographical position" further defines the effect concept and, therefore, should be added. The final effect concept then is, "survival, in general war, of small states in an unfavorable geographical position."

2. There are two cause concepts offered for comparison in the sentence. Comparisons generally contain two relationships, one positive, the other negative, because they attempt to contrast two relationships. In this sentence, the two cause concepts are "neutrality in the present stage of arms technique" and "an alliance with one of the nuclear, great powers." The modifier mentioned above, "small states in an unfavorable geographic position," could also be added to these cause concepts because they further clarify and define the policies of neutrality and alliance as well as help maintain the speaker's logic.

3. The linkages "offers a better chance," and "than does, which offers less" connote the comparison of two probability relationships. In these cases the second concept to be compared is often obscured by the absence of a more obvious linkage, such as in the case of the first concept. This is often the case in English sentence structure. Phrases such as "than does" imply that the second concept included in the sentence is affected by the same linkage as the first but in a lesser sense. These sentence types in English are called complex/compound sentences. Having established the linkages, the coder must then ask himself, "Are the relationships positive or negative?" "Seems to offer a better chance" is unquestionably positive. Why, though, is "than does, offers less" negative? The comparison being made in this sentence implies that "neutrality, in the present stage of arms technique" offers a *better* chance. Consequently, "an alliance with one of the nuclear, great powers" offers *less* chance, indicated by the comparison, "than does." A hypothetical sentence indicating this comparison might read, "An alliance with one of the nuclear, great powers offers less chance for survival in a general war." Thus, the relationship indicated by *less* is negative. The final coding is as follows:

neutrality of small states in the present stage of arms technique	/+/	small states in a favorable geographical position survival in a general war
an alliance of small states with one of the nuclear great powers	/−/	small states in a favorable geographical position survival in a general war

F. PRONOUN CAUSE OR EFFECT CONCEPTS

The pronoun cause or effect concepts are those sentence groups in which the cause or effect concepts referred to are pronouns such as "this," "it," "that," "which," "he," "she," "they," or "we." Such pronouns refer to concepts that have been mentioned previously in the text. In these cases the coder must look to the text for the concept that the pronoun is replacing. This may or may not be closely connected to the sentence containing the relationship. Nevertheless, the concept referred to should be located and substituted for the pronoun in the denotation as coded.

Sample sentence: "It is reasonable, therefore, to revert once more to the proposal concerning an anti-ballistic missile system in

the hope that it may be taken as a step toward building up United States' security and reducing the risk of nuclear war."

1. The relationship in this sentence may be isolated in the phrase, "it may be taken as a step towards building up United States' security and reducing the risk of nuclear war." In the sentence the cause concept would seem to be "it." "It," however, is not meaningful or correct as it stands. Because "it" refers to the proposal concerning "an anti-ballistic missile system," the correct concept is "proposition of an anti-ballistic missile system."

2. There are two effect concepts, "United States' security" and "the risk of nuclear war." For the coder there can be no question of interdependence between the two concepts; the effect concepts must always be coded separately.

3. The linkages are "reducing" and "building up," "minus" and "plus," respectively. The coder should be careful not to confuse the relative "goodness" or "badness" of the concepts and the positiveness or negativeness of the linkage. That is, although the "risk of nuclear war" is universally accepted to be a bad thing, if its linkage is, for example, something that enhances the "risk of nuclear war," the relationship is still positive, "plus." If the linkage is negative, it is negative; the concept in no way affects the linkage.

4. The sample sentence contains one other pronoun, namely, the "it" at the beginning of the sentence. "It" is an example of an expletive, an idiomatic usage in which "it" stands as the subject of a sentence or phrase but carries no definitive meaning. Such idiomatic expressions are not relationships, and do not concern the coder. Thus, the final coding appears as follows:

the proposal concerning an anti-ballistic missile system	/+/	international security
the proposal concerning an anti-ballistic missile system	/−/	risk of nuclear war

G. CONTENT ANALYSIS

As has been mentioned, some sentence groups carry assertions that cannot be coded on the basis of their structure alone. For example, consider the following case:

Sample sentence: "The foreign minister's behavior has been entirely erratic. It is difficult . . . No, I would go even further. This department is now unable to plan rationally."

1. It is clear that there is a causal relationship; but what is it, and how should it be coded? Content analysis cases, once resolved, are coded in the same manner as all other problems. The coder should not attempt to handle these types of problems as casually and quickly as he or she would simpler structures.

2. That there is not a structural relationship between the two sentences is clear. As in most content analysis cases, in this example, the relationship between the behavior of the foreign minister and rational planning is not structurally linked (that is, there is no overt, structural causal linkage). The linkage is, however, implied by the logical content of the statement.

3. The relationship should be coded by including the implied linkage. In this case the linkage is a negative one because it is implied that the foreign minister's erratic behavior hurts rational planning in this department. The final coding is as follows:

the foreign minister's erratic behavior	/−/	this department's ability to plan rationally

H. INVERTED CAUSE/EFFECT RELATIONSHIPS

Some sentences contain relationships in reverse order. They may even carry transitive verb linkages that seem to indicate that they themselves are causing some action. However, a closer analysis often indicates that the verb linkages are actually not causal and transitive, but intransitive indicators of an effect relationship. Often, these verbs will indicate permission or some negation of permission. Other types are constructed, such as need or lack of need. Some of these constructions are such that the transitive verb clause is followed with "by," "from," "without," or "unless," for example.

Sample sentence: "Bulgaria's national interests do not permit ties, nor the pursuit of alignment with a pro-Western policy."

The cause concept would appear to be Bulgaria's national interests but, if this were the case, there is not an effect concept to form a sensible relationship. Bulgaria's national interests do not affect anything directly. The real causal variables are "ties with a pro-Western policy" and "pursuit of an alignment with a pro-Western policy." They affect Bulgaria's national interests in a

negative sense. The negative quality is denoted by negation of permission.

More abstractedly, this sentence is of the form, "anticipated consequences prevent policy adoption." Sentences stating relationships between the anticipated consequences of policies and the adoption of those policies should be coded "(adoption of) policy/relationship/consequence of policy."

ties with a pro-Western policy	/−/	utility of Bulgaria
pursuit of an alignment with a pro-Western policy	/−/	utility of Bulgaria

Sample sentence: "America cannot secure a permanent peace without the Russians' help."

This is an example of a transitive verb clause followed by "without." America's securing permanent peace again affects nothing. On the other hand, "the Russians' help" has an effect on America. Thus, the correct relationship is as follows:

Russians' help	/+/	America's securing a permanent peace

I. UTILITY RELATIONSHIPS

Utility relationships are those in which some cause concept has an effect on something or someone's well being or general utility. By utility we refer to those effect concepts that refer to the unspecified best interests of a person, institution, country, and so on. The utility concept must only be used when the benefit or best interest is unspecified. Almost all utility variables include a noun or noun clause and most refer to a proper noun. Such examples are France, the Democratic party, Indiana's well-being, British interests, and so on. They are preceded by modifiers indicating a positive or negative utility relationship. In utility relationships and situations these modifiers are actually indications of the nature of the linkage. Unlike other modifiers, they do not shed light on the concept itself, but on the relationship. Thus, for example, "cost of foreign policy" is a regular concept, while "peril of Finland" expresses a negative relationship of some cause concept to Finnish best interests. To use coder language, Finnish best interests are recorded

as "Finnish utility." Likewise, "economic prosperity of Finland," because it sheds light on a particular type of benefit, is not a utility variable, while "Finnish interests" may be translated into Finnish utility because the interests are general.

The coder should not begin immediately to associate terms such as "bad," "good," "advantageous," or "disadvantageous" with utility, although in special cases to be mentioned they may be. As has been stated, these types of words should appear as structural modifiers of a noun or noun clause, to qualify as utility linkages. Thus, whereas "his is a dangerous plan" is a utility statement, "in regard to Plan B, Plan A is dangerous" is not. It is the basic type of simple causal relation, with a negative linkage.

Understanding that noun modifiers shed light on utility, and that they indicate the positiveness or negativeness of a relation, will help the coder understand the following two types of utility relations:

In some specific contexts even less explicit statements may be interpreted as utility assertions. If an entire article or speech is about England, then such statements as "the policy is dangerous," or "the proposal ought not to be adopted," given without further specification, may legitimately be interpreted as having a negative linkage to "English utility."

Obviously "loaded" terms such as "tyranny" or "collapse of the army" may with safety be given a linkage to utility. The linkage, though not explicit, is implied in the choice of terms. The coder should take care to make such assumptions only in obvious cases, and to note "assumed" under the linkage on the coding sheets. One way to make this determination would be as follows:

If we look at nouns and noun clauses it is clear that in some cases a value is being placed on each noun. If a value can be divided into either the "plus" or "minus" category, and if it does not significantly further define the nouns it modifies, then it is likely the modifier qualifies as an assumed utility linkage.

The coder should take care not to code a case unless the modifier in *isolation* can be clearly classed as positive or negative. In this way he or she will be careful not to impute the speaker's expressed value preference to the variable, unless it is present in the variable itself. Imputing a "plus" or "minus" to a descriptive modifier constitutes distortion.

A coder translates any positively or negatively valued modifier into a utility assertion by his assumption that the value is related

to unspecified best interests. This type is an "assumed utility relation," because we make an assumption that when, for example, we say "unwise choice" we are really stating that the choice is unwise for someone or something's utility. Whenever the coder encounters these types of modifiers, he codes them as the positive or negative linkage from the noun or noun clause to utility. If, on the other hand, the adjective is not clearly positive or negative, it is classified as descriptive and is included as part of the variable to which it is structurally attached.

One difficult aspect of locating "assumed utility relations" is that they often lie in the middle of other structural relations. These sentences may contain two or more assertions. Only by internalizing the dual outlook of content and structure can they both be ascertained.

The final type of utility relation is the simple statement of utility, which supports or derides a choice, plan, policy, person, or group; for example, "Infantry are impractical in this modern age" is a clear statement of utility. In isolation, these types are clear, while in context they are at times more complex. A speaker may make a series of comparative statements. But comparisons are not relations. For example, he might say, "We need more aircraft, not more infantry, infantry is useless." Aircraft are not causally related to infantry. Rather, they are both independent and related to utility, the first positively, the latter negatively. Let us examine four sample sentences a coder might encounter.

Sample sentence: "The repercussions of international tensions bode ill for France."

"France" is the object of "repercussions of international tensions," while "bode ill for" indicates a negative link. In the case where a proper noun, such as France, is receiving some action for or against its best interests, the relationship is one of utility; thus, the final coding is as follows:

repercussions of international tensions	/−/	utility of France

Sample sentence: "National interests demand that America returns her relations with Latin America to the same basis of trust which existed, for example, at the signing of the Monroe Doctrine."

1. "National interests" is the utility variable here, because "national" and "interests" in no way specify special interests different from the general best interests of America.

2. "Demand" is linkage of the type specified earlier, indicating need. Thus, the linkage is positive.

3. The cause variable is, "America returns in her relations with Latin America to the same basis as at the time of the signing of the Monroe Doctrine." The final coding is as follows:

America's return in her relations with Latin America to the same basis as at the time of the signing of the Monroe Doctrine	/+/	American utility

Sample sentence: "Adoption of the policy of impeachment will cause tyranny in the United States Legislature."

Examination of the sentence reveals an assertion of the most basic type first described in this test. But within the sentence, the effect variable, "tyranny in the United States Legislature," carries an implicit negative descriptive modifier, "tyranny in." Since tyranny in a democratic society is antithetical ito its goals, we may say an assumption of negative utility exists. The final coding is as follows:

adoption of the policy of impeachment	/+/	tyranny in the United States Legislature
tyranny in the United States Legislature	/−/	United States utility

Sample sentence: "If the Governor of California cuts the budget he will be making a mistake."

Structurally, the sentence is an "If . . . then" type of assertion. As has previously been explained, these are treated as if the event were a fact and not a future possibility. Because the sentence simply states that the policy is a "mistake" for an unspecified best interest, it is coded as a negative utility relation.

California's Governor cutting the budget	/−/	California utility

J. COMPLEX SUBJECT/SIMPLE LINKAGE/ SIMPLE OBJECT

Sample sentence: "It was not in Poland's interests that she should be an ally of France, standing watch along the Russian border, and the first to be overrun, without the political significance to influence the decisions of war and peace."

1. What is being affected? "Poland's interests" is the object. Thus, because the concept expresses general best interests, the concept is "utility of Poland."

2. "Cannot be" indicates a negative effect on "utility of Poland"; thus, the linkage is "minus."

3. Because there is only one "minus" linkage, it is clear that cause concepts are only those that are negatively linked to "utility of Poland." They appear in this sentence, as in most sentences of this type, as a series of connected subject clauses. Thus, the cause concepts are: "she (Poland), an ally of France"; "Poland, standing watch along the Russian border"; "Poland, the first to be overrun"; "Poland, without the political significance to influence decisions of war and peace." It should be noted that "Poland" has been added to all these cause concepts in order to specify the identity intended by the meaning of the sentences. If, however, there are cases where no specific identity is intended, the general nature of the concept should be preserved.

4. The last question to ask when multiple causes occur is whether or not they are dependent upon each other to maintain the relationship to the effect concept. That is, are both Cause A and Cause B necessary to cause a negative relationship to Effect C, or will each separately still be capable of carrying the same negative charge? In this case, Polish utility is negatively affected by any of the cause concepts, regardless of the existence of the other concepts, according to the speaker. Thus, the coding should include four separate relationships. The coder must not search for interdependence; it should be obvious. For example, the sentence might read, "both A and B cause C," or "without A, B will not cause C." If the interdependence is not explicitly stated, the concepts should be coded as independent. The final coding of the sample sentence is as follows:

Poland as an ally of great power	/−/	Polish utility
Poland's standing watch along the border	/−/	Polish utility
Poland's being the first to be overrun	/−/	Polish utility
Poland's being without the political significance to influence the decisions	/−/	Polish utility

K. COMPLEX SUBJECT/SIMPLE LINKAGE/ COMPLEX OBJECT

Complex subjects, like complex objects, must be coded separately. When subjects are independent of one another, this is not difficult. The coder's task is more complex when he is faced with "interdependent cause concepts." The structure of such patterns follows the basic model, "If B is high, then A helps C." The nature of the relationship between A and C is dependent on the value of B; B determines whether A "helps" or "hurts" C. Other than this, B has no function.

There is a special convention created to solve such dilemmas. The first step is to determine whether the concept that is not a direct cause is a "fact" or a "preference." If it is a fact, the relationship between A and C is coded as stated, in view of the fact. A sentence modeled after relationships dependent on facts would be, "Because the fact B is true, A hurts C." The relationship is coded simply as A /−/ C. The same basic model stated in the negative would be, "If the fact B were not true, A would help C." In all cases the coder derives the true positiveness or negativeness of the fact. Here we assume that because B is true, A still hurts C. The coding for the negative model is the same as for the positive.

If B is not a "fact" but a "preference," we must assign a value to that preference according to the speaker's viewpoint. Often, the value will be evident from the statement itself. If not, the coder is called upon to find the stated value of the preference in his coding sheets as it has been recorded, and to assign the stated value to the relationship at hand. The sentence, "If B is high then A helps C" is coded as "A /+/ C," assuming that the speaker

prefers that B is high. In all cases the final linkage value would be found by multiplying the value of the preference by the stated dependent value of the relation to find the resultant, recorded value.

Sample sentence: "If there is unanimous domestic support for it, adoption of a peace-oriented neutral policy is the best basis for maintaining Finnish security and independence."

1. In this case, there are two interdependent cause concepts. Their interdependence is indicated by the connector "if there is," which precludes by definition an independent application of cause concepts to achieve the stated relationship. On the contrary, "if there is" demands a joint application for achieving the expected effect. This interdependence is further supported by the use of the singular term, "basis," in the sentence, which indicates a joint platform for action. When looking for interdependent cause concepts, nouns such as "basis," for example, which combine preceding noun concepts in a single grammatical statement, are excellent indications of interdependence.

Of the two variables, it is clear that "unanimous domestic support" is a condition placed upon "it," "adoption of a peace oriented neutral policy." Placement in a subjunctive phrase is the best indication of a concept's role. It is safe to assume that "unanimous domestic support" was meant to restrict the nature of the stated relationship. Thus, assuming that the speaker prefers "unanimous domestic support," it is given a positive value.

2. The phrase "Finnish security and independence" is not a single effect concept because it does not carry one single concept. Rather, it is a set of concepts, "Finnish security" and "Finnish independence."

3. The linkage is indicated by the phrase "is the best basis for maintaining." The stated relationship is, of course, "plus." Because the conditional value is "plus," and since a positive times a positive is a positive, the resultant linkage is positive.

The final coding is as follows:

the adoption of a peace-oriented neutral policy	/+/	Finnish security
the adoption of a peace-oriented neutral policy	/+/	Finnish independence

L. SIMPLE SUBJECT/COMPLEX LINKAGE/ COMPLEX OBJECT

Sample sentence: "Acceptance of the proposed arms limitation agreement will weaken the power of American military planners, strengthen the power of American proponents of general disarmament, but not affect the short-range military spending of either the U.S. or the USSR."

1. "Acceptance of the arms limitation agreement" is the cause concept, and there are multiple effect concepts with different relations to it. The effect concepts are "the power of American military planners," "the power of American proponents of general disarmament," "short-range U.S. military spending," and "short-range USSR military spending."

2. There are four linkages: the first is "plus," the second "minus," and the remaining are "0." The entire sentence is a simple subject with a complex linkage relationship to four separate effect variables. The final coding is as follows:

acceptance of the arms limitation agreement	/−/	power of American military planners
acceptance of the arms limitation agreement	/+/	power of American proponents of general disarmament
acceptance of the arms limitation agreement	/0/	short-range U.S. miiltary spending
acceptance of the arms limitation agreement	/0/	short-range USSR military spending

M. COMPLEX SUBJECT/COMPLEX LINKAGE/ COMPLEX OBJECT

Sample sentence: "Honest recognition of the superior force of the Soviet Union will be the condition and touchstone of our national existence, for to harbor revanchist thoughts or indulge in open or secret scheming to regain lost territory means the destruction of the Ukrainian people."

1. First breakdown: In cases of this complexity the coder may

find it easier to separate concepts by putting quotes around each and underlining seeming linkages, as follows: "Honest recognition of the superior force of the Soviet Union" *will be the condition and touchstone of* "our national existence," for to "harbor revanchist thoughts" or to "indulge in open or secret scheming to regain lost territory" *means* the "destruction of the Ukrainian people."

2. The above is an example of a sentence carrying multiple cause and effect concepts, as well as both negative and positive linkages.

3. The "honest recognition of the superior force of the Soviet Union" is the first cause concept. "Will be the condition and touchstone" indicates a supportive role, hence a "plus" relationship to "our (Ukrainian) national existence" is established. "Ukrainian national existence" is the effect concept.

4. Second, two negative relationships are stated. "Harboring revanchist thoughts" must be adjusted to indicate that it refers to the Ukraine. Thus, the concept should read, "Ukraine's harboring of revanchist thoughts." "Open or secret scheming to regain lost territory" should, for clarity, be regarded as two concepts, because it indicates that either may be applied separately and the stated relationship will still maintain. Thus, the seeming concept is split to form two, as follows: "open scheming to regain lost territory" and "secret scheming to regain lost territory." It should be noted that the Ukraine will ultimately be included as an identification for these concepts. "Destruction of the Ukrainian people" is the effect concept, while "means" indicates a "plus" relationship even though, in an absolute sense, the result is not a good one. The whole relationship, though negative, is positive in its linkage.

The final coding is as follows:

the honest recognition of the superior forces of the Soviet Union by the Ukraine	/+/	Ukrainian national existence
harboring revanchist thoughts by the Ukraine	/+/	destruction of the Ukrainian people
open scheming by the Ukraine to regain lost territory	/+/	destruction of the Ukrainian people

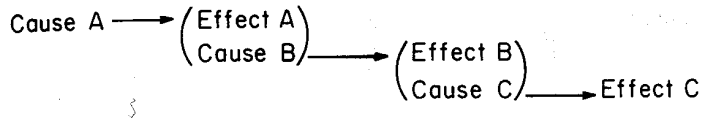
secret scheming by the Ukraine to regain lost territory	/+/	destruction of the Ukrainian people

N. DOUBLE ROLES FOR CONCEPTS WITHIN RELATIONSHIPS

A graphic example of double roles looks like Figure A1–1.

FIGURE A1–1.

An Example of Double Roles for Concepts



Sample sentence: "I believe that Italy's alliance with Germany would make the country a sleeping partner in an alliance that would impose on her overwhelming burdens which could not be borne in the long term."

1. Concepts may at one point be cause concepts and yet may at other times even within the same sentence, be effect concepts. The example of the above sentence is illustrative.

2. The initial question in these cases is, "What are all the possible concepts?" They are: "Italy's alliance with Germany"; "Italy as a sleeping partner in an alliance"; "overwhelming burdens."

3. What are the relationships? Italy's alliance with Germany has a positive relationship indicated by "would make [Italy] a sleeping partner in an alliance."

4. Then, "Italy, a sleeping partner in an alliance" carries a positive relationship indicated by "would impose . . . overwhelming burdens."

5. Finally "which" replaced with "overwhelming burdens," as outlined in the procedure for pronoun substitutions, negatively affects some unspecified object. The linkage is negative due to the use of the words, "could not be borne." Moreover, "borne"

must take an indirect object that is inferred but unstated. That object must be Italy, since Italy is the lesser partner in the alliance.

6. The coder must be careful to note where effect concepts or cause concepts are implied, for the implied relationship must be coded like any other relationship. The final coding of all relationships is as follows:

Italy's alliance with Germany	/+/	Italy as a sleeping partner in an alliance with Germany
Italy as a sleeping partner in an alliance with Germany	/+/	creation of overwhelming burdens for Italy
creation of overwhelming burdens for Italy	/−/	Italian utility

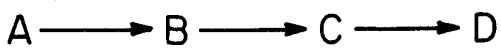
7. The coder should note that in such cases as that of the unspecified and implied object, a utility variable is used.

O. CODING CHAIN-OF-EVENTS ASSERTIONS[3]

When a double role is not obvious but implied, relationships may be deduced from the principle of a chain of interdependent events. Coding a chain of events requires careful attention to the logic of the speaker's statement. There are several different types of chains, which require different codings. The first type is the most straightforward. This type can be considered to be one statement with an initial cause setting off a chain of events, where the first effect becomes the second cause and the second effect becomes the third cause, and so on. The line of cause and effect is a direct line without branches. Graphically, the statement looks like Figure A1–2.

FIGURE A1–2.

Simple Chain of Events



[3] New material.

Sample sentence: "Adopting the policy of ineligibility would cause the President not to relinquish his office when the term is over: he will take over the military force: a civil war will ensue and when it is over, the victorious side will put a despot in power."

1. The initial step the coder must take is to locate the precipitating cause, the one which initiates the chain. In this case it is the first clause in the sentence, "adopting the policy of ineligibility." Often the first part of the sentence or first sentence in a series is the most likely first cause.

2. Once the first cause is located, the first relationship is as easily established as any "simple cause/simple linkage/simple effect" relationship. It is coded as follows:

adopting the policy of ineligibility	/+/	President not relinquishing his office at the end of term
President not relinquishing his office	/+/	President taking over the military force
President taking over military force	/+/	a civil war ensuing
a civil war ensuing	/+/	victorious side putting despot in power

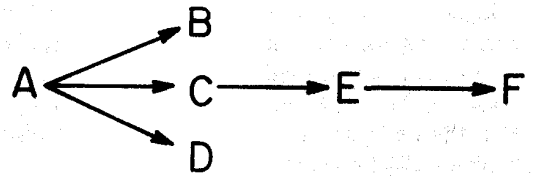
The loaded term "despot" is used to indicate that the outcome is harmful to the general American utility. Therefore we add the following:

victorious side putting a despot in power	/−/	American utility

3. There are other types of chains of events, of course. In the English language there are as many combinations of the above two types as is graphically possible to create. Even so, they are all combinations of the basic two patterns, "simple cause/multiple effect" and "simple cause/simple effect chain." Let us look at one example of a more complex possibility. Graphically, it would appear as in Figure A1–3. A sample group of sentences for such a graph might be as follows: "The policy of impeachment would have three immediate effects. One, it would bring about a check on the President's power. Two, it would make more feasible the provision of a four-year term. And finally, it would place impeachment power with the legislature. Of the three, this is the

FIGURE A1–3.

Chain with Simple Cause and Multiple Effects



only unacceptable one. It will bring about the President's dependence on Congress and will lead to tyranny in the legislature."

The statements would be coded as follows:

policy of impeachment	/+/	check on Presidential power
policy of impeachment	/+/	policy of four-year term
policy of impeachment	/+/	President's dependence on Congress
president's dependence on Congress	/+/	tyranny in the legislature
tyranny in the legislature	/−/	U.S. utility

P. THE PROBLEM OF IRRELEVANT RELATIONS[4]

The coder will be called upon to exercise discretion in deciding to omit some relationships not relevant for the purposes of his analysis. Determination of such cases is a difficult matter, at best; there are, however, certain types of statements that often call for exclusion.

Examples

In general, the rule the coder should follow is not to code examples of previously asserted relationships. Examples fall into three general categories: 1) exemplary specifications of the general causal relationship; 2) historical analogies supporting the

[4] New material.

relationship; 3) general "Universal Truth Claims" supporting the relationship.

The logic behind the elimination of examples is clear. If we think in terms of the cognitive map, we can imagine that examples would have no place in the speaker's overall logical picture. Neither would refutation of examples. They would appear as isolated assertions on the cognitive map, without links to the relationships they support. Because, for coding purposes, they are essentially considered repetitious of previously coded relationships, their elimination is justified.

Although each of the three types of examples is somewhat different, the determining factors and the points common to all examples are that examples can add nothing new to the general case relationship, nor are they related, either by cause or effect, to any other variable in the coder's list. If such a relationship exists, the statement is not an "example" as defined in this text, and should be coded as a relationship. In addition, an example could have a double role, in which the second role may qualify as a cause or effect concept.

Sample sentence: "Any growing economy requires foreign markets; Japan's does."

Assuming that Japan is *not* the subject of the document being coded, it is clear that "Japan's does" has a supportive role in the sentence. The relationship asserted is that, in general, growing economies need foreign markets. The Japan example is a specific, isolated case of the stated relationship and, as such, is not coded. The final coding would be as follows:

existence of foreign markets	/+/	health in economy

Sample sentence: "During the Cuban missile crisis it was a wise choice of Kennedy's to establish a trusted, representative policy-making group. This was not done in the Bay of Pigs invasion and the results were disastrous."

Let us assume that the subject matter of the document is a case study of the Cuban missile crisis. It is, then, clear that the first statement is codable. On the other hand, the second sentence, if coded in its own terms and carried into the cognitive map, would stand unconnected to any other part of the map, making no apparent contribution. Although both sentences have common points, the Bay of Pigs invasion does not fall within the direct

parameters of the subject, the Cuban missile crisis. It is considered an historical example. The sentences are coded as follows:

Kennedy's establishment of a trusted, representative policy-making body during the Cuban missile crisis	/+/	United States utility

Sample sentence: "We must not choose the policy of an election by the Senate. The people at large should choose the President. History shows that elections decided by a few in closed conclave are never better than those decided by many in the open."

The first two sentences in the sample are "utility statements" coded under the rules described for such cases. How should the coder treat the third sentence, "History shows that elections decided by a few in closed conclave are never better than those decided by many in the open"?

Initially, the coder notes that it falls directly after two coded statements and is logically supportive of them. Second, it adds no new information to those statements; rather, it is a general repetition of them. Most general statements of this type include such phrases as "history shows" and "everyone knows that." For this reason, they are termed "Universal Truth Claims." When used as merely supportive examples, they are not coded as separate assertions. The final list of relationships should be as follows:

policy of election of President by Senate	/−/	United States utility
policy of election of the President by the people at large	/+/	United States utility

IRRELEVANT SUBJECT MATTER

All analyses should have parameters set according to the researcher's concerns. Relationships falling outside those parameters are safely excluded. If a windy speech in the British parliament is being coded only for its comments on foreign policy, comments on agricultural policy may, of course, be excluded. Establishing

a clear definition, preferably prior to coding, will be important to the nature of the cognitive map that results.

NONCAUSAL ASSERTIONS

There are some statements that may have the appearance of a causal assertion but do not actually reflect a cause-effect belief. Consider the sentence, "Since World War I arms limitations agreements have failed."

This sentence could have a causal or merely a temporal interpretation. The former is equivalent to the assertion:

World War I	/−/	success of arms limitation agreements

The latter interpretation is that World War I is a reference point in time and not the causal agent. Sentences of this type should not be coded as causal assertions unless the context unambiguously indicates the speaker is making a causal assertion.

Definitions sometimes take on the appearance of a causal assertion. Consider the following sentence:

"The security of a nation's borders is its ability to defend its frontiers. When one increases, so does the other."

While an apparent cause-effect relation is stated in the second sentence, the first indicates that the relation is true by definition. Statements of definitions are important considerations in the merging process described below, but are not to be taken as causal assertions.

If a speaker introduces two concepts with a cause-effect relation and later indicates that the relation is definitional, the coded assertions are invalidated and should be crossed out. For example, if the two sentences of our example (with pronoun modifications) were reversed or separated by other text, the initial cause-effect assertion would be invalidated by the established definitional equivalence.

THE PROBLEM OF SIMILAR CONCEPTS

Once all the causal assertions in a text have been found and coded, an important problem arises. Realizing that the list of relationships over a given text, once recorded, will become the cognitive map, it is clear that duplicate concepts are misleading

redundancies and should be eliminated. The coder must decide which, if any, of the similar concepts can be treated as one for the purposes of mapping. The question is a crucial one, for it may make a significant difference to the form and properties of the cognitive map itself.

Many of these duplicates can easily be identified; some, however, are more difficult. Before presenting a method for eliminating duplicates, a few words about prerequisite clerical techniques that will greatly simplify this and other coder tasks seem helpful.

CLERICAL TECHNIQUES

As the coder records the relationships in the text it is necessary to devise a method for assigning identifying symbols to each unique concept. One successful method is to assign all concepts a symbol derived from the page in the text where they first appear. If three new concepts are encountered on page 12 of a document, the first concept would be "12A," the second, "12B," and the third, "12C." If the identical concept appears later in the text it is denoted not only by its paraphrase, but by the assigned symbol as well. "Page/letter" symbols greatly simplify construction of the speaker's cognitive map. By using this system, most clearly identical concepts will have been located during the course of coding by their duplicate page/letter symbols. By good clerical practices the coder has eliminated the great majority of merging problems.

THE MERGING PROCESS

Although most concepts are not candidates for merging and need not be scrutinized, some are superfluous. Merging is the retrospective analysis of some possibly repetitive concepts generated in coding to eliminate unnecessary ones by merging them into their more likely counterpart concept also found in the text.

This process should not be attempted (with the possible exception of clear opposites, discussed below) until the text has been completely coded. The following instructions indicate the nature of merging by substituting common symbols to be used for the merged concept for all appearances of the concepts. Thus, concepts that initially have been given different page/letter symbols are, during this process, assigned one symbol and, consequently, one identity in the speaker's map.

In making merging decisions, the coder will have to keep close track of the speaker's meaning in each instance of the concept's use which is now under scrutiny, for discretion must be used at key points. There is no single best way to merge concepts because the process necessarily involves judgments by the individual. One successful method has been to group concepts to be scrutinized by their content, in isolation first, and then to submit them to contextual tests to determine whether or not a merger is appropriate. The basic categories of merging decisions are explained below. The coder is encouraged to be conservative in applying these tests. All concepts should be treated as separate and distinct until it is demonstrated that they are the same. This is particularly true when considering whether different speakers are using the same concept, a problem discussed below.

There are, generally, two approaches to merging that the coder should use, and they are applied simultaneously. One includes some general considerations that may apply to any case of merging; the other is a structural view of the problem that involves separating the individual cases into a range of concept types such as nouns, noun clauses, and modifiers.

General Considerations for Merging

One initial determination the coder must make involves the general text. If a document is broad in scope, it follows that mergers of concepts are more likely to be appropriate than if the text is highly specific. The general nature of concepts should vary more or less proportionally with the generality of the text. For example, if a short document concerns the broad aspects of domestic policy, "amount of agriculture" and "amount of horticulture" may safely be merged, since the speaker probably does not mean to distinguish between them. If, however, the document were concerned with agriculture, the nuance is probably significant and should be maintained.

If a coder finds a group of similar concepts, he must also satisfy other key criteria before merging one or more. The coder should locate any predominant concepts. These are concepts that are used often by the speaker. In general, when a speaker refers to a concept numerous times he has attached a specific identity to it. When selecting among concepts to be merged, such concepts are maintained. The other, less frequently used, concepts may be merged in these predominant types.

One excellent general question to ask about concepts under consideration is whether or not the variable appears again in the text. If it does not, the chance is that the nuance need not be maintained. If the speaker at all times refers to "British military strength," for example, and breaks this habit once to say "British air and sea power," it is likely to be a safe merger. If, on the other hand, the speaker makes an express distinction between the two concepts, they should not be merged. Distinctions are made by comparing the two concepts in some fashion. For example, if it is the speaker's contention that British military strength is partly measured by air and sea power, but also partly measured by land forces, the speaker has made a distinction that should be maintained. Such comparisons may be direct or indirect. In this respect, one good way to tell that one variable is distinct from another is that there is an express relationship between them, which at some point has been recorded by the coder. Another clue that two variables cannot be merged is that they have different causes or effects.

Structural distinctions are made when the speaker links the less predominant concept to other concepts not connected to the more predominant concept. If this occurs several times, the merger is questionable. In respect to structural distinctions, two considerations are: whether the concept is connected by cause or effect to other concepts, and whether it is used generally in conjunction with another concept. Many times, if the concept under consideration has been referred to only in conjunction with a more general variable, it may safely be considered part of that variable. If, on the other hand, it is linked to other variables with which the more general concept is not associated, it may well have a value of its own in the speaker's logic.

One final general question the coder must ask himself is the following: would the speaker feel that a substantive part of his logic had been distorted if the merger were made? This question is evaluative; nevertheless, it must be asked and answered by the coder on each merger. Even if a probable merger has satisfied all the previous stipulations and yet seems tangibly different by the coder's evaluation, a discretionary judgment is required. But by using all the provided rules, this remnant of art in coding is not often encountered.

Having explained the general rules that are applicable to all merging cases, it is possible to break merging problems down into more specific categories for further analysis.

Ordinary Meanings of Singular Nouns and Noun Opposites

Sample sentences:

"Neutrality is in our best interests."
"Nonalignment should always be our policy."

1. The sample sentences present the simplest merging case. Assuming the coder is also approaching the example in view of the general merging guidelines, what can be said about the specific case? It is plausible that, in isolation, and for most purposes, "nonalignment" and "neutrality" are two versions of the same policy. If this supposition is supported by inspection of their patterns of use, the validity of this merger is insured. Thus, the relationships should appear identical by assigning one symbol to the two concepts, called hypothetically 1A. The relationship to appear in the coder's sheets will be altered to appear as follows:

(1A)		(1B)
neutrality	/+/	utility
(1A)		(1B)
nonalignment	/+/	utility

2. By this method of reassignment the relationship will appear only once in the cognitive map.

Like synonymous nouns, antonyms (concepts that are opposite in meaning) may be merged. For concepts to be opposites in coding, they must have juxtaposed positive and negative values without possible gradations of value. That is, if the absence of one invariably and necessarily means the presence of the other, the concepts are true opposites. If this criterion is met, one of the two values may be selected and used in the map. Whenever the opposite value of the concept appears in the text it is assigned a negative value and multiplied by the linkage value to achieve a resultant value for the relationship to be mapped.

Sample sentences:

"Having the quality of perseverance helped the pilgrims."
"The lack of it (perseverance) would have hurt them."

1. It is clear that the "lack of perseverance" is the opposite case of "having the quality of perseverance." By the speaker's meaning, either one has perseverance or not; a case of positiveness and negativeness in values has been assigned to one concept. For this reason, maintaining two concepts would be misleading; it would

not show the contrast in the sentence that was meant by the speaker. One concept with two opposite values is not treated like two concepts when constructing the cognitive map. Assuming the coder selects "having the quality of perseverance" (which will be called 1A, to appear on the map), how is the opposite case, "lack of perseverance," treated? It is always assigned a negative value, "minus," to be multiplied by the value of the stated linkage in each sentence in which it occurs. In the sample sentence the linkage value is "minus." Multiplying the two values in the example nets a positive value, "plus," for the resultant relationship. The final coding would then be as follows:

(1A)		(1B)
having the quality of perseverance	/+/	pilgrims' utility
(−1A)		(1B)
the lack of perseverance	/−/	pilgrims' utility

2. In these two cases of noun synonyms and noun antonyms, the coder may find it helpful to consult a standard reference work on synonyms and antonyms, such as *Roget's Thesaurus.*

Ordinary Meanings of Phrases

The logic applicable to the case of synonymous and antonymous nouns is also applicable to noun phrases. The case of noun phrases is more complex, however, because it may still be possible to merge phrases that contain no clear synonym or antonym. The key to deciding whether or not phrases may be merged is that the coder must be convinced that they are equivalent. For example, if one phrase can be true when the other is not, then the phrases are not equivalent.

Antonymous phrases are a somewhat special case, and pose one possible qualification to this rule. Thus, before the equivalency test can be applied to such pairs of concepts, any opposite values in concepts to be compared must be resolved. When the opposite, negative, juxtaposed value of the concept ($-A_1$) is encountered, it is considered as if it were the positive case of the concept ($+A_1$) for the purpose of testing the rule against the merging case. By making both values comparable, the equivalency test is universally applicable to all pairs. One other test to determine if phrases are in fact opposites is that the phrases could never be simultaneously

true; the truth of either one must always imply the falsity of the other.

Sample sentence pairs:

"The executive should be removable for flagrant offenses."
"The executive should serve during good behavior."

"We must avoid having the city manager completely dependent on the city council."
"If we have the city manager appointed by the council, he will be a mere creature of the council."

"Finland will be strengthened if it adheres faithfully to all of its obligations."
"Finland would be strengthened if it were to maintain friendly relations with all countries near and far."

1. In the first two pairs of sentences, the similar phrases should be merged as one concept; in the third pair they should not. An executive who serves "during good behavior" is removable, or else the qualifying phrase would have no meaning at all, and an executive "removable for flagrant offenses" is presumably not removable as long as he behaves well. A city manager who is a "mere creature" of the city council is certainly dependent on it, and a "completely dependent" manager may rightly be said to be the mere creature of the council. However, Finland could maintain friendly relations while breaking minor obligations right and left, and keeping to certain kinds of treaty obligations could lead to war.

2. If the variables are assigned hypothetical page/letter symbols such as 1A, 2A, and so forth, the coding will be as follows:

(1A)		(1B)
removal of executive for flagrant offenses	/+/	utility
(1A)		(1B)
executive serving during good behavior	/+/	utility
(2A)		(2B)
complete dependence of city manager on city council	/−/	utility

(2A)		(2B)
city manager as a mere creature of the city council	/−/	utility
(3A)		(3B)
Finland adhering faithfully to all obligations	/+/	strengthening Finland
(3C)		(3B)
Finland maintaining friendly relations with all nations near and far	/+/	strengthening Finland

Modifiers

Noun concepts often have modifiers attached to them. Differences in modifiers usually signal that the concepts are distinct in the speaker's logic. In almost all cases, for example, "British foreign policy" and "Finnish foreign policy" would be mapped separately. "Nuclear weapons policy" and "conventional weapons policy" are also separate. As a third example, "tyranny by the executive" would be distinct from "tyranny by the legislature." Not all cases are so simple, for reasons to be examined.

Initially, there may be similarity or opposition among modifiers, as among concepts. The speaker may for stylistic variation refer to "complete honesty" at one point and to "thoroughgoing honesty" at another. These would usually be treated as the same concept, unless the speaker had made a distinction, somewhere in the text, between them.

In addition, modifiers used together in one place may be used separately elsewhere. If reference is made in one place to "an explicit and permanent neutrality policy" and in another to "an explicit neutrality policy," it is nevertheless likely that more than stylistic variation is occurring; the speaker seems to be drawing an important distinction. Two concepts, two identities on the cognitive map, are necessary.

There may on occasion be modifiers that do not readily change the noun concept. In an essay on planning, for example, the author may refer to "planning" and to "planning for the future." Unless the author clearly intends a difference between the two ideas, the

coder should feel secure in his common-sense notion that since all planning is for the future, the two concepts are really the same.

Finally, differences in modifiers may appear in the presentation by the speaker. In such cases, the coder's instruction to ignore exemplary relationships should take precedence over the impulse to record the concepts separately. Consider the most complex case of the modifier, for example.

Sample sentences: "Military might is the key to our successful defense. Our military strength is needed to dissuade the enemy from aggressive actions. Our conventional troop strength stopped his aggressions in Belgium, and our strength in nuclear missiles stalled his aggressive plans for Brazil."

Clearly, there are not four relationships here, even though different modifiers are applied to "strength," "aggression," and to "might." There are, rather, two general points exemplified by two specific ones. In accordance with the rules on examples and merging, only the general points should be coded. The final relationships appear as follows:

(14A)		(14B)
military might	/+/	(our) defense
(14A)		(14C)
military strength	/+/	Dissuading enemy from aggressive actions

Specified Meanings

Whatever a dictionary may say or the coder may think about various words, the policymaker will occasionally assert his own definitions of concepts and how they are related to one another. In these cases the policymaker's interpretations must be followed.

Sample sentence: "Intrigue is to be expected in politics and may at times help the political process, but with cabal comes palpable danger to the state."

Although the two concepts "intrigue" and "cabal" seem mergeable in isolation, by the logic of the sentence the final coding would be as follows:

(1A)		(1B)
intrigue in politics	/+/	quality of the political process

(1C)		(ID)
cabal	/−/	state's utility

The coder should be sensitive to the fact that meanings can be specified by context as well as by explicit statements. Assume, for example, that a general is discussing relations between Egypt and Israel, and that all of his remarks pertain to military matters. If the general uses the apparently distinguishable concepts "strength" and "military strength," but never draws or implies a distinction between them, the coder may safely combine the two as one concept, based on the context. For, although it could be argued that "military strength" is different from overall "strength," and is therefore separable, nonetheless in this speaker's mind the two concepts are as one, and that view should be respected by the coder.

In addition, there may arise a case in which the policymaker is inconsistent in his specification of definitions.

Sample sentences:

"Planning is advising; if you do one you are doing the other."

"Planning, based as it is on known technical procedures, can guarantee success."

"Advising, which is really an art rather than a science, is a favorite activity of politicians."

Here there are contradictory indications of whether the speaker considers the concepts "planning" and "advising" to be the same concept. The rule here is rather simple: if the speaker makes a clear statement that the two concepts are the same, as he has here, then they should be coded as one, and resultant inconsistencies in argument can then be observed in the map. If there is no such clear statement, and no obvious connection between the two by ordinary meaning, they should be left separate. The final coding would be as follows:

(1A)		(1B)
planning, based as it is on known technical procedures	/+/	success

(1A)		(1C)
activity of advising, which is really an art rather than a science	/+/	politicians' utility

The task of merging concepts that are similar is difficult but

essential. If no such combinations were made, a normally coherent and understandable document might appear fragmented and disconnected; consequently it would not present an accurate representation of the speaker's logical thought. For this reason, the coder is advised to approach merging problems cautiously, using all of the guidelines outlined. Content and context are critical to merging. When, however, from all the rules on merging similar concepts it still does not seem possible to make a clear decision, it is best to leave the concepts separate.

Merging concepts used by different speakers poses an even more difficult judgmental process. As in the case of merging one individual's concepts over different assertions, there are critical context tests that must be applied before deciding that two or more people are using the same concept.

Any special definitions of a concept mentioned, and any serious disagreements about the kinds of other concepts used in relation to a concept, serve to question the propriety of a cross-individual merger. Agreement of use, explicit mention of agreement, and identical operations suggested for measuring a concept all serve to validate a proposed merger. When in doubt, again, do not merge across individuals.

On occasion clarifying questions are asked by participants to discover if they, in fact, mean the same thing by a particular concept. If they decide that they do mean the same thing then a cross-individual merge is justified beyond doubt. There is only one caution to be considered here. Sometimes clarifying questions will lead a speaker to redefine a concept, to change his usage. If a speaker so changes his mind, mentions of the concept before the questioning may not merge properly with mentions after the revision. The coder must decide: 1) Is the concept the same before and after clarification? 2) Is the concept now shared by other participants? 3) Was the concept used before clarification shared with the concept used by other participants?

The general principle is that if two speakers use the same concept in the same way, then there must be a merger between them. For example, if one speaker uses the phrase "British strength" to refer to what another speaker calls "British power," then these two concepts must be merged. Unlike the merging of concepts used by a single person, cross-individual merging does not require that the merged concepts have the same causes and the same effects.

CONCLUSION

The fact that the English language is as varied as those who use it makes the coder's task complex and difficult. No set of rules will completely solve the problems he or she might encounter. These rules, however, provide the coder with guidelines which, if conscientiously followed, will result in outcomes meeting social scientific standards of comparative validity and reliability.

The Questionnaire Method
—*Fred S. Roberts*

As a do-it-yourself guide for future researchers, some procedures for derivation of cognitive maps from questionnaires are set forth in this section. These are the procedures used in the empirical study by Roberts, and are similar to the procedures used in Hart's empirical study. They can be readily adapted to a variety of research designs of greater or lesser complexity.

The questionnaire method for deriving cognitive maps or signed digraphs was briefly described in the empirical study of energy demand (Chapter 7). Here, I shall describe the steps involved in this method, and discuss the issues involved in this type of procedure.

Many of the judgments needed to build a cognitive map with the questionnaire method are subjective, even though experts form the panel. To see that many opinions are included, groups of experts are used. The basic problems involved are how best to solicit the judgments of each expert, and how to combine the judgments of the different experts to obtain one cognitive map.

The procedure I describe first identifies variables, then arrows and signs. We concentrate on the identification of variables, for this is the part of the procedure that is sloughed over by most authors who have solicited subjective judgments from panels of experts. It is also the part of the procedure that might be most crucial.

I look at variable identification as a two-step procedure. First, I identify all potentially relevant variables, and then I select from these a set of most representative or most important variables.

Parts of this appendix appeared earlier under the title "Building and Analyzing an Energy Demand Signed Digraph," in *Environment and Planning*, 3 (1973), pp. 199–221. The author gratefully acknowledges the permission of Pion Press, Ltd., the publishers of *Environment and Planning*, to include this material here.

I also wish to repeat the other acknowledgement list at the end of Chapter 7.

The procedure I shall outline is far from being the only possible procedure, and it will not be applicable in many situations, even though it has many choices and variants. No one procedure will be appropriate for every problem being mapped. Use of several alternative construction procedures can only lead to further insights into the decision problems being considered, and so is encouraged.

In the procedure I have found useful, the first step (Round 1) is a free response round. This could be done in a group session of the traditional sort—everyone sits around a table and volunteers potential variables. However, it could also be done on an individual basis, by questionnaire, with each person responding freely on his own, and not subject to any restrictions that might be imposed on him in a group situation. He is asked to list as many variables as he can think of that might be relevant to (constrain, influence, cause, be affected by, and so on) the problem at hand. There seems to be no substitute for the use of subjective judgments of experts in this step. But the experts here should be chosen from a wide variety of disciplines, and should include "lay" experts who are knowledgeable, well-read, or concerned about the problem being considered, but who do not necessarily represent a specific technical discipline.

The second step is a feedback of Round 1 results. This is especially important if the Round 1 results were obtained by combining individual free responses. The group list should be compiled and sent back to all the experts, requesting additions. Alternatively, this could be done by the person building the cognitive map.

If the size of the total list of variables is not too great, the experts may be used to limit the number of variables by a clustering procedure, as in Dalkey, et al. (1970). Again, for this step, the experts need not be specialists. If the size of the total list of variables is large, clustering is not feasible, and some other procedure must be employed.

If clustering is not appropriate, or perhaps even if it is, it is useful to try to classify the variables obtained in Round 1 (with iteration) into well-defined categories, subcategories, and so on. A hierarchical classification procedure such as that described in Raiffa (1969) might be appropriate. This classification procedure most likely would be carried out by the person doing the construction of the cognitive map, as it was in the energy demand situation described in Chapter 7. In the process of making this systematic

classification, the categories and subcategories might very well suggest variables not previously listed.

To be completely faithful to the use of experts at each step, one would send out the classification scheme to the experts to get their comments, and to get them to add variables suggested by it. However, this is a fine point to the gathering of variables that might not always be necessary.

If the number of variables is too large, this number can be limited to some extent by using the classification scheme. In the energy demand study, only the variables listed in one of the possible subcategories (energy demand in intraurban commuter transportation) were used for further analysis. Other subcategories could also be used. This limitation, while making the remaining steps in construction easier, does limit the scope of the final variable set.

Having a collection of variables and a new scope for the problem, one tries to limit the set of variables further. Perhaps clustering would be appropriate here, if it has not been used before.

The method I chose to limit the variable set is the use of importance ratings. In this method the experts are asked to rate the importance of the variables in each subcategory in a number of ways. In particular, it is usually useful to obtain ratings of overall importance (judged independently of subcategory) and relative importance (judged in relation to subcategory).[1] It is suggested that different subcategories be handled by different groups of experts, and, whenever possible, that the ratings be done by people expert in the specific discipline related to the subcategory. Not all raters must be expert in each of the disciplines relevant to the subcategory, so long as all important relevant disciplines are represented. It is also suggested that overall importance and relative importance ratings be done by different experts, though this is not essential. The importance ratings can be obtained by asking the experts to sit around in a group, in the usual decision-making situation. Or they can be obtained by having the experts fill out individual questionnaires, without cooperation. The latter technique is recommended in many situations to minimize the effects of extraneous personality factors present in group discussion.[2]

[1] Specific procedures for obtaining overall and relative importance ratings are outlined in Chapter 7.

[2] For further arguments in favor of individualized questionnaires, see the section on the use of expert judgments in Chapter 7.

The initial importance ratings can be presented to the experts for iteration, if that is desired. This could be done in a group session. Alternatively, it could be a Delphi-type iteration, with limited interaction. Here, the experts are given some information about the results—for example, median overall importance rating and geometric mean relative importance rating for each item. With this information as input, the experts are asked to reestimate their importance ratings. The advantages of this limited-interaction iteration are, again, the basic advantages of the Delphi procedure: elimination of extraneous personality factors, role-playing, and so on, from the group's decision making.[3]

Rating importance can be a difficult task. In the importance-rating exercise discussed in Chapter 7, the experts found the work tedious because it was so long. Some felt that they could not give a meaningful answer in the short time allotted to each judgment. These problems could be avoided by using different sets of experts for different subcategories. One respondent said he felt that all his numbers were "totally meaningless." The data of such a respondent could be eliminated by having experts estimate their confidence, as was done in Dalkey and Rourke (1971) and Roberts (forthcoming b).

Perhaps more significantly, in this exercise the experts felt that the issue at hand was not well enough defined. Several asked for a clarification of the meaning of "important": "important for what?" "important in what context?" and so on. The instructions were, indeed, vague on this point. They called for rating the "importance of a variable for the problems we are concerned with." When asked for clarification, I usually said "important for (impact on) energy use and related environmental factors." I clarified this further for the persistent questioners, explaining that they could think of this rating of relative importance as an "indicator" of the subcategory or the subcategory's impact. This seemed to satisfy them somewhat. But it should be pointed out that there is a subtle distinction between having an impact on energy use and the environment, as opposed to being an indicator of such impact, with a further distinction between being an indicator of a subcategory and being an indicator of a subcategory's impact. These differences are probably not important enough to invalidate the results. However, it must be emphasized that in-

[3] Further discussion of Delphi can be found in Chapter 7 and in the paper by Dalkey (1969).

structions in connection with questionnaires should be precise and detailed. Specifically, the term "importance" should be carefully defined for the respondents.

One of the respondents felt that it was impossible to rate the variables because they were all interrelated, hence all equally important. I do not think this is true, but it raises a significant point. To illustrate this, consider two of the variables, fuel economy of a car and quantity of safety equipment. Fuel economy is certainly related to quantity of safety equipment. But I doubt whether anyone will argue that these two variables are equally important as far as the growing demand for energy is concerned. On the other hand, there are some serious difficulties in comparing the relative importance of two variables that are closely related. It might, indeed, be reasonable to expect that two closely related variables would have equal importance ratings.

One expert remarked on his questionnaire that the ratings depended on the order of magnitude of the phenomena. He gave the example of safety: "As it is presently, this problem is not sensed very strongly by people for commuting, because there are few accidents. If cars were really made unsafe, say 100 times more than now, the ratings would have been very different." This comment points up the fact that, unless specified otherwise, a questionnaire deals with levels of the variable at present or in the immediately foreseeable future. Presumably the questionnaire would have markedly different responses if the variables were interpreted at levels in the distant future, or under various scenarios different from the present. Thus, responses to questionnaires should be made in context. If the situation is interesting under various different contexts, separate cognitive maps (signed digraphs) should be built under each context. Thus, along with the instructions, a specification of the scenario or context under which the answers are solicited should be provided.

There was one additional comment about the importance questionnaire, which was repeated several times and is important to mention. Some respondents felt that they were not competent to make such importance ratings, or rather that an expert on, say, pollution, would be the better one to make the ratings in the subcategory relating to his expertise. That point is well taken. Probably every effort should be made to have importance ratings within a subcategory. However, as mentioned in Chapter 7, it is not necessary that each judge be an expert in *all* of the disciplines

relevant to the subcategory, so long as all the important disciplines are represented.

Unfortunately, as we also remarked in Chapter 7, for the problems with which we are dealing it is often not easy to define (or obtain) the type of expertise that is needed. And even if that can be done, experts frequently disagree. Thus, whenever possible, judgments in a subcategory should be made by more than one expert. The group judgment technique has been developed because experts do disagree.

Let us pass now to the stage where importance ratings have been made, either in one step or in two. Now we come to the question of how to use these ratings to choose a particular set of variables. There is, once again, no a priori way to choose a good method. Indeed, it is probably a good idea to use a number of methods of iteration. In the exercise described in Chapter 7, I used three methods in iteration. I chose a preliminary list of twenty-four variables by choosing from each of the twenty-four subcategories of variables that variable with highest median overall importance ranking. In case of ties, I chose the variable with the highest geometric mean relative importance ranking.[4] This preliminary list could have been chosen in numerous other ways—for example, choosing one or two variables from each subcategory that has at least one variable with median overall importance rating of, say, six or more on a seven-point scale. The problem with this method is that not every major category will necessarily be represented. The preliminary list could be obtained by choosing all variables, regardless of subcategory, that have median overall importance ratings of, say, six or more on a seven-point scale. Again, not every major category will necessarily be represented. Alternatively, this preliminary list could have been obtained by choosing one or two variables from each collection of subcategories belonging to a given category. There are no firm rules for choosing one of these procedures over any other.

Once the preliminary list was chosen, I performed a clustering analysis to pick out ten variables in all. Finally, I iterated again, choosing from among the ten variables in question only those that had median overall importance ratings of five or greater in a seven-point scale. These two iterative steps could, of course, have been done in reverse order. Alternatively, one of the steps could

[4] The reason for using median overall importance and geometric mean relative importance is discussed in Roberts (1973).

have been the gathering of relative importance ratings on the preliminary list, and using these ratings to choose variables.

The message from all this is that there is not one specific technique for gathering variables to use in a signed digraph or cognitive map. Rather, there is a "bag of tricks" that is available for use, and only by experience does one learn which tricks are most appropriate to a given situation.

Indeed, since there are so many ways of building a list of variables, it is perhaps better to build several such lists, and then use them to build several contrasting cognitive maps. As a final test of the "correctness" of the variable list(s), experts could again be asked to give comments.

Actually, any list developed by the questionnaire method is always open to the question: how do you know you have an accurate or representative set of variables? This same question can be directed at the final cognitive map, as well. We return to this issue below.

Let us assume now that we have obtained a list of variables for use in a cognitive map. The next question is how to determine the arrows and signs.

To me, the most important advantage of the questionnaire method is that it allows for the systematic consideration of all ordered pairs of variables. Too often, policy makers do not use a systematic approach, and the result is that important causal relationships are omitted. Indeed, as has been pointed out by Axelrod in Chapter 4 and emphasized in Chapter 9, there is great danger of omitting feedback from consideration when people spontaneously describe a policy domain without being forced to consider all ordered pairs of variables systematically.

It is usually a good idea to randomize the presentation of variable pairs. If there are nine variables, there are seventy-two ordered pairs (without repetitions), and this calls for many judgments. Clearly, early judgments will affect later judgments. In some situations, it might be advantageous to allow those making judgments to return and change earlier judgments on the basis of later ones. And to minimize the effect of order of presentation, it is worthwhile to present each expert who makes the judgments with a list of ordered pairs of variables in a different order.

When an expert is presented with an ordered pair of variables (x,y), it is usually a simple matter for him to decide if a change in x has a significant effect on y, and if so, whether the effect

is positive or negative. Experts do not complain as much about the difficulty of this task as they do about the difficulty of, say, importance ratings. Indeed, I have found that it is even possible to ask experts to estimate the relative strength of the effect of a change in x on y, and the time lag involved before the effect takes place. The questions must be asked very carefully, however. Indeed, one must be careful to specify, if possible, what one means by significant; more important, one must be careful to specify, if one is interested in causation, that the effect you are interested in is not an indirect effect, but a direct causal effect. If the instructions are not clear, they can lead to difficulties. For example, in the exercise described in Chapter 7, the instructions were not entirely clear on this point. The result was that the experts agreed on a negative arrow from fuel economy to emissions. Now an increase in fuel economy does not directly cause a decrease in emissions, although it does so indirectly by leading to a decrease in fuel consumption. But the experts confused direct causation with this indirect causal path, which also appears in the final cognitive map or signed digraph of Figure 7–2. It is a good idea to check systematically for inclusion of indirect effects by considering all triples x,y,z for which there are arrows from x to y, y to z, and also x to z. Is x to z truly a direct effect?

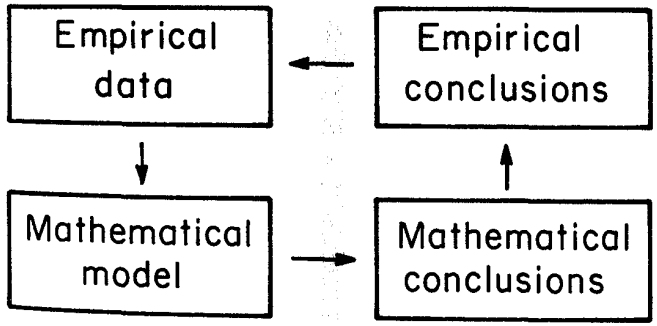
After getting judgments of arrows and signs, there is no further work to be done if there is only one expert involved, except that it might be a good idea to let him see the final cognitive map and give him a chance to reconsider some of his decisions.

If several experts have identified arrows and signs, there is the problem of reaching some consensus. Where there is disagreement, perhaps this should not be hidden, and several cognitive maps drawn, with alternative arrows and signs. Alternatively, one can think of many procedures for reaching consensus. Some of these are described in Chapter 7. The method I used was to say that there was an arrow from x to y if at least a certain proportion of the experts (6 of 7) said there was an arrow. Then, I chose for the arrow that sign which a sufficiently large number of the experts (60 percent) agreed on. If there wasn't that much agreement, I let the sign of the arrow be undecided, and considered a number of alternative signed digraphs with different signs on the arrow. Again, there is no a priori way of deciding what is a good method for combining experts' judgments of arrows and signs. But this method seems as reasonable as any other, and it is easy to use.

Before closing, we should discuss a question that is critical to the success of any construction technique: once you have built a cognitive map, how do you know you have an accurate description of the system?

The answer is, you never know for sure. All mathematical models, including cognitive maps, rest on the supposition that you have included all the relevant information in your assumptions. Obviously, such models can be checked by simply feeding them back to experts. In the case of the cognitive maps constructed by the questionnaire method, these should be given back to the panel of experts for comment and possible modification, or to an independent expert for evaluation. This is one kind of feedback. A second kind of feedback comes from the conclusions attainable, rather than from the structure of the model itself. The method of mathematical models works by means of a continuing feedback loop such as that in Figure A2–1.[5]

FIGURE A2–1.
Continuing Feedback Loop



The mathematical conclusions obtained from the model must be translated into empirical conclusions, and these must be checked against empirical data. In the case of the cognitive maps, these empirical conclusions can be presented to the panel of experts. On the basis of their knowledge of the empirical data, they can in turn modify the mathematical model, that is, the cognitive map.

[5] This diagram is motivated by the discussion in Kemeny and Snell (1973, chapter 1).

By these means, an initial cognitive map might be modified a number of times before the experts are satisfied. It should always, as are all mathematical models, be regarded as tentative and subject to the constant review of the feedback loop shown above.

In addition to regarding a cognitive map as tentative, one should probably not expect that a single cognitive map will accurately represent the system being studied. Alternative cognitive maps could be built using other methods or new scenarios, resulting in different, context-senstive judgments on arrows and signs. Each of these cognitive maps will yield information, and it should be very useful for the policymakers to compare and contrast the conclusions.

APPENDIX THREE

The Mathematics of Cognitive Maps
—*Robert Axelrod*

This appendix establishes the mathematical basis for the manipulation of cognitive maps. Using the theory of directed graphs, it introduces an eight-valued system of relationships that includes values such as "nonnegative" and "ambivalent" as well as "positive" and "negative."

The mathematical system is used to derive a cognitive map from a set of assertions, to determine the total effect of any concept variable on any other concept variable, and to offer advice on how policy choices can be derived from a cognitive map.

INTRODUCTION

This appendix describes the basic mathematical operations needed for a full understanding of the derivation and manipulation of cognitive maps. It assumes a knowledge of basic set theory and matrix multiplication. It also assumes a knowledge of the terms introduced in Chapter 3 for the analysis of cognitive maps.

This appendix will show how assertions made by a person about the same causal relationship can be combined, how the indirect effect of arrows in a single path can be calculated, how the total effect of different paths can be determined, and how advice about policy choices can be derived from a cognitive map.

THE VALUES THAT A RELATIONSHIP MAY TAKE

Relationships from one concept variable to another are regarded as causal.[1] These causal relationships can take on different values.

[1] In this appendix, as elsewhere in this volume, the terms "concept variable" and "point" are used to refer to the nodes of a directed graph, while the terms "relationship," "link," and "arrow" are used to refer to the arcs of a directed graph. The "cognitive map" is the entire directed graph with values attached to the arrows.

The most basic values are positive and negative. These values are described in Chapter 3. Chapters 6 and 7 and Appendices 2 and 4 employ only these two values. An expanded set of eight values is used in Chapters 4 and 5 and Appendix 1. The operations are the same in either case, but for completeness the expanded set is presented here.[2] The collection of eight values is simply all of the logical combinations of positive, negative, and zero:

+ positive
− negative
0 zero
⊕ nonnegative, i.e., {0,+}
⊖ nonpositive, i.e., {0,−}
m nonzero, i.e., {+,−}
u universal, i.e., {+,−,0}
a ambivalent, i.e., the empty set.[3]

COMBINING ASSERTIONS TO FORM RELATIONSHIPS

To build a cognitive map from a set of assertions it is necessary to combine into one relationship all assertions that have the same cause variable and the same effect variable. When each member of a panel of judges makes an assertion about each relationship (as in the questionnaire method), a method analogous to voting is used. Details are given by Roberts in Chapter 7 and Appendix 2. When a single person may make several assertions about the same relationship (as in a document), the assertions are combined by taking the intersection of their values. This latter procedure is quite simple.

All the assertions a person makes about the effect of A on B are combined into a single causal relationship by taking the intersection of their values. For example, the intersection of ⊕ (i.e., the set consisting of 0 and +) and + is simply +. Thus if a person says "A can't hurt B" and also says that "A helps B" the relationship is entered into the cognitive map as "A helps B." As another example, the intersection of + and − is the empty set that is represented by the ambivalent value, a. Thus, if a person says "C helps D" and also says "C hurts D" this is represented in the cognitive map as an ambivalent relationship from C to D.[4] Such a relationship can be seen in Morris' cognitive map in Chapter 5, where Morris made two inconsistent statements about the relationship from P6 to R, that is, about the effect of a particular way of choosing the President and Vice President on "the existence of excessive Senate power." If a person makes no explicit or implicit assertion about the effect of one concept variable on another, that particular relationship is assumed to be zero.[5]

[2] For a formal treatment of alternative sets of values see the Mathematical Appendix in Axelrod (1972b). Incidentally, Hart introduces yet another value, "concave downward," which he explains in his Chapter 8.

[3] The ambivalent value can not be coded from a single assertion. It arises only when two or more assertions are combined, as indicated in the next section.

CALCULATING THE INDIRECT EFFECT OF A SINGLE PATH

Once the relationships between all of the variables are determined, the cognitive map can be drawn. Relationships that are in sequence form paths, and paths transmit indirect effects. For example, suppose there is a positive arrow (that is, causal relationship) from A to B and another positive arrow from B to C, then there is a path from A to C through B, and this path carries an indirect positive effect. The positive value of the arrow from A to B is combined with the positive value of the arrow from B to C to yield the positive value of the path from A to C through B. The operation of combining direct effects of relationships that are in sequence into indirect effects of a path is called multiplication. If the exact numerical values of the arrows were known, regular multiplication could be used, but when only the signs of the values are known, the rules of multiplication give these results:

1. Positive times anything is that thing.
2. Zero times anything is zero.
3. Ambivalent times anything (except zero) is ambivalent.
4. Negative times negative is positive.
5. Multiplication distributes over union. For example, $(-)(\ominus) = (-)(-\cup 0) = ((-)(-))\cup((-)(0)) = (+)\cup(0) = \oplus$.

[4] This assumes that both statements are about the *direct* effect of C on D.

[5] This is why it is important to have a document that is complete in terms of the scope of the investigation.

6. Multiplication is symmetric. For example, $(\ominus)(-) = (-)(\ominus)$.

DETERMINING THE TOTAL EFFECTS OF DIFFERENT PATHS

When two or more paths start with the same point and end with the same point, their effects can be added into a total effect of the first point on the second. The operation is called addition. The rules governing addition of effects of paths from A to B are the following:

1. Zero plus anything is that thing.
2. Ambivalent plus anything is ambivalent.
3. Positive or negative plus itself is itself.
4. Positive plus negative is universal.
5. Addition distributes over union.
6. Addition is symmetric.

SOLVING THE DECISION-MAKING PROBLEM

The decision-making problem, as stated in Chapter 3, is the following: given a cognitive map with one or more policy variables and a utility variable, which policies should be chosen and which should be rejected? The solution to the problem is given by calculating the total effect of each policy on the utility variable. Policies that have a positive total effect on utility should be chosen, and policies that have a negative total effect should be rejected. Policies with a nonnegative total effect should not be rejected, policies with a nonpositive total effect should not be accepted. Policies with a zero total effect on utility do not matter. No advice can be given about policies with a universal total effect, a non-zero total effect, or an ambivalent total effect on utility.

With a little practice, the operations of multiplication and addition can be done in one's head while tracing out the paths of a moderate-sized cognitive map that is displayed as a graph. For large scale work, however, it is useful to have a more systematic way of performing the calculations. Matrix algebra provides a convenient means to this end, especially since matrix operations are easy to implement on a computer.

The matrix of direct effects is called the valency matrix, V. It has as its ij^{th} entry the value of the (direct) causal relationship from concept variable i to concept variable j. When this matrix is multiplied by itself, the ij^{th} entry of the new matrix is the indirect effect of concept variable i on concept variable j through all the paths of length exactly equal to two. This is because matrix multiplication is defined by

$$(AB)_{ij} = \sum_k A_{ik} B_{kj}$$

For $A = V$ and $B = V$, this gives

$$V^2_{ij} = \sum_k V_{ik} V_{kj}$$

Each of the terms of the form $V_{ik}V_{kj}$ expresses the indirect effect of a path from i to some k and from that k to j. Summing the effects of all such paths (through each possible concept variable k) gives the indirect effect of all paths of length two from i to j. Likewise, raising the valency matrix to the third power gives the indirect effect of all paths of length three from i to j. Likewise, raising the valency effects matrix to the qth power gives the indirect effect of all paths of length q from i to j.[6] In an acyclic cognitive map of n concept variables, there is no path longer than $n-1$. Therefore, the valency matrix which has as its ij^{th} entry the total effect of i on j for an acyclic cognitive map can be calculated from the direct effects matrix with the operations of addition and multiplication defined above as follows:

$$T = \sum_{q=1}^{n-1} V^q$$

This total effects matrix, T, can be used for generating advice based on the total effect of each policy variable on the utility variable. It can also be used to study the structure of a cognitive map. A cognitive map is acyclic if and only if all of the main diagonal entries of its total effects matrix, T, are zero (that is, no concept variable has an effect on itself). A cognitive map is balanced if and only if there is no universal, non-zero, or ambivalent entry in its total effects matrix (that is, if the total effect of

[6] This idea is adapted from Harary, Norman, and Cartwright (1965).

every concept variable on every other concept variable is not *indeterminate*).[7]

Further applications of matrix operations on cognitive maps, including some with different types of addition and multiplication, are given in the next appendix by Nozicka, Bonham, and Shapiro. For more on the mathematics of cognitive maps that have cycles, see Roberts, Chapter 7.

[7] This extends the common definition of semipath balance to cover the eight-valued case of cognitive maps discussed here.

Simulation Techniques

—*George J. Nozicka, G. Matthew Bonham,* and *Michael J. Shapiro*

Cognitive maps can be used in the simulation of individual belief systems. One such simulation, of a Middle East expert, was employed in Chapter 6 by Bonham and Shapiro. This appendix describes the techniques used in that simulation. Among the operations performed by the simulation on a given cognitive map are the formulation of alternative explanations of an unanticipated event, the selection of the preferred explanation, the development of expected consequences of the event, the search for relevant policy options, and the ranking of the relevant policy options.

The computer simulation used in Chapter 6 was developed in the course of our investigations of foreign policy decision-making behavior (Shapiro and Bonham, 1973). The simulation uses digraph theory as its mathematical base. Digraph theory, or the theory of directed graphs, provides convenient matrix techniques for the representation and manipulation of structural relationships (Harary, Norman, and Cartwright, 1965), and this enables the computer processing of decision makers' belief systems.

The cognitive map that represents the subset of a decision maker's belief system relevant to the foreign policy situation being analyzed is converted to the form of a *valency matrix*. The valency matrix A is a square matrix of size $n \times n$, where n is the total number of concepts in the corresponding cognitive map. For the purposes of our simulation, A is a signed binary matrix. Each element v_{ij} can take on the values $+1$, 0, or -1; $v_{ij}=1$ if a positive relationship from i to j is present in the cognitive map, -1 if a negative relationship from i to j is present in the cognitive map, and 0 otherwise. The diagonal elements a_{ij} are considered to be 0.

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The transformation of a cognitive map into its corresponding valency matrix is illustrated in figures A4–1 and A4–2. Figure

FIGURE A4–1.

Illustrative Cognitive Map

Concepts 1 and 2 are policy concepts.
Concepts 3 through 9 are cognitive concepts.
Concepts 10 and 11 are affective (value) concepts.

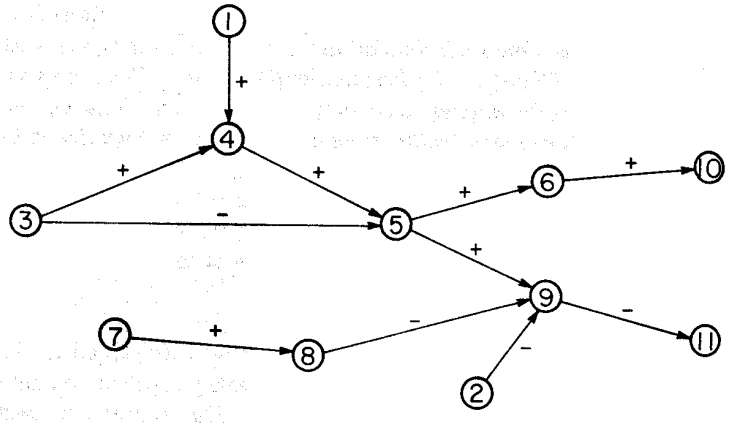

FIGURE A4–2.

Valency Matrix and Associated Row and Column Sums for the Cognitive Map in Figure A4–1

	1	2	3	4	5	6	7	8	9	10	11	Row abs. sums
1	0	0	0	1	0	0	0	0	0	0	0	1
2	0	0	0	0	0	0	0	0	−1	0	0	1
3	0	0	0	1	−1	0	0	0	0	0	0	2
4	0	0	0	0	1	0	0	0	0	0	0	1
5	0	0	0	0	0	1	0	0	1	0	0	2
6	0	0	0	0	0	0	0	0	0	1	0	1
7	0	0	0	0	0	0	0	1	0	0	0	1
8	0	0	0	0	0	0	0	0	−1	0	0	1
9	0	0	0	0	0	0	0	0	0	0	−1	1
10	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0
Column abs. sums	0	0	0	2	2	1	0	1	3	1	1	11

A4–1 shows a small cognitive map involving eleven concepts and the causal relationships that are perceived to exist among them. Figure A4–2 then shows the valency matrix that results when the above-stated transformation rules are applied to this illustrative cognitive map.

The valency matrix has a number of useful properties.[1] The row sum of the absolute values of the elements of row i gives the *outdegree* (od) of concept i, that is, the number of concepts perceived to be affected directly by concept i. Similarly, the column sum of the absolute values of the elements of column i gives the *indegree* (id) of concept i, the number of concepts perceived to affect concept i directly. The sum of the indegree and outdegree for concept i gives the *total degree* (td) of concept i, a useful operational measure of that concept's *cognitive centrality* in the decision maker's belief structure. Mathematically, these relationships can be expressed as

$$\mathrm{id}(i) = \sum_{j=1}^{n} v_{ij}$$

$$\mathrm{od}(i) = \sum_{j=1}^{n} v_{ji}$$

$$\mathrm{td}(i) = \mathrm{id}(i) + \mathrm{od}(i)$$

Applying the total degree criterion for measuring cognitive centrality to the valency matrix in Figure A4–2, concepts 5 and 9 are found to have the highest total degree (4; 2+2 and 1+3, respectively). Examination of the cognitive map in Figure A4–1 confirms that these two concepts are, indeed, the most central.

Operationally, however, cognitive centrality is not determined on the basis of total degree alone. Some of the perceived relationships in a decision maker's cognitive map are based on analogies from past events. In such cases, the relational paths between historical events and the affected concepts are also added to the cognitive centrality index. Moreover, since many of our cognitive maps are based on the perceptions of several decision makers, the possibility of multiple relations between a pair of concepts exists, and such multiple paths are also considered in the computation of cognitive centrality.

The most useful property of the valency matrix is that it readily permits the computation of the *reachability matrix* R. The reach-

[1] See Harary, Norman, and Cartwright (1965), pp. 17–18.

ability matrix [2] raised to the second power is a square matrix also of size $n \times n$, each of whose elements r_{ij} is 1 if concept j is reachable from concept i, and 0 otherwise. Whereas the valency matrix A indicates only direct relationships between concepts, that is, concept linkage paths of length 1, the reachability matrix reflects the existence of indirect or deductive relationships as well. Indirect paths, that is, concept linkage paths of length greater than 1, can be located by raising the adjacency matrix to successive powers. If element v^2_{ij} of matrix V^2 is non-zero, a path of length 2 exists between concepts i and j; if $a^2_{ij}=0$, such a path does not exist.

Figure A4–3 shows this property of the valency matrix; there, the illustrative valency matrix is squared to test the existence of paths of length 2. Element a^2_{15}, for example, is non-zero; this reflects the existence of a path of length 2 between concepts 1 and 5. Such a path exists, indeed, in the cognitive map via concept 4.

FIGURE A4–3.

Valency Matrix in Figure A4–2 Squared (A^2), Showing the Existence of Paths of Length 2

	1	2	3	4	5	6	7	8	9	10	11
1	0	0	0	0	1	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	1
3	0	0	0	0	1	−1	0	0	−1	0	0
4	0	0	0	0	0	1	0	0	1	0	0
5	0	0	0	0	0	0	0	0	0	1	−1
6	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	−1	0	0
8	0	0	0	0	0	0	0	0	0	0	1
9	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0

Similar relationships exist between the matrix V^3 and paths of length 3, the matrix V^4 and paths of length 4, etc. By using boolean operations, the reachability matrix can thus be computed as $R=V+V^2+V^3+\ldots V^{n-1}$ since the longest possible path in a cognitive map with n concepts is of length $n-1$. In computation, it is rarely necessary to raise A to the $(n-1)^{th}$ power, since such long paths rarely exist; it is only required to raise A to a power k such that $A^k=0$. Once this point is attained, no additional non-zero reachability matrix elements will be located. The full reachability matrix for the illustrative cognitive map is shown in Figure A4–4.

[2] See Harary, Norman, and Cartwright (1965), pp. 117–122.

FIGURE A4–4.

Reachability Matrix and Associated Row and Column Sums for the Cognitive Map in Figure A4–1

	1	2	3	4	5	6	7	8	9	10	11	Row sums
1	0	0	0	1	1	1	0	0	1	1	1	6
2	0	0	0	0	0	0	0	0	1	0	1	2
3	0	0	0	1	1	1	0	0	1	1	1	6
4	0	0	0	0	1	1	0	0	1	1	1	5
5	0	0	0	0	0	1	0	0	1	1	1	4
6	0	0	0	0	0	0	0	0	0	1	0	1
7	0	0	0	0	0	0	0	1	1	0	1	3
8	0	0	0	0	0	0	0	0	1	0	1	2
9	0	0	0	0	0	0	0	0	0	0	1	1
10	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0
Column sums	0	0	0	2	3	4	0	1	7	5	8	30

For the purposes of the simulation, a complete effects matrix is computed from the valency matrix of direct effects. The *complete effects matrix* C is the same as the total effects matrix defined in Appendix 3, except that the only entries used are +1, −1, and 0. If there is imbalance (that is, if the indirect effect of one concept on another is positive through one path and negative through another), then the indirect effect of the shortest path is used as the entry in the complete effects matrix. The imbalance still exists, though, and needs to be considered subsequently in the simulation.

The computation of row and column sums of the absolute values of the elements of R gives other useful measures analogous to the outdegree and indegree of the adjacency matrix. The row sum of R for row i specifies the total number of concepts reachable from concept i, while the column sum for column i gives the total number of concepts from which concept i can be reached.

After the valency reachability and complete effects matrices are constructed, the simulation of a given foreign policy event can begin. The event is input in the form of an initial list of concepts to be highlighted in the cognitive map. From these initially highlighted concepts, a full *highlight vector* is constructed by the process of indirect highlighting. All concepts from which an initially highlighted concept can be reached lie on potential explanatory

antecedent paths, and are so identified in the highlighted vector. Similarly, all concepts that can be reached from an initially highlighted concept lie on potential *consequent paths,* and therefore are also indirectly highlighted. These operations are performed by consulting the columns and rows, respectively, of the reachability matrix. Concepts not highlighted, initially or indirectly, in the highlight vector will play no explanatory role in the problem under analysis; such concepts can therefore be eliminated for the time being from both the valency and reachability matrices. Policy concepts will be used in the selection and evaluation of relevant policy options, but do not play an explanatory role; as a result, they are also temporarily removed from the valency and reachability matrices.

If, in the illustrative cognitive map, concept 5 is initially highlighted because it reflects some important aspect of a foreign policy problem under analysis, then concepts 3 and 4 would be indirectly highlighted because they lie on potential antecedent paths and concepts 6, 9, 10, and 11 would be indirectly highlighted because they lie on potential consequent paths. Concepts 7 and 8 are not highlighted, and will therefore not play a role in the explanation-finding process; neither will concepts 1 and 2, which are policy concepts.

The highlighted concepts and the perceived relationships among them form the subset of the decision maker's belief system from which explanations will be deduced; the analysis of this remaining network is the central part of the model. This consists of six phases:

search for antecedent paths;
search for consequent paths;
formulation of alternative explanations;
selection of the preferred explanation;
search for relevant policy options; and
evaluation and ranking of relevant policy options.

The search for antecedent paths involves the identification of the various linear sequences of concepts leading to the concepts externally highlighted. Antecedent paths are located by starting with the initially highlighted concepts and, for each, searching the respective *column* of the valency matrix to identify the immediately

antecedent concepts. If there are several immediately antecedent concepts, the one with the highest cognitive centrality is chosen as the best next step in the path; this procedure directs the search to the most complex, and hence most central region of the cognitive map. Once the second concept of the path has been chosen, the valency matrix is searched for the concept directly antecedent to it with the highest cognitive centrality. This procedure is followed until a concept with no antecedents is reached; this concept with an indegree of 0 marks the beginning of this antecedent path. At this point all relationships unique to this antecedent path are removed from the valency matrix. The same procedure is then followed to locate the next possible antecedent path, and so forth, until gradually the entire set of antecedent relationships in the valency matrix is fully reduced.

At this point the full *set of antecedent paths* has been identified. Each path is now tested to ascertain whether at least one of the relationships on the path is perceived as historically supported. If no historical support exists, the path is suppressed. In this manner, the set of antecedent paths is reduced to the *set of plausible antecedent paths,* which is then stored.

Applying this algorithm to the illustrative cognitive map will result in the location of two antecedent paths: (3–4–5) and (3–5), when concept 5 is the initially highlighted concept.

The search for consequent paths is performed in an analogous manner. This time, however, the search begins with the value concepts rather than with the initially highlighted concepts. The columns of the valency matrix are again used to locate directly antecedent concepts, and the choice among several directly antecedent concepts is again resolved by the cognitive complexity criterion. The construction of a consequent path proceeds until either an initially highlighted concept or a concept on an antecedent path is reached. At this point, the relationships unique to this consequent path are removed from the valency matrix and the search procedure is performed iteratively until the full *set of consequent paths* has been identified. The historical support test is not applied to consequent paths, since these reflect conjectures regarding future behavior rather than inferences from past experience. The set of consequent paths is thus identical to the *set of plausible consequent paths.*

The illustrative cognitive map with concept 5 initially highlighted will yield two consequent paths when this algorithm is applied; these are (5–6–10) and (5–9–11).

From the full set of plausible antecedent and consequent paths, one or more explanations can be derived. The number of explanations available depends on the number of unique, mutually inconsistent sets of antecedent and consequent paths that exist. Inconsistency, in this sense, is identical to imbalance. If the sign of the perceived relationship between two concepts when determined over one path differs from the sign obtained over another path, imbalance is present, and the paths belong to two separate inconsistent explanations, one of which will be accepted and the other suppressed.

Explanation selection is accomplished in the model with the aid of a *path balance matrix* P. If the number of plausible antecedent paths is a and the number of consequent paths is b, then the path balance matrix P is a square matrix of size $c \times c$, such that $c = a + b$. Matrix P is binary with each element $p_{ij} = 1$ if paths i and j are mutually balanced, and $p_{ij} = 0$ if they are imbalanced. Entries on the main diagonal equal 1 by definition. The matrix is symmetric, because the balance relationship is symmetric (that is, if i balances j, then j balances i). The balance relationship is not transitive, however, since, if i balances j and j balances k, it does not necessarily follow that i balances k. For this reason, each element of P above the main diagonal, p_{ij}, has to be uniquely determined by examining the subnetwork of relationships among the shared concepts on paths i and j. If paths i and j share less than two concepts, imbalance is not possible, and p_{ij} is set at 1.

The path balance matrix may then be used to identify all sets of antecedent and consequent paths that form balanced consistent explanations. The model predicts that the explanation that will be preferred by the decision maker will be the one with the highest cognitive centrality. The cognitive centrality of explanation k is defined in the model as

$$cc_k = \sum_{i=1}^{n} (cc(i)\ x_{ik})$$

where n is the total number of concepts, cc(i) is the cognitive centrality of concept i, and x_{ik} is a boolean variable with a value of 1 if concept i is present in explanation k, and 0 otherwise.

Operationally, the search for the preferred explanation is accomplished within the model in the following manner: the cognitive centrality for each antecedent and consequent path located is computed as the sum of the total degrees of its component concepts. The path with the highest cognitive centrality is selected as the base of the explanation. All other paths are then examined in order of decreasing cognitive centrality, with the aid of the path balance matrix, to determine whether they are consistent with all paths previously selected as part of the preferred explanation. If so, they are added to the explanation.

When the explanation-finding algorithm was applied to the illustrative cognitive map, four antecedent and consequent paths were located:

1 (3–4–5); 2+3+4=9
2 (3–5); 3+4=7
3 (5–6–10); 4+2+1=7
4 (5–9–11); 4+4+1=9

The cognitive centrality of each path is shown following the identifications of the component concepts. From the five paths a 4 x 4 path balance matrix is derived (Figure A4–5). This matrix shows

FIGURE A4–5.

A 4×4 Path Balance Matrix

	1	2	3	4
1	1	0	1	1
2	0	1	1	1
3	1	1	1	1
4	1	1	1	1

that all paths are mutually balanced, with the exception of paths 1 and 2. Paths 1 and 2 are inconsistent, since path 1 yields a positive linkage between 3 and 5, while path 2 yields a negative linkage. Applying the preferred explanation search algorithm to this path balance matrix, an explanation consisting of paths 1, 3, and 4 is selected; this explanation has an overall cognitive centrality of 17.

With the preferred explanation identified, the valency matrix is reduced by removing from it all nonpolicy concepts and relationships that are not present in the explanation; policy concept linkages are restored to the valency matrix at this time. A final reachability matrix can then be computed, and the search for relevant policy options can be performed.

The search for policy options involves the examination of the reachability matrix to determine if, for each given policy concept, one or more concepts that are part of the explanation are reachable. If so, that policy concept is added to the set of relevant policy concepts; otherwise it is discarded as inapplicable.

In our example there are two policy concepts, concepts 1 and 2. Both of these are relevant, since they are adjacent to concepts that are part of the preferred explanation (concept 1 is adjacent to concept 4, while concept 2 is adjacent to concept 9).

The set of relevant policy concepts is evaluated and ranked. Evaluation is performed in terms of the differential impact of the policy concepts on an externally specified and ranked set of high-order value concepts. This operation involves the use of a *policy impact matrix* Q, which is a rectangular matrix of size $p \times s$, where p is the total number of relevant policy concepts and s is the total number of the high-order value concepts. Q is a signed binary matrix where each element q_{ij} specifies the sign of the perceived effect that policy concept i has on value concept j. Essentially, Q is a submatrix of the complete effects matrix C, and is constructed from it.

The ranking of the relevant policy concepts is then done using a lexicographic decision algorithm. Based on the proposition that decision makers do not seek to maximize all of their values simultaneously, but rather pay selective attention to one high-order value at a time, this procedure involves the iterative classification of the policy concepts into three categories (positive impact, zero impact, and negative impact) with respect to each value concept, starting with the most important value first. This is computed by calculating a *policy impact index* N for each relevant policy concept, such that

$$N_i = \sum_{j=1}^{s} (10^{s-j} q_{ij})$$

where the s value concepts are so ranked that value 1 is perceived as more important than value 2, etc. Selection of the preferred

policy, then, involves selection of the relevant policy concept with the highest policy impact index.

In our example, the policy impact matrix is of size 2×2 involving 2 policy concepts (1,2) and 2 value concepts (10,11) (Figure A4–6). Policy concept 1 is thus perceived to have a positive effect

FIGURE A4–6.

A 2×2 Policy Impact Matrix

	10	11
1	+1	−1
2	0	+1

on value 10 and a negative effect on value 11; policy concept 2 has no perceived effect on value 10 and a positive effect on value 11. If value concept 10 is deemed more important than value concept 11, policy concept 1 would be preferred. If the value rankings were reversed, then concept 2 would become the preferred policy.

The simulation model has been implemented in FORTRAN IVH for the IBM 370/145 system available at The American University Computation Center, and in its present form is capable of processing cognitive maps involving up to two hundred concepts.

APPENDIX FIVE

Guide to Source Materials
—*Robert Axelrod*

This appendix offers suggestions on source materials for the researcher who wishes to employ the cognitive mapping approach. Suggestions are made on how material can be custom made, borrowed from other studies, or located in documentary sources. For the researcher who wants unobtrusive and verbatim records of private meetings, twenty-one specific suggestions are offered, but the point is also made that such strict requirements are not necessary for most research purposes.

This appendix is designed to help a researcher who wishes to use the cognitive mapping approach. In Chapter 11 fifteen projects were suggested, and many others are possible. Most of these projects require the availability of suitable source material to analyze. This appendix is devoted to offering suggestions on source material suitable for the analysis of cognitive maps.

The primary principle in seeking suitable material is that the researcher distinguish between necessary and desirable features of the materials. For example, if the goal is to study the role of new information in decision making, the researcher might be able to find suitable materials in four or five places. If, however, the researcher *also* insists that the documents deal with a particular subject, say, United States-Cuban relations between 1965 and 1970, then no suitable material may be available. If a given subject *is* required, the best information retrieval devices are people who specialize in that subject area, especially librarians, scholars, and practitioners.

CUSTOM-MADE MATERIALS

A tremendous aid to the study of cognition and decision making is that the researcher does not have to rely on previously existing

I would like to thank Margaret Wrightson, my research assistant, for her help in formulating many of the descriptions of the sources cited in this appendix.

materials. For many research topics, generating one's own materials is also possible. This has the advantage of allowing the researcher to have some control over the participants, the subject matter, and the setting. If often has the disadvantage of requiring the generalization of the findings to a different setting, which is not under the control of the researcher.

Gaming provides a fruitful technique to generate suitable source materials. For example, in Chapter 6 Bonham and Shapiro used a political-military game with three players to generate the transcript of a Middle East expert talking about his beliefs in the context of a specific policy problem. Experimental psychologists and sociologists have long done small-group experiments that allow the participants to communicate with each other in more or less structured formats. Dozens, if not hundreds, of these small-group experiments have already been recorded on audio or video tape, and many are probably available for analysis.[1] In some cases, the researcher may be lucky enough to find what he is looking for in a previously conducted experiment for which the authors are willing to make available the tapes or transcripts of the discussions. In any case, the sheer number of such experiments demonstrates that it may not be too difficult to conduct one's own small-group experiment, custom designed to generate source material under suitable conditions. This is especially true if the research goal is to understand the effects of some particular variables that can be readily manipulated or statistically controlled in such laboratory settings.

For those who want more realism, but still want to have some control over the setting, a useful compromise is to use medium-level decision makers from ongoing institutions such as local governments, businesses, and unions. An example of this approach is Barber's (1966) study of local budgeting, in which entire town councils met to consider his own hypothetical budgetary problems. Such ongoing groups may require anonymity, but they make excellent subjects because they can be studied in detail, but still retain the often critical contextual factors of a standing group that are so hard to simulate in an experiment with college students.

Another way in which the experimenter can generate his own material is with the questionnaire method. This method allows the researcher to select his own subject area and his own respondents, and then ask the respondents (or judges, as they have been called) to specify the causal linkage between every ordered pair of varia-

[1] For guides to the small-group literature, see Chapter 11, n. 10.

bles. This is what Roberts did in Chapter 7, with judges giving their judgments about the beliefs of several different actors as represented in a large collection of documents they had read. With such structured questionnaires, one can derive the cognitive maps quite directly, as described in Roberts in Appendix 2. With less structured interviews, one can use the documentary coding technique to derive the maps.

Semistructured interviews are especially helpful when the researcher wishes to control the subject matter, but still allow the respondents to express themselves in their own words. An excellent example is Putnam's (1973) study of Italian and British members of the parliament, which analyzes their cognitive styles as well as their policy preferences. Materials such as this could also be used for cognitive mapping analysis, especially since Putnam found that he was able to tape record more than 95 percent of the interviews. Interviews that guarantee the respondent's anonymity may be better than policy discussions as source materials, if the research goal is to make inferences about beliefs rather than (say) the dynamics of the policy process. The researcher must be careful, however, about his own impact on the message elicited. For example, if the interviewer asks what the respondent means by a certain statement, the respondent is likely to provide more detail on that subject, and this may make his cognitive map have more points and arrows in that neighborhood.

UNOBTRUSIVE MEASURES

For those who want source material uncontaminated by the presence of the researcher himself, unobtrusive measures are needed.[2] For the purposes of cognitive mapping, the main source of such unobtrusive materials is documents generated for purposes other than the researcher's own. The range of such documentary material is almost as great as the collections of major libraries and archives.

If one wants to stay close to the form of the assertions actually made by the actors, one can use the documentary method of coding the documents. This method is not suitable for large collections of documents, because of the time it takes to code a long text (see Chapter 10, section B). For documents of limited length, however, the documentary coding method is perfectly suitable.

[2] A wonderful book on this subject is Webb, et al. (1966).

If one is interested in analyzing written words, rather than spoken words, the range of source material is huge. Just go to a library. For example, if one wanted to study Adolph Hitler's early assertions, his *Mein Kampf* is readily available (Boston: Houghton Mifflin, 1943). For assertions made in greater privacy, there are available very rich collections of letters and diaries of many public figures, especially dead ones. There are also some excellent collections of internal governmental memoranda. The origins of World War I provide a wealth of published material from each of the governments involved. For a guide to this material, see Zinnes (1963). An outstanding recent collection is *The Pentagon Papers.*

1. *The Pentagon Papers* (The Senator Gravel edition, 5 volumes, Boston: Beacon Press, 1971–1972); or *U.S.-Vietnam Relations, 1945–1967; Study* (12 volumes of text consisting of the first 43 volumes of the original 47-volume study, Washington, D.C.: Government Printing Office, 1971). This is the leaked Defense Department history of U.S. decision making on Vietnam. It contains the text of numerous classified documents as well as an interpretive history.

For some purposes, spoken words have important advantages over written words. For one thing, spontaneously spoken words may provide a better indication than carefully composed words of how the person thinks about an issue on his own. For another thing, the critical interactions between policy makers are often done through the spoken rather than the written words. For these reasons, all three empirical studies in this volume that used the documentary method used source materials based on spoken words.

Words can be spoken in public or in private. Documentary materials recording words spoken in public are anything but rare. A fascinating early example is the contemporary accounts of Thucydides.

2. Thucydides, *The Peloponnesian War* (Benjamin Javett, trans., New York: Bantam, 1960). Contains Thucydides' reconstruction of many speeches, including some of Pericles and the two debates in Athens on what should be done with the inhabitants of the conquered cities of Mytilene (416 B.C.) and Melos (427 B.C.).

More recently, there are public debates of legislatures. The recent output of the American Congress is awe-inspiring, but for older material the British are unexcelled.

3. *Cobbett's Parliamentary History of England: From the Norman Conquest in 1066 to the Year 1803.* (36 volumes, Lon-

don: Printed by F. Curso Hansard, Peterborough-Court, Fleet Street, published by R. Bagshaw, Brydges-Street, Covent Garden, 1806). Earlier volumes reported speeches in the third person, but later volumes contain many lively debates on political issues. The degree of editing is hard to determine in many cases, due to the formal mode of speech. *Parliamentary Debates* (Hansard's), (London: His/Her Majesty's Stationery Office). There are approximately 1800 volumes of parliamentary debates from 1803 to the present in Hansard's. The earlier volumes contain many one- or two-page speeches followed by some rebuttal. The more recent volumes contain substantial verbatim discussion and disagreement.

In the last few decades the recording of legislative debates, legislative hearings, administrative hearings, speeches, press conferences, interviews, and trials has reached astronomical proportions. If the researcher can employ such public utterances on recent public affairs, there will be no lack of volume. Even TV news coverage is available.

4. *Vanderbilt News Archives.* This archive contains videotapes of the network evening news programs since August 5, 1968. Videotapes and audiotapes are available for rental, either as full programs or compilations of specified items. Some companion materials on major news events are also available. For access to the collection, write The Administrator, Vanderbilt Television News Archive, Joint University Libraries, Nashville, Tennessee 37203.

For some research projects, confidential source material is needed. This would be the case if the researcher wanted to study topics such as how policy-making groups operate in private, or how assertions made to a few close colleagues differ from assertions made to the general public on the same subject. Here is where the shortage of source materials begins to be a problem. The problem arises precisely because the researcher wants to observe behavior that the participants intended to be confidential. The principal method for dealing with this problem is to use source materials that were generated for institutional reasons and that later become available. In searching for such material, the researcher should be aware that such materials can become available in a variety of ways, including:

1. leaks (for example, the *Pentagon Papers,* mentioned earlier);
2. capture (for example, the Nazi archives);
3. release due to legal proceedings (for example, some of former President Nixon's White House tapes);

4. automatic release after a fixed period of time (for example, most of the British documents, including the Eastern Committee transcripts used in Chapter 4); and
5. negotiated release with specific conditions (that the participants' identities will be masked; for example, the publication of transcripts of psychiatric therapy sessions).

Spoken words are not always recorded verbatim. This is especially true when the documents are the institutional records of what happended at meetings. In such case, the available records are usually in the form of more or less detailed minutes. Whether minutes are preferable to verbatim transcripts depends on the purpose of the research. If the goal is to study the stylistic differences between two participants, minutes might not be adequate. On the other hand, if the goal is to study the flow of the argument, then a good set of minutes might well be preferable to a verbatim transcript, because the minutes would be much more concise. Three examples of such minutes of policy meetings are from the American Constitutional Convention, the Munich negotiations, and the Japanese decision to attack the United States in 1941.

5. James Madison, *Journal of the Federal Convention,* ed. E. H. Scott (Chicago: Scott, Foresman, 1898). These are Madison's detailed notes on the Constitutional Convention of 1787, which formed the basis of Ross's study of Gouverneur Morris in Chapter 5 of this volume.

6. E. L. Woodward, Rohan Butler, and Margaret Lambert, eds., *Documents on British Foreign Policy, 1919–1939,* third series, vol. II, 1938 (London: His Majesty's Stationery Office, 1949). Germany, Foreign Ministry, *Documents on German Foreign Policy, 1918–1945,* Series D, Vol. II (Washington, D.C.: Government Printing Office, 1949). The detailed British and German minutes of the Munich negotiations between Hitler and Chamberlain are contained in these volumes. They match very closely.

7. Nobutaka Ike, trans. and ed., *Japan's Decision for War: Records of the 1941 Policy Conferences* (Stanford: Stanford University Press, 1967). These are the records of five imperial conferences and fifty-seven liaison conferences between representatives of the cabinet and the army and navy. They deal with questions of foreign policy, such as the decision to move south against Britain and the United States rather than north against the Soviet Union.

For some research purposes, it is helpful to have verbatim records of meetings that were held in confidence. Having verbatim

records is useful to guarantee against distortion and to preserve style. Having records of meetings that were held in confidence is useful to guarantee that the speakers are addressing each other and not some larger audience.

Naturally, verbatim records of meetings held in confidence are not very common. Most meetings held in confidence are kept in confidence, and are not available to the researcher. Moreover, keeping verbatim records is an expensive process, and therefore not usually undertaken. What follows are twenty-two instances of such available verbatim records of nonpublic meetings. The first group is nongovernmental, from a union-management negotiation (number 8) and an academic discussion of programmed learning (9). The next group consists of records of high-level meetings on foreign and military policy from Britain (10), the United States (11), Germany (12–14), and Japan (15–16). Then there are multinational negotiations from the end of World War I (17–19), the depression of the 1930s (20), and the beginning of the Cold War (21–23). The next group deals with the crises in China in 1924 and 1946 (24 and 25), and in Nigeria in 1967 (26). The final group includes domestic American political meetings dealing with federal-state relations (27), rules for affirmative action in the Democratic party (28), and the White House cover-up of Watergate (29).

8. Ann Douglas, *Industrial Peacemaking* (New York: Columbia University Press, 1962.) The first part of the book is an abstract analysis of bargaining styles in industry, while the second part is a 466-page transcript of one labor-management negotiation. The true names of the fifteen participants are not disclosed. The transcript is from the tape recordings of seven sessions held between March 21 and April 18, 1953. The conversations of the negotiating sessions are extremely candid and unedited.

9. Gilbert Teal, ed., *Programmed Instruction in Industry and Education* (Stanford: Public Service Research, Inc., 1963). This books includes the verbatim transcript of the proceedings of a conference on the Institute of Programmed Instruction, July 10–14, 1961. There were thirty participants. Topics discussed include learning theory, principles for programmed instruction, evaluation of programming methods, implications of research in program improvement, and roles of instructors. The editor notes that the comments of the participants are presented almost exactly as spoken, with only minor grammatical changes. The discussions

are not argumentative, though differences of opinion are expressed. The transcript is approximately 300 pages.

10. *Eastern Committee, Minutes and Verbatim Annex, Cab 27/24* (London: Public Records Office, 1919–1920, available on microfilm). This is the material used in my study of British neoimperialism in Persia (Chapter 4). Other meetings of the same committee discuss policy toward other regions between the Mediterranean and India, including Palestine, Armenia, and the Caucasus. Altogether, ten meetings in 1918–1919 were recorded verbatim, probably with a small amount of editing to improve the grammar.

11. *The Morganthau Diary. China:* Vols. I and II, 1965; *Germany:* Vols. I and II, 1967. (U.S. Senate, 89th and 90th Congresses, Subcommittee on Investigating the Administration of the Internal Security Act and Other Internal Security Laws of the Committee on the Judiciary). Henry Morganthau, President Franklin Roosevelt's trusted Secretary of the Treasury from 1934 to 1945, had transcripts kept of conversations among high-ranking Treasury officials. Together with his files of letters and memos, his "diaries" compose over eight hundred volumes. In the course of the Senate investigations, material dealing with the Treasury Department's involvement in foreign affairs was published in the four volumes cited here. These volumes contain many verbatim records of candid phone conversations and policy meetings, with little editing.

12. Germany, Wehrmacht, Oberkommando, *Hitler Directs His War,* Felix Gilbert, ed. (New York: Oxford University Press, 1950). See also Germany, Wehrmacht, Oberkommando, *Hitlers Lagebesprechungen Die Protokollfragmente seiner militarischen Konferenzen, 1942–1945* (Herausgegeben von Helmut Huber, Stuttgart: Deutsche Verlags-Anstalt, 1962). These are the secret records of Hitler's daily military conferences during World War II. They include very candid discussions. The Gilbert edition contains 150 pages in translation, while the Huber edition contains 900 pages in the original German.

13. Office of the U.S. Chief Council for Prosecution of Axis Criminality, *Nazi Conspiracy and Aggression,* Vols. 1–6. (Washington, D.C.: Government Printing Office, 1946). While not all of the captured Nazi archives have been translated and published, some of the most interesting documents are available through publications related to the Nuremberg trials. Among the transcripts published by the U.S. Chief Council is one of a meeting chaired by

Goering on November 12, 1938, dealing with the Jewish question in light of the massive pogrom that just occurred (Vol. 4, 425–456), and one of a meeting between Hitler and his military aides on the deteriorating military situation as of January 27, 1945 (Vol. 6, 655–717).

14. *International Military Tribunal, Trial of the Major War Criminals before the International Military Tribunal, Nuremberg, 14 November 1945–1 October 1946,* Vols. 1–4 (Nuremberg, 1949). Among the interesting materials in these volumes are transcripts in German of telephone conversations dealing with Austria in 1938 (Vol. 31, 354–384), and the stenographic report of the trial of eight people for the 1944 attempt on Hitler's life (Vol. 33, 299–530).

15. International Military Tribunal for the Far East, *International Military Tribunal for the Far East: Decisions of the Imperial Conference in Prosecutor's Evidence—Exhibits.* Vols. 1–131. (Tokyo, 1946–1947). This huge collection includes many exhibits of the records (most with translations) of high level Japanese policy meetings, largely from the 1930s, including records of the Privy Council and the Imperial Conference meetings. Among the most useful records of meetings are exhibits 241, 492, 527, 528, 552, 787A, 850, 911A, 1030, and 2205A. Unfortunately, these records tend to be short relative to the length of the meetings, indicating that they are probably paraphrased rather than strictly verbatim.

16. Miyoji Ito, *Suiuso Nikki.* (Tokyo: Hara Shobo, 1966). These are the records of a participant in the *Gaiko Chosakai* (Diplomatic Advisory Council) during the period 1918–1919. Among the issues considered by this high level group were the Japanese positions at the Paris Peace Conference and the Japanese role in the Siberian intervention. The records consist of five hundred pages of virtually verbatim notes covering twenty-six meetings, but they are not available in translation. For a discussion of the group and its significance see Morley (1957).

17, Harry R. Rudin, *Armistice 1918.* (New Haven: Yale University Press, 1944). Excerpts of transcripts from a German cabinet meeting on October 17, 1918 (pp. 145–153), the Allied Supreme War Council on November 1 (pp. 276–277), the War Council and a representative of Germany on November 1–2 (pp. 290–302), and an Allied discussion of specific armistice terms on November 4 (pp. 303–317).

18. Great Britain, Foreign Office; Rohan Butler and E. L.

Woodward, eds., *Documents on British Foreign Policy, 1919–1939, First Series, 1919.* (London: His Majesty's Stationery Office, 1948–1954). Transcripts of meetings between Allied leaders at the 1919 Paris Peace Conference (Versailles Conference) are contained in Vol. 2, 914–968), Vol. 3, 348–355, and Vol. 5, passim.

19. U.S. Department of State, *Papers Relating to the Foreign Relations of the United States, The Paris Peace Conference, 1919* (Washington, D.C.: Government Printing Office, 1945–1946). Volume 4, 191–201, contains transcripts of a meeting of the Council of Four (Wilson, Lloyd George, Clemenceau, and Orlando) with the premier of Poland on June 5, 1919. Volume 9 contains transcripts of a series of meetings between representatives of the five major powers (the International Council of Ministers) and representatives of the smaller powers in January 1920. Volume 11 contains transcripts of a series of meetings of the Commissioners and Technical Advisers of the American Commission to Negotiate Peace during the period June to September 1919.

20. Great Britain, Foreign Office; Rohan Butler and E. L. Woodward, eds., *Documents on British Foreign Policy, 1919–1939, Second Series.* (London: His Majesty's Stationery Office, 1947–1948). Volume 2 contains the transcripts of meetings of the London Conference of 1931 with representatives of seven industrial nations discussing the current world economic situation and possible corrective measures. The shortness of the transcripts in relation to the duration of the meetings indicates heavy editing. Volume 3 contains a transcript of a meeting between representatives of Great Britain and Germany in 1932 on the problem of German war reparations.

21. U.S. Department of State, U.S. Congress, House Document No. 154. *Foreign Relations of the United States, 1945. Diplomatic Papers: The Conferences at Malta and Yalta: 1945.* (Washington, D.C.: Government Printing Office, 1955). This volume contains the records of Hess and Mathews. The Yalta Conference brought together Stalin, Roosevelt, and Churchill in February 1945. The records of the meetings (chapter 3, pp. 611–855) consist largely of the notes of Hess and Matthews. The editing is fairly heavy, especially in the longer speeches of the participants.

22. U.S. Department of State. *Foreign Relations of the United States, 1945, Vol. II. The Conference of Berlin (The Potsdam Conference).* (Washington, D.C.: Government Printing Office,

1960). This volume contains approximately six hundred pages of records of the Potsdam Conference. Of the various accounts, only the "Rohen Notes" are written as direct quotes, but the shortness of these notes indicates that they are probably paraphrased.

23. U.S. Department of State. *Foreign Relations of the United States, 1946* (Washington, D.C.: Government Printing Office, 1970). Volume 2 contains transcripts of the meetings of the Big Four foreign ministers discussing provisions of the Rumanian, Hungarian, Bulgarian, and Italian Peace Treaties, July to December, 1946. The transcripts are 3 to 15 pages in length and include approximately 25 meetings, 350 pages in all. There is a moderate degree of editing without damage to the center of the conversations. Volume 3 contains transcripts of the 1946 Paris Peace Conference between representatives of the Big Four, with a moderate degree of editing.

24. Warren Kuo, *Analytic History of the Chinese Communist Party* (Taipai: Institute of International Relations, Republic of China, 1966). This volume contains the record of a conversation of June 25, 1924, on the organization of the Chinese Communist Party and the Kuomintang (pp. 396–400). The participants are Representative Borodin and KMT Central Supervisory Committee Members Hsieh Chih and Chang Chi. In this rare document, the Chinese responses to Borodin are not denoted by speaker, but otherwise the texts seem only lightly edited.

25. U.S. Department of State, *Foreign Relations of the United States, 1945, Volume X–XI, The Far East: China* (Washington, D.C.: Government Printing Office, 1972). These are the records of the Marshall Mission to China in 1946, which aimed to mediate between the forces of the Nationalist government and the Communist forces. They contain the verbatim transcripts of numerous meetings between General George Marshall and Chou En-lai, both alone and with a representative of the Nationalist government. Although the negotiations came to naught, they were vigorously pursued from January to December 1946.

26. Nigeria, Federal Ministry of Information, *Meeting of the Nigerian Military Leaders Held at Peduase Lodge, Aburi, Ghana, 4–5 January, 1967*. This is a verbatim record of the meetings held in Ghana among the Nigerian military leaders in their unsuccessful effort to stave off a civil war. Among the leading participants were the men who later led the opposing sides in the war: Lieutenant-Colonel Gowon and Lieutenant-Colonel Ojukwu.

27. *Proceedings of the Meeting of Joint Federal-State Action Committee. First Session, October 3, 1957* (Chicago: The Master Reporting Company, 1957). This is a stenographic record of discussion between federal and state officials (including several governors) on the following topics: the school lunch program, disaster relief, vocational education, water pollution, and supplementary old age assistance. Editing is slight to moderate in this 102-page transcript.

28. *Democratic Reform Commission Proceedings.* This commission formulated the controversial rules for affirmative action for the 1972 Democratic National Convention. The transcripts are available for inspection at the Democratic National Committee (1625 Massachusetts Avenue, N.W., Washington, D.C. 20036), and excerpts have appeared in Theodore White's *Making of a President, 1972* (New York: Atheneum, 1973).

29. Former President Nixon's White House Tapes. (A definitive edition is not yet available, but transcripts of the tapes have been published by the New York *Times* as they became available.) Former President Nixon arranged the tape recording of virtually every conversation he had in the White House Oval Office and several other selected locations from 1969 to 1974. Apparently, except for H. R. Haldeman, not even his senior advisors knew their discussions with the President were being recorded. It is an understatement to say that these tapes can be a valuable source of insight into high-level decision making under conditions of assumed confidentiality.