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Expert–Novice Differences in the Understanding and Explanation of Complex Political Conflicts

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We compare the structure and content of political experts' knowledge with that of novices. We were particularly interested in whether experts would show more causal and historical reasoning in explaining political events, as well as whether their knowledge was structured in the form of a narrative. Eight relative political experts (advanced political science graduate students), 19 intermediate knowledge subjects (7 psychology graduate students and 12 knowledgeable undergraduates), and 9 novices were extensively interviewed about 1 of 3 political conflicts in a 2-step knowledge extraction process advocated by Graesser and Clark (1985). Experts relied more on events; used a more historical analysis consisting of past states, events, goals, and actions; and, most important, relied heavily on causal reasoning to create a coherent, understandable causal scenario or narrative. In addition, experts' overall explanation networks were significantly more connected (but less centralized) than those of the other groups.

The Israelis versus the Palestinians, the war among the Serbs, the Muslims and the Croats in the former Yugoslavia and other highly complex political topics have dominated the media in recent years, and many people, from State Department experts to average citizens, have strained to better understand them. But how do people understand and explain such complex social topics? What, if any, are the differences in the ways that the State Department expert and the average citizen understand and explain these topics?

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The issue of how political beliefs and knowledge are cognitively represented is long-standing (e.g., Abelson, 1973; Axelrod, 1976; Rokeach, 1960, 1973), but it has attracted surprisingly little research. Political scientists and political psychologists became interested in such cognitive structures only about 2 decades ago (e.g., Bolland, 1985; Conover & Feldman, 1984; Sears, Huddy, & Schaffer, 1986). Traditionally, they have been interested in the broad concept of ideology (e.g., Converse, 1964) rather than in the detailed study of the organization of political knowledge.

Several authors (e.g., Fiske, 1986; George, 1980; Larson, 1994; Lau, 1986; Sears et al., 1986) have argued that to understand how people deal with such issues, it is important to study political schemas or organized political knowledge. However, it is not clear what that knowledge is, how it is organized, and how people use it. Moreover, it is not clear whether the structure and organization of this knowledge may differ between those who are more and less politically knowledgeable. Only recently have researchers begun to address these questions (e.g., Fiske, Lau, & Smith, 1990; Hsu & Price, 1993; Judd & Krosnick, 1989; Lau & Sears, 1986; Voss, Tyler, & Yengo, 1983). In this study, we examined the structure of the knowledge that people use to understand complex political situations and whether, with increasing expertise, the nature and connectedness of the knowledge changes. We were particularly interested in the possibility that relative experts would be more likely than novices to organize their knowledge as dynamic, historically oriented causal scenarios or narratives that represented the causal and goal-based links among political events and the actions of political actors. We examined this possibility by examining the content and structure of verbalized explanations about complex political situations, which were provided in response to a detailed interview.

Drawing from work in cognitive psychology, researchers have begun to study expert–novice differences in the understanding and solution of political problems (e.g., Fiske, Kinder, & Larter, 1983; Hamill & Lodge, 1986; Lau & Sears, 1986; Voss, Greene, Post, & Penner, 1983; Voss, Tyler, et al., 1983). Cognitive theorists studying well-defined problems, such as physics problems, have determined that the difference between experts and novices is reflected in the structure of their knowledge (e.g., Chase & Simon, 1973) and how they reason about a problem (e.g., Chi, Feltovich, & Glaser, 1981). For instance, physics experts tend to organize problems in terms of underlying abstract physical principles, whereas novices organize them in terms of the concrete features of the problem.

However, most of the research on expert–novice differences has been devoted to this (e.g., Chi et al., 1981; Chi, Glaser, & Rees, 1982) or other nonsocial domains, such as chess (Chase & Simon, 1973), bridge (Charness, 1979, 1981a, 1981b, 1983), baseball (Chiesi, Spilich, & Voss, 1979; Spilich, Vesonder, Chiesi, & Voss, 1979), the game of Go (Reitman, 1976), or children's knowledge of dinosaurs (Chi & Koeske, 1983). Researchers have only begun to study structural differences in the knowledge of high- and low-knowledge individuals in social domains, such as politics.

Not only do political experts know more, but their knowledge seems more tightly organized and interconnected (e.g., Judd & Downing, 1990; Judd & Krosnick, 1989; Lusk & Judd, 1988; McGraw & Pinney, 1990; Sears et al., 1986). Experts show greater evaluative consistency among attitudes and are more likely to respond in terms of general underlying ideological principles. Perhaps as a result, experts process political information more quickly (Fiske et al., 1983, 1990; Hamill & Lodge, 1986).

Memory for political information is also consistent with the organized, schematic nature of experts' knowledge. Experts better recall political information (Fiske et al., 1990; McGraw & Pinney, 1990), are more likely to selectively remember information consistent with their beliefs (e.g., McGraw & Pinney, 1990), and are more likely to falsely recognize new statements that are consistent with their schemas (e.g., Hamill & Lodge, 1986).

Other studies have focused on how political decision makers use their knowledge in understanding complex situations (e.g., Axelrod, 1976; Lau, 1986; Voss, Greene, et al.,1983). For example, Voss, Greene, Post, and Penner (1983; see also Voss, Tyler, et al., 1983) had experts and novices engage in think-aloud protocols about how they would increase Soviet crop production if they were the head of the Soviet Ministry of Agriculture. In general, experts spent more time developing a representation of the problem, were far more likely than novices to structure their representations in terms of abstract causes, and engaged more extensively in argument development related to the solutions.

However, none of the previously mentioned studies have examined the nature of the detailed knowledge that people bring to an understanding of a complex political situation. Specifically, they have failed to investigate both the types of knowledge and the specific nature of the reasoning *links* or relationships between types of knowledge used to understand complex political situations.

For example, three major ways in which knowledge might be represented is in terms of (a) categorical or taxonomic representations, (b) logical or implicational representations, and (c) causal and intentional representations. Much of the work on expert–novice differences in nonsocial domains has focused on categorical or taxonomic representations and logical rules of inference. For instance, Chi and Koeske (1983) examined differences between children who were and were not "dinosaur experts" in their taxonomic representations of dinosaurs. Chi et al. (1981) studied differences between experts and novices in how they categorized and mathematically represented physics problems.

However, work on political expertise has not examined these different representational possibilities, and it has ignored the possibility that causal and intentional representations may play a major role in the representation of political knowledge. Yet causal representations are central in both physical and social domains (e.g., Gentner & Stevens, 1983; Graesser & Clark, 1985; Pennington & Hastie, 1986, 1992; Read, 1987; Schank & Abelson, 1977).

Read (1987), Pennington and Hastie (1986, 1992), and Johnson, Hassebrock, Duran, and Moller (1982), as well as others, argued that people's causal theories and knowledge about goal-directed behavior play a large role in explanations and representations for social events. For instance, Read argued that social actors construct causal scenarios to understand how the behaviors of people, present and past states, and events influence each other.

Similarly, Pennington and Hastie (1986, 1992) argued that an adequate model of complex decision making must include descriptions of the particular causal representations that are appropriate for the domain being studied. These authors, in an analysis of juror decision making, show that jurors use their general knowledge of the structure of human purposive action sequences (an episode schema) to impose a story organization on trial information in which causal and intentional relations among events are central.

Given that most political events involve the behaviors of social actors, it would seem likely that knowledge of complex political events is organized in terms of causal structures that identify the causal and intentional relations among actions and events. However, people vary in how much they know. Some people should better understand a particular problem because they have the detailed knowledge necessary to construct more detailed, more extensive, more structured, and more coherent problem representations—in this case, causal scenarios.

For example, compare a political scientist whose specialty is Middle Eastern affairs with an individual whose knowledge about the Middle East is confined to occasional viewings of Dan Rather, Tom Brokaw, or Peter Jennings. An expert such as our political scientist should have a richly detailed knowledge base about the historical and present events, past and present actors, their goals, and their actions in relation to one another, as well as the physical and mental states of being that have resulted in the present set of circumstances. This political scientist should be able to use extensive causal reasoning to tie all that knowledge together to create a cohesive explanation for the present situation. On the other hand, novices, such as our limited television news watcher, are likely to have bits and pieces of knowledge about events, actors and actions, goals, and so forth, but they have little sense of how they all go together, making causal reasoning difficult.

Thus, experts and novices are likely to differ significantly in the nature of their knowledge base and, therefore, in their framing of the problem. In particular, experts are likely to engage in significantly greater causal and goal-based reasoning than are novices.

Work by Axelrod (1976) provided partial support for these arguments. He showed that the knowledge of political elites could be represented in terms of cognitive maps indicating the causal relations among important events. However, he did not compare the cognitive maps of elites to those less expert, and he did not provide the detailed analysis of the kinds of knowledge or reasoning that are being proposed here.

In addition to examining expert–novice differences in specific types of reasoning, it is also important to examine the structure of problem representations for abstract, general characteristics such as general connectedness and central beliefs. Past work in expert–novice differences, particularly in well-structured domains such as physics problem solving, has determined that the knowledge of experts is significantly more structured and centrally organized than that of novices. Central beliefs seem to organize large bits of knowledge, and extensive knowledge derives from such central concepts. Although previous work on political expertise (e.g., Judd & Krosnick, 1989; Lusk & Judd, 1988; Sears et al., 1986) provides indirect evidence for the greater connectedness and organization of political experts' knowledge, there is little direct evidence.

Thus, in our study we examined differences between relative political experts and novices in the structure and types of knowledge they use and, most important, how they tie that knowledge together for an understanding of the nature of a complex political topic. Following Read's (1987) causal scenario model and Pennington and Hastie (1986, 1992), we expected that experts will be more likely to engage in causal reasoning and have stored complex cause-oriented structures in memory. These structures may include detailed knowledge about past states and events, as well as the relationships among these states and events and past and present outcomes. Those high in knowledge (i.e., relative experts) may explain the current situation by reasoning through a long causal chain of complex relationships among actors, events, and outcomes. Those low in knowledge (i.e., novices), on the other hand, may reason about a situation and explain it in a far more superficial way, referring only to the immediate aspects of the problem and without a detailed analysis of the actors' plans and goals, which would entail detailed causal reasoning. One further implication of this argument that experts will rely on detailed causal scenarios is that they may be much more likely to rely on a detailed past history of the situation, whereas novices may focus much more on the present situation.

We performed a detailed comparison of relative experts' and novices' explanations of one of three political conflicts: the Israeli–Palestinian conflict, the crises in the Soviet Union shortly after its breakup, and apartheid in South Africa. Using a theoretical framework provided by Read (1987) and Pennington and Hastie (1986, 1992), in particular, and a coding system developed by Graesser and Clark (1985), we examined the specific nature of the knowledge and reasoning used to explain these complex political scenarios.

Graesser and Clark (1985) described procedures for coding verbal protocols into several different kinds of knowledge—states, events, goals, and actions—and for coding the various possible kinds of relationships among those types of knowledge: causal, goal based, and logical or inferential. These procedures allow for the determination of both the sheer numbers and the relative proportions of the total network devoted to several types of knowledge: states, events, goals, and actions. Perhaps more important, their system allows for a determination of how each indi-

vidual organizes that knowledge through the use of causal, goal-based, or logical reasoning. Such techniques also allow for a determination of the overall connectedness and centrality of the networks used to understand and explain the situation.

In sum, we investigated expert–novice differences in the content and structure of explanations of three complex current political situations. Although most work in the expert–novice field involves only experts and novices, our work examined intermediate knowledge individuals as well to trace how the development of expertise influences the organization of the knowledge base and the specific reasoning used to understand political situations. For practical reasons, our relative expert group consisted of advanced graduate students majoring in international relations or political science who indicated that they were relative experts in the topic. Thus, results of our study undoubtedly underestimate the impact of expertise. Note that this is a more stringent definition of *expertise* than has typically been used in the study of political knowledge structures (Voss's work is a notable exception, e.g., see Voss, Greene, et al., 1983; Voss, Tyler, et al., 1983). Most of the work in this area has used a multiple-choice knowledge test or a test of media exposure administered to a college or adult sample to define expertise. Political experts in those studies were more similar to our two intermediate-knowledge groups. As we show in the following sections, the political science graduate students were far more knowledgeable than our intermediate-knowledge groups.

We examined two different intermediate-knowledge groups, who had indicated that they were both generally politically aware and who had scored highly on a test of knowledge about the relevant actors and events: a group of psychology graduate students and a group of introductory psychology students. Novices were psychology undergraduates who indicated low political awareness and who scored poorly on a knowledge test.

METHOD

Participants

Thirty-six individuals participated: 8 experts, who were 3rd-year or higher political science or international relations graduate students at the University of Southern California (USC); two intermediate-knowledge groups, one consisting of 7 social psychology graduate students also from USC and the other consisting of 12 relatively high-knowledge undergraduate students from the USC introductory psychology subject pool; and a novice group consisting of 9 relatively low-knowledge students recruited from the USC introductory psychology subject pool. The social psychology graduate students were included in the sample to ensure that the characteristics of the relative experts' protocols were not due simply to their higher

cognitive and verbal abilities or advanced academic training. The social psychology graduate students were approximately the same age and educational level as the political science graduate students, so any differences between them would not be due to education or cognitive abilities. The experts were each paid $20.00 for their participation, whereas the social psychology graduate students volunteered their time. The introductory psychology students participated for extra credit in their class.

Participant selection. Each participant in the three nonexpert groups was given a knowledge test about the three topic areas—apartheid in South Africa, the Israeli–Palestinian dispute, and the crises in the former Soviet Union—as well as a questionnaire containing a 9-point political awareness scale and eight 6-point scales dealing with how often each subject acquainted himself or herself with local, national, and international politics. Each knowledge test consisted of 15 multiple-choice questions (each with five options). Individuals were selected for the study only if they met the following criteria:

1. They answered two thirds or more questions correctly on at least one of the knowledge tests and rated themselves high on general political awareness (7–9 rating) and indicated that they were frequent viewers and readers of local, national, and international politics (4–6 rating). These participants were defined as having intermediate knowledge. All of the social psychology graduate students and 12 of the introductory psychology students were classified as part of this group.
2. They answered one third or fewer questions correctly on at least one of the knowledge tests and rated themselves as low in political awareness (1–3 rating). These participants were defined as novices. Nine introductory psychology students formed this group. All other participants were thanked for their participation and dismissed.

If participants scored either appropriately high or appropriately low on a single knowledge test, they were assigned to discuss that subject. If they scored appropriately on more than one knowledge test they were assigned to the topic they felt most comfortable talking about.

The international relations and political science graduate students were recruited through a memo placed in their campus mailboxes and paid $20 for their participation. Volunteers who considered themselves to be experts in more than one topic were asked to discuss the topic with which they felt most comfortable. These students were given the political knowledge tests and the political awareness scale at the conclusion of their interview. All of them had perfect scores on the knowledge tests and rated themselves high ($M = 8.25$) in general political awareness.

Materials

Each knowledge tests consisted of 15 multiple-choice questions. The questions concerned the major individuals and groups involved and the major issues, which were identified through an analysis of newspaper and magazine articles for the 2 months prior to the start of the content extraction phase of the procedure. The political awareness questionnaire consisted of a 9-point scale about general political awareness and eight 6-point scales about frequency of viewing and reading news about local, national, and international politics. Both measures have been used frequently to establish political expertise (Fiske et al., 1990). Such a two-pronged approach was employed because general political sophistication and domain-specific expertise have been found to be somewhat independent of one another (McGraw & Pinney, 1990).

Procedure

As per Graesser and Clark (1985), the content extraction phase of the study consisted of two parts: (a) free generation and (b) question answering. Verbal protocols were audiotaped for later analysis. Each protocol was obtained from a participant in a one-on-one interaction between the participant and the first author.

Free generation. In the free generation phase of content extraction, participants were simply told to talk "off the top of your head" about anything they thought was important in understanding the problem. In pretesting, it became apparent that prompts would be necessary to get participants, particularly low-knowledge novices, talking. Thus, it was suggested to all participants in all groups that they could discuss the important people involved in the situation, the important groups or countries involved in the situation, any specific issues that were particularly significant, anything about the background or history of the problem that they found relevant, or in general anything that they thought important in their understanding of the problem. Participants were informed that they were being audiotaped but that their responses would be kept completely anonymous and confidential and that they could leave the study at any time without any penalty. To assure anonymity, each participant was assigned a code number, and this code number was used on all materials for each participant. Participants were told that they could talk for as long as they wanted. If participants had addressed one of the aforementioned points and then looked stumped as to what to say next, the initial prompt was repeated. The length of this phase of content extraction ranged from 2 min to 1 hr. A maximum length of 1 hr was set, although several of the political science graduate students could have spoken longer. Each of the political science graduate students spoke for at least 45 min during this phase of the study, considerably longer than all members of the other groups.

Question answering. Following the free generation phase, participants were excused and asked to return about 1 week later for some follow-up questions. During the period between the sessions, the verbal protocols were transcribed and segmented into statement nodes and coded according to Graesser and Clark's (1985) methods, with some modifications to be discussed shortly. All of the statement nodes were coded by the first author as one of five types: states, events, goals, ongoing actions, and discrete actions. Criteria for these coding categories can be found in Table 1 and are explained shortly. A list of the statement nodes was then produced for each participant.

When the participant returned for the second session, it was explained that each statement made in the free-generation phase would be repeated and would be followed by a *why* or a *how* question or perhaps both. If the statement had been coded as a state, event, or goal, a *why* question was asked, and if the statement had been coded as either a discrete or ongoing action, both *why* and *how* questions were asked. For example, if the statement was "Gorbachev was a great person," (a state) the researcher said to the participant "You said that 'Gorbachev was a great person.' Why is Gorbachev a great person?" If the statement was "Gorbachev reformed the USSR," (an action) both "Why did Gorbachev reform the USSR?" and "How did Gorbachev reform the USSR?" were asked. Participants were instructed to say whatever they thought and to talk as long as they wanted. The sessions ran anywhere from 10 min to 1 hr, with a 1 hr maximum limit being placed on the session.

The political science graduate students presented a special problem because their initial protocols were so long (M = 211.7 statements [271.4 nodes]), indeed too long for a question for each statement. Pretesting determined that a maximum of 70–75 statements could be questioned and keep the session within the 1-hr time limit. Therefore, after each statement was coded, a stratified random sample of statements was chosen. For example, if 65% of the statements in the freely generated protocol were states, 65% of the 75 statements (a total sample of 49 statements) to be asked about in the question-answering phase would be states. The necessity for randomly sampling political science graduate students' statements means that any estimates of the connectedness of their protocols is probably an underestimate.

Ratings. Following the question-answering phase, the verbal protocols were again transcribed and separated into statement nodes. Each participant rated each of their statements for "its importance in your understanding of the problem." Graesser and Clark (1985) used other measures, but in pretesting for our study these were found to be redundant with importance and thus were not used. Each statement was rated on a 7-point scale ranging from 1 (*not at all important*) to 7 (*extremely important*). Ratings were done by the subject pool participants in a third session, whereas the others completed the ratings task in their free time.

RESULTS

Knowledge Tests and Political Awareness

Reliabilities for each knowledge test were reasonable: South African situation, $\alpha = .67$; the Israeli–Palestinian conflict, $\alpha = .63$; and the former Soviet Union, $\alpha = .65$. Performance on the general knowledge tests was also related to the item measuring general political awareness: Israeli–Palestinian test, $r = .32$, $p < .01$; the South Africa test, $r = .47$, $p < .001$; and the former Soviet Union test, $r = .45$, $p < .001$.

Structuring

Once the protocols were completely transcribed (free generation plus question answering), they were then structured. According to Graesser and Clark's (1985) methodology, structuring consists of two parts: statement node typing and relationship identification.

Statement node typing. There are five potential types of nodes: states, events, goals, ongoing actions, and discrete actions. *State nodes* are defined as "ongoing states that remain unchanged throughout some time frame" (Graesser & Clark, 1985, p. 58). For example, "The PLO is a major force in Middle East Politics" was coded as a state node. *Event nodes* are defined as involving "a state change within a time frame" (Graesser & Clark, 1985, p. 58). Events were further defined, for the purpose of this study, as "statements of change in states in which no specific actors are mentioned as causative agents." This was done to distinguish them from actions. It is important to note that a statement about something in the past could be coded as either a state or an event depending on how it was phrased. The changing–unchanging dimension within a particular time frame differentiates states and events (Graesser & Clark, 1985). If the statement referred to something that was *unchanging* in the time period referred to (e.g., "The Russian government was despotic"), it was coded as a state. However, if the statement referred to a state *change* in that time period, it was coded as an event (e.g., "The Russian government became despotic").

Action nodes were defined as specific, intentional actions taken by one or more animate causative agents. Thus, "Russia became the Soviet Union" would be coded as an event because no causative agent is named, whereas "Lenin changed the government" would be coded as an action because a specific causative agent is named. Action nodes were coded as one of two types: discrete actions and ongoing actions. Statements of past or future actions were coded as discrete actions and divided into goal and event nodes, as they consist of a specific state change as a result of a deliberate intention to change by an animate causative agent, according to Graesser and Clark (1985). *Ongoing actions* were defined as actions continuing to

occur in the present and were divided into goal and state nodes because they consisted of states presently still occurring due to a deliberate intention by an animate causative agent. Ongoing actions were not a category employed by Graesser and Clark, but pretesting for our study revealed that several people (particularly more knowledgeable people) distinguished between actions that are ongoing in the present situation and act much like present states and actions that occurred in the past and led to state changes (the definition of *events*). Thus, we decided to code the two types of actions separately to further examine whether an expert–novice difference exists in the use of the two types of actions to understand the three political scenarios. Finally, *goal nodes* were defined by Graesser and Clark as "some state or event that an animate agent desires" (p. 58). For example, "The Israelis want peace" would be coded as a goal node.

Relationship identification. Once the nodes were categorized, the relations among them were determined. *Arcs* are labeled links indicating the type of relationship between two statement nodes. The six categories used in this study are consequence, implies, reason, outcome, initiate, and manner. Each arc category is defined by a source node, an end node, and one or more composition rules, which determine which statement node categories (i.e., state, event, goal, and action) are permitted in the source and end node positions. Certain combinations of nodes and arcs form the basis of specific cause and goal-oriented substructures.

Graesser and Clark (1985) argued that the heart of cause-oriented structures is a consequence arc, as it indicates a causal relation between a state or event (the source node) and a subsequent state or event (the end node). The following examples show three types of consequence relations:

1. The Israeli government's policies are brutal. They have led to the Palestinian uprising (state leading to event).
2. Mikhail Gorbachev had courage. This enabled the institution of glasnost (state enabling event).
3. De Klerk's actions were those of a reformer. His actions resulted in new freedom for Blacks (state resulting in event).

All three statements show causal relations between a source node and a subsequent end node. All are types of consequence arcs and were coded as such in this study.

Implies arcs indicate relationships among nodes when categorical or syllogistic reasoning is employed. They characterize the relation between a state or event and another state or event. One difference between consequence and implies arcs is that the former causally connect source nodes that precede end nodes in time, whereas the latter connect source and end nodes that occur or exist at the same time and for which there is no causal relationship. Coders were instructed to use implies

arcs when the respondent was explaining "what he or she meant" by a previous declarative statement, such as "Gorbachev is cool." The following two statements would be connected by an implies arc, as they embody syllogistic reasoning:

1. Gorbachev is cool.
2. Gorbachev is a democrat.

Implies arcs form the basis of implicational substructures.

The heart of goal-oriented structures is formed by reason, outcome, and initiate arcs. *Reason arcs* connect two goal nodes, such that the attainment of one goal (the source node) leads to another (the end node). For example, the following statements would be coded into two goal nodes connected by a reason arc: "The Palestinians want an international conference on the Middle East. The Palestinians want a homeland." A reason arc is used because the participant is indicating that the reason the Palestinians want a conference is that they want a homeland. Thus, the homeland is the superordinate goal and the conference is the subordinate goal.

Outcome arcs are defined as those linking goals with outcomes (events and states), wherein the outcome of the goal is the end node of the outcome arc. Outcome arcs are used when participants state that a goal has led to a state or event. For example, if the participant explained "There is an intifada against the Israelis" by saying "The Palestinians want a homeland of their own," an outcome arc would be drawn from the latter to the former. Each action statement contains an outcome arc, as each action consists of a goal node and an outcome in the form of either an event or a state node, depending on whether it is a discrete action or an ongoing action.

Initiate arcs interrelate states and events with the goals they initiate. They are used when participants explain goals by saying that states or events initiated them: "The Palestinians were kicked out of their homes in 1948" (initiates) "The Palestinians want a homeland."

Manner arcs connect two nodes to denote how an event or action occurs. They were used to connect one event node with another event node if the source node explains how the end node occurs now or how it did occur. For example, the statements "The United States supports the Israelis. The United States gives them money" would be connected via a manner arc, as the second statement explains how the United States supports the Israelis.

Action nodes presented two problems not covered by Graesser and Clark's (1985) coding system, and new coding rules had to be generated to cover them (remember that action nodes were divided into a goal node and either an event or state node, depending on whether it was a discrete or ongoing action). If the statement being explained was an action (either a discrete or an ongoing action) and the respondent was replying to a *why* question, the statement explaining the action was coded as explaining the goal part of the action. For example, if the statement to be explained was "The Israelis are oppressing the Palestinians" (an ongoing action),

and the respondent explained this action by saying "The Israelis are worried about their security" (a state), an initiate arc would be drawn between the second statement and the goal node of the ongoing action ("The Israelis want to oppress the Palestinians"). This is because the respondent is saying that the goal of the action was initiated by the state of being worried. If the respondent was explaining how an action occurred in the past or how it is occurring now, then a manner arc was drawn between the latter statement and the state or event node of the action. Thus, if the statement being explained was the aforementioned action and the response to the *how* question was "There is a curfew in the occupied territories," then a manner arc would be drawn from this statement to the state node of the aforementioned action. Finally, if an action was being used to explain a previous statement in response to a *why* question, an arc was drawn from the state or event node of the action, rather than the goal node, to the node being explained. Thus, for example, if the respondent explained the aforementioned action by saying, "The PLO [Palestine Liberation Organization] is constantly plotting against Israel," an initiate arc would be drawn from the state node of "The PLO plots … " to the goal node of "The Israelis want to oppress … ."

Table 1 summarizes how the network structures were coded. The table is divided according to how each type of node and arc was defined and coded.

TABLE 1
Coding Network Structures

Nodes

- *State* nodes (S) are ongoing states that remain unchanged throughout some time frame. Could refer to past, present, or future events.
- *Event* nodes (E) involve a state change within some time frame. Use only when there is no definite subject mentioned.
- *Goal* nodes (G) refer to some state or event an animate agent desires. Use when you see words like *wants*, *needs*, *desires*, and so on,
- *Action* nodes come in two types: discrete actions (DAs) and ongoing actions (OAs). DAs are those that are taken by a specific agent (mentioned by the subject) at a specific time. These actions are coded by writing them as a goal node and an event node. OAs are those that have occurred over a long period of time and are still occurring presently. A specific agent must be present. These actions are coded by writing them as a goal node and a state node.

Arcs

- *Consequence* arcs refer to three types of relationships between nodes. One is a leads to relation where a state leads to an event. An enable relation is when a state enables an event to occur. A results relation occurs when an event leads to some state.
- *Implies* arcs refer to implicational relationships. Use particularly when syllogistic reasoning (if–then) is apparent. Use only to connect states and events.
- *Reason* arcs connect goal nodes. Use when one goal provides a reason for another goal.
- *Outcome* arcs are used to link goal nodes with events and states. Use when a goal is seen as leading to states and events.
- *Initiate* arcs are used when a state or event leads to a specific goal.
- *Manner* arcs are used when a node describes how an event or action occurs.

Interrater Reliability

In addition to the first author, who coded all nodes and arcs, each of two blind coders coded a total of 10% of randomly chosen nodes and arcs for each knowledge group. Ten percent of those 10% were coded by both blind coders to determine their percentage agreement. There was 86% agreement between the first blind coder and the first author on node types and 66% agreement on arc types. The corresponding percentages of agreement between the second coder and the first author were 88% and 81%. On average there was 87% agreement between the blind coders and the first author on statement node types and 74% agreement on arc types. There was also 83% agreement between the blind coders on statement nodes and 76% agreement on arc types.

Example Transcripts and Concept Maps

To provide a concrete context for the consideration of the differences between the different groups, a sample transcript from each of the four knowledge groups for the Arab–Israeli conflict is presented in Tables 2–5. Concept maps for each of the four transcripts are presented in Figures 1–4. As confirmed by the following analyses, higher knowledge subjects provided much more extensive transcripts and had more complex concept maps.

Node and Arc Measures

Because discrete actions are defined as containing goals and events, and ongoing actions are defined as containing goals and states, three new statement node categories were created. *Total states* was created by summing the total of states and ongoing actions for each subject. Similarly, *total events* was created by summing the totals of events and discrete actions and *total goals* by summing goals, discrete actions, and ongoing actions.

Statement Node Types

Mean numbers of statement node types. As expected greater knowledge of a political situation is accompanied by a greater number of nodes in both the initial and total protocol (for the initial protocol: expert $M = 271.4$, psychology graduates $M = 76.7$, intermediate undergraduates $M = 54.9$, novices $M = 13.3$; total protocol: expert $M = 597.2$, psychology graduates $M = 328.1$, intermediate undergraduates = 227.3, novices $M = 53.9$). Because these results simply confirm that our experts knew considerably more, we do not consider them in more detail.

Proportions of statement node types. Because the results for the initial and total protocols paralleled one another closely, results are reported only for the

TABLE 2
Example of a Low Knowledge Transcript for the Arab–Israeli Conflict

Node Type	*Actual Statement*
State	There is a conflict between Israel and the Palestinians.
Goal	The Palestinians want to take over Israel.
State	They are in a fight.
State	The war is centered in the Gaza Strip.
State	It is guerilla warfare.

TABLE 3
Example of an Intermediate Knowledge Transcript From Undergraduates for the Arab–Israeli Conflict

Node Type	*Actual Statement*
State	There is a conflict between Israel and the Palestinians.
Action	Sometime after WWII, the British government mandated Israel as a Jewish state.
Event	The basic conflict is that, through the war in 1967, Israel attained certain territories: the West Bank, the Gaza Strip, and the Golan Heights.
Event	As Jewish settlement increases, Palestinian opposition is increasing.
State	The Palestinians are angry (because)
State	The Jewish people are allowed to buy the land.
Action	They get better treatment from the Israeli government.
State	The Palestinians are angry also because they do not have any representation in the government.
Action	They are being governed by Jewish people.
State	They do not appreciate being governed by the Jewish people.

TABLE 4
Example of an Intermediate Knowledge Transcript From Psychology Graduate Students of the Arab–Israeli Conflict

Node Type	*Actual Statement*
State	There is a conflict between the Israelis and the Palestinians.
Action	Two people are fighting over an area of land.
State	The Israelis believe that the area is the Holy Land.
State	The Israelis believe the land has belonged to the Jews since thousands of years ago.
State	Until the 1950s, the Jews were not living there.
Event	Israel was given that land area after WWII.
Action	The Palestinians were living there.
State	The Palestinians considered it their own land.
State	The Israelis believe they have a biblical right to the land (so).
Action	The Israelis came in and pushed out the Palestinians.
State	The conflict is over land ownership.
State	Legally, the land belongs to the Israelis now.
Action	The Israelis are trying to control the Palestinians.
Goal	The Palestinians want more power.
Goal	The Palestinians want the land back.
Goal	The Israelis want to keep them down.

TABLE 5
Example of an Expert Transcript for the Arab–Israeli Conflict

Node Type	*Actual Statement*
Event	The conflict started at the turn of the century.
Event	Jews in Europe decided they needed a homeland.
State	They thought Palestine was their homeland (because)
State	They believe that they had lived there (and)
Action	They had established their own kingdom.
Action	They tried to establish a connection with the European politicians (because)
Goal	They wanted to establish their own state in Palestine.
State	Britain needed some help from the Jewish community in Europe during WWI.
Action	The price for that help was a promise from the British government to help the Jews establish their own state in Palestine.
Action	However, the Arabs helped the British against the Ottoman Empire.
Action	The Arabs were given promises of establishing their own independent Arab state.
Event	After WWI, the League of Nations was established.
Event	Britain was given a mandate over Palestine.
Goal	The League of Nations wanted to help the people of Palestine improve their situation.
Goal	The League of Nations wanted the people to rule themselves.
Action	The British allowed waves of Jewish immigrants to go to Palestine.
Action	The Arabs in Palestine refused that.
Event	However, they could not resist the British authorities
Event	After WWII, the League of Nations was canceled.
Event	The United Nations was established.
Action	Britain decided to get out of Palestine.
Event	There were problems as a result.
Action	There was fighting between the Jews and Arabs in Palestine.
Action	The problem was discussed in the Security Council.
Action	The Security Council passed Resolution 181.
Event	The resolution said that Palestine should be divided into two states: an Arab state and a Jewish state.
Event	The land was to be divided so that it became 60% Jewish and 40% Arab (because)
State	The Jews had good connections with the great powers.
State	The Arabs did not have good connections with the great powers.
Action	The Arabs and Jews did not accept Resolution 181.
Event	This led to war in 1948.
Event	The Arabs had just become independent (and)
State	They were not prepared for war.
State	The Jews were well trained.
Action	The Jews spanned their territory and occupied 75% of Palestine.
Event	The Arabs did not recognize Israel as a state.
State	The Arabs believed that Palestine belonged to them.
State	The Arabs believed that if the Jews wanted to live in Palestine as regular citizens they could.
State	However, the Arabs did not believe that the Jews could establish their own state.
Event	In 1967, there was another war between Arabs and Israel.

(*continued*)

TABLE 5 (*Continued*)

Node Type	*Actual Statement*
Action	Both claim that the other parties started the war.
Event	The war was short.
Action	The result was that Israel occupied all of Palestine, the Golan Heights, and the Sinai Desert.
State	The Israelis were 60 miles from Cairo.
State	The Israelis occupied Jerusalem.
State	Jerusalem is very holy for Muslims from around the world.
Event	Resolution 242 said Israel has to withdraw from the occupied lands.
Event	Resolution 242 said there should be negotiations between Arabs and Israelis to end the conflict situation.
Action	Both parties refused Resolution 242.
Event	In 1973, there was a war.
Event	Arabs gained some successes.
Action	The Arabs liberated some of the desert.
Event	Syrians had some success.
Action	They liberated the Golan Heights.
Action	The war was stopped by U.S. intervention.
Action	The United States forced both parties to stop fighting.
Action	President Sadat agreed to stop fighting on the promise by the US to solve the whole problem.
Event	In 1978, there was peace negotiations between Sadat and Begin in the United States.
Action	They signed a peace agreement.
State	According to this agreement, Israel would withdraw from Arab lands.
State	In return, Egypt was to have normal relations with Israel.
Event	This upset the other Arabs (because)
State	The Arabs used to be one coalition among Syria, Egypt, and Jordan.
State	The other Arabs thought that Egypt did not care about them (because)
Action	Egypt had liberated their own land.
Action	The Palestinians said they had to handle their own affairs.
Action	In 1969, the Palestinians established the PLO (because)
Goal	The Palestinians wanted to coordinate the various Palestinian groups.
Action	The PLO was recognized by Arabs as the legitimate representative of the Palestinian people.
Action	The PLO was recognized by nonaligned people as the legitimate representative of the Palestinian people.
Action	The PLO was recognized by many other states as the legitimate representative of the Palestinian people.
Event	Palestinian rights of self-determination were recognized everywhere except
Action	Palestinian rights of self-determination were not recognized by the United States.
Action	Palestinian rights of self-determination were not recognized by Israel.
State	The United States thinks Camp David is the only solution for the problem.

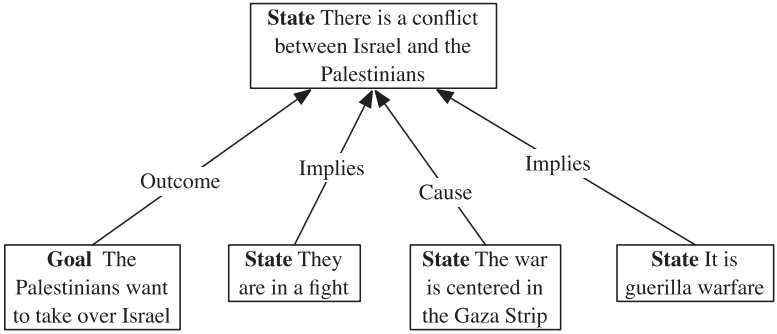

FIGURE 1 Concept map of low-knowledge transcript of Arab–Israeli conflict.

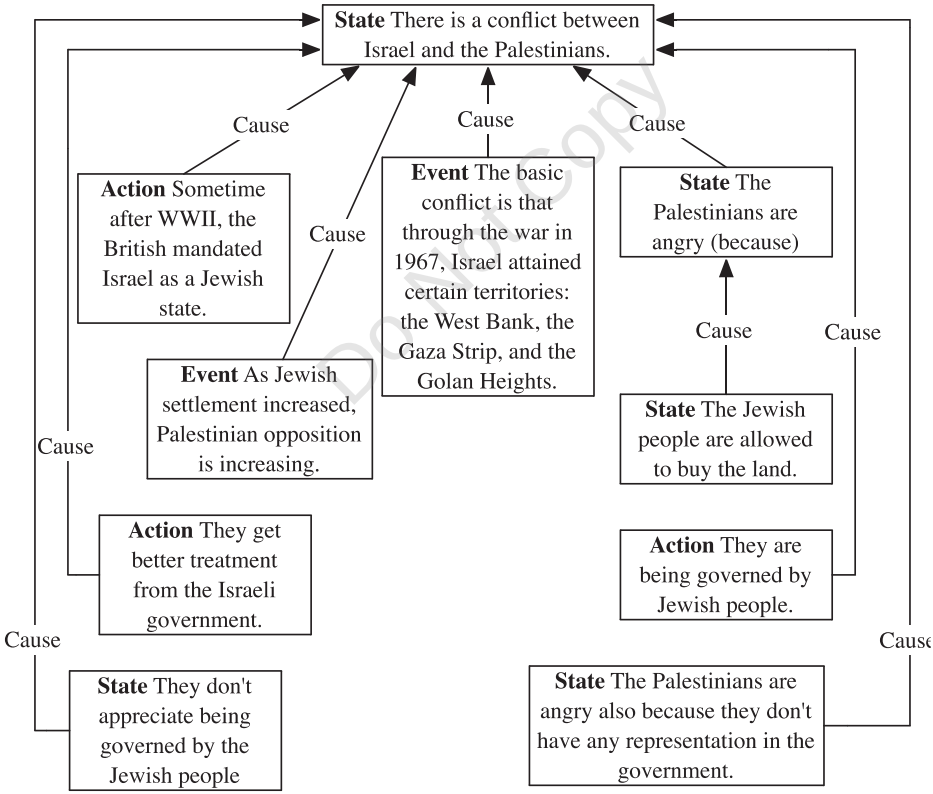

FIGURE 2 Concept map of intermediate-knowledge (undergraduates) transcript of Arab–Israeli conflict.

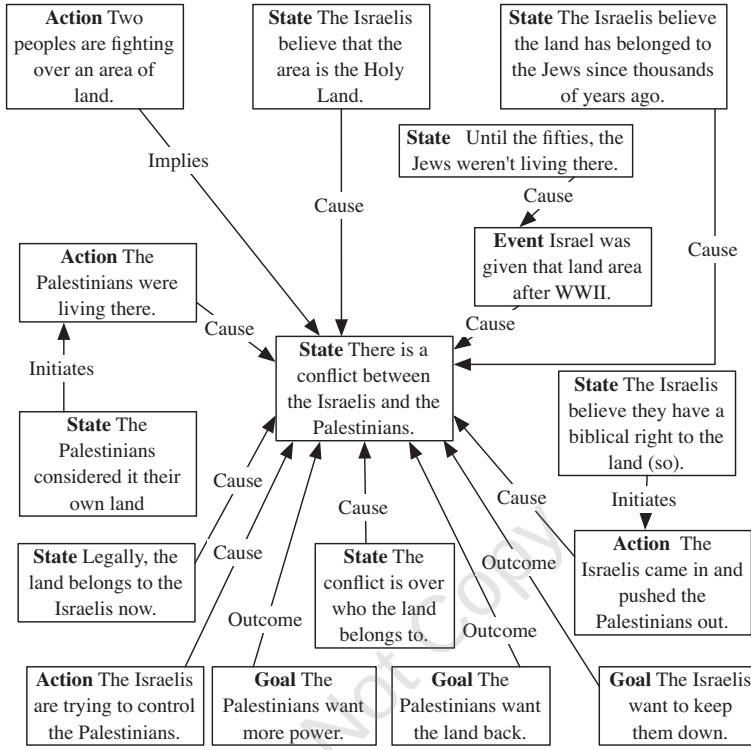

FIGURE 3 Concept map of intermediate-knowledge (psychology graduate students) transcript of Arab–Israeli conflict.

total protocol, which is the most complete representation of subjects' knowledge. Proportions of each node type were calculated to determine if there were significant differences among the knowledge groups in the types of knowledge most preferred to explain the conflicts (see Table 6). As expertise increases, analyses of variance for a linear trend indicate that there is an increased proportionate use of events, total events, and discrete actions and a decreased proportionate use of total states and ongoing actions, all Fs$(1, 32) > 8.70$, ps $< .01$. Further, there was a marginally significant trend for states, $F(1, 32) = 2.42$, $p < .13$. Thus, it would appear that the more expert groups explain the conflicts in a more dynamic way, with more focus on the changing nature of the situation.

Contrasts were then performed between adjacent groups (see Table 6). Political science graduate students, compared to the psychology graduate students, used proportionally more events and total events in the total protocols and proportionally more discrete actions in the total protocol, although the effect was marginal. In contrast, the psychology graduate students relied more than the experts on ongoing actions.

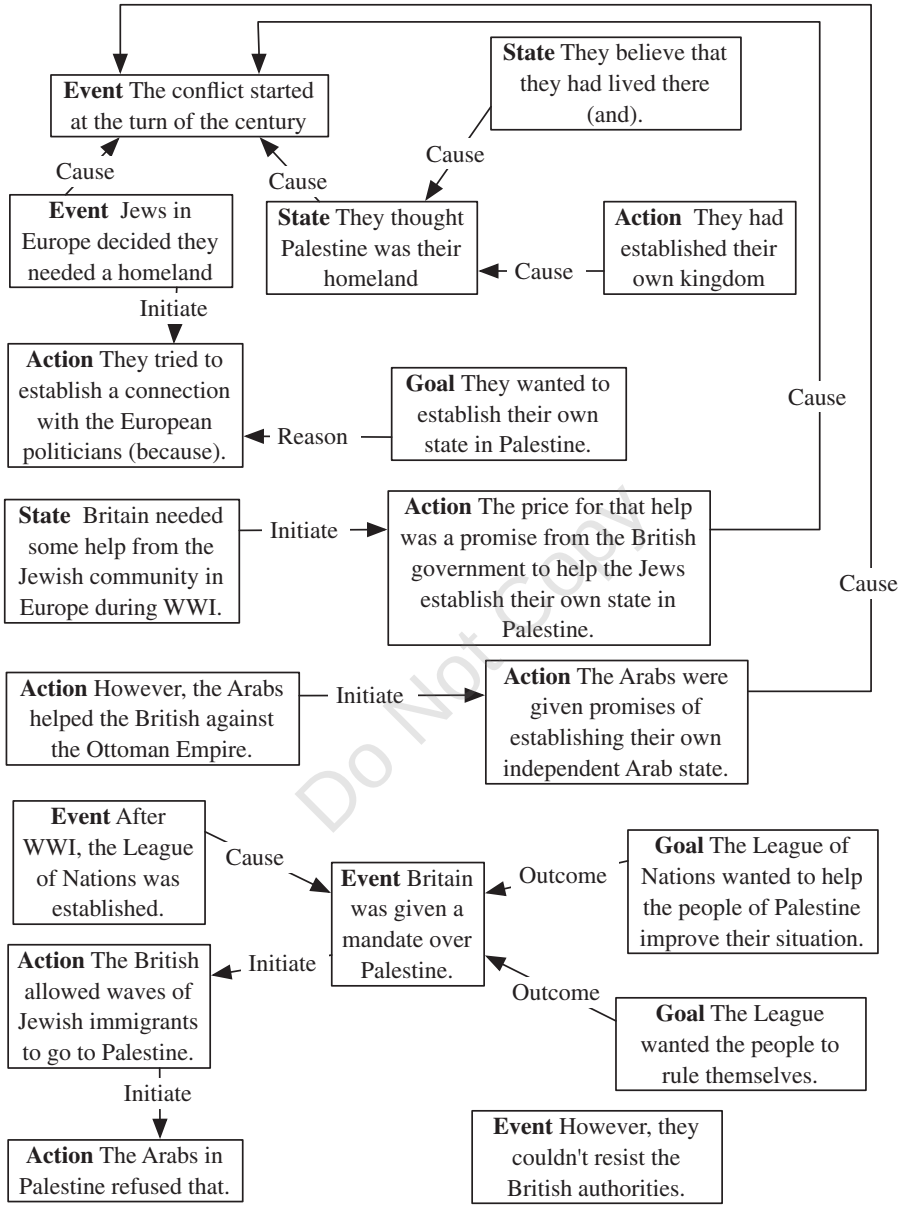

FIGURE 4 Concept map of expert transcript of Arab–Israeli conflict.

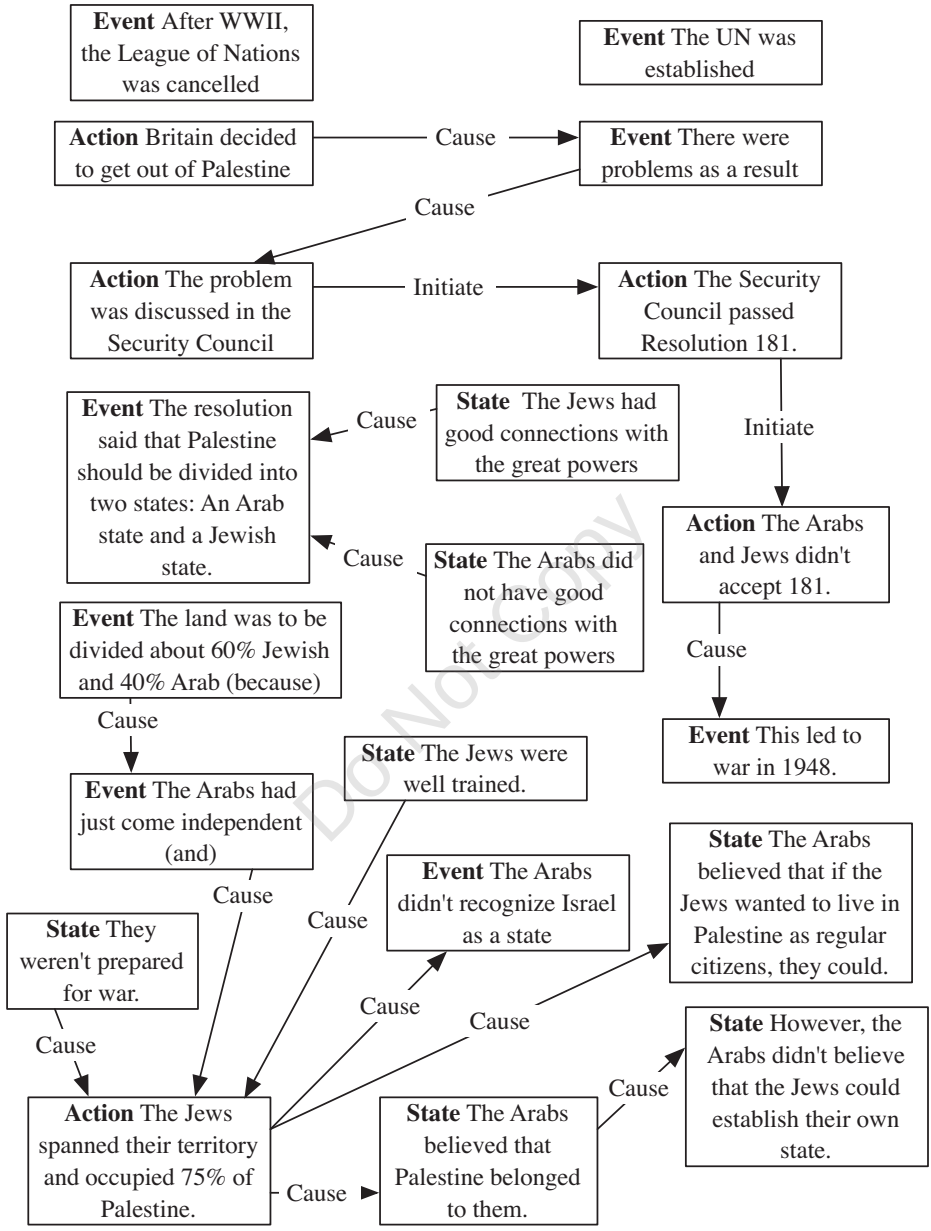

FIGURE 4 (*Continued*).

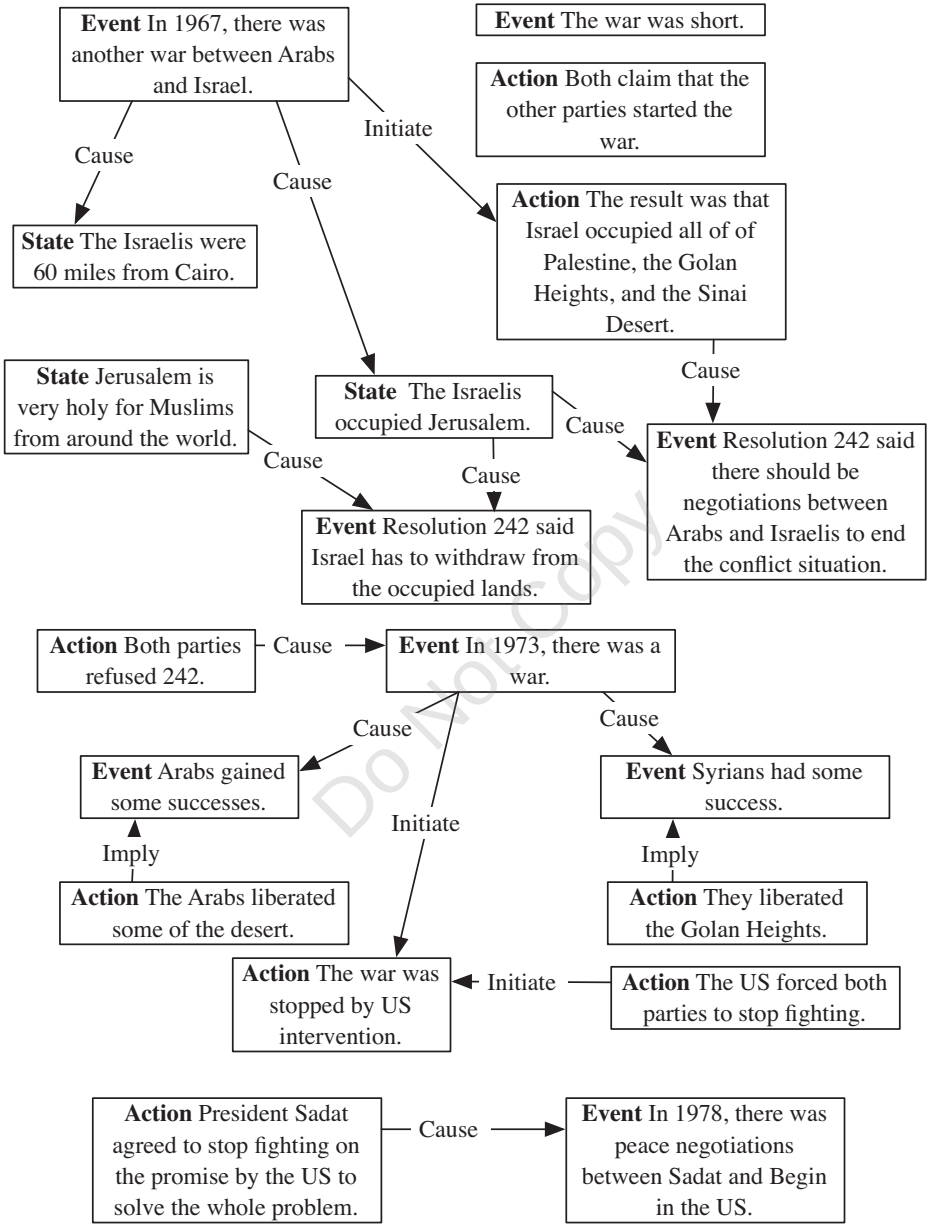

FIGURE 4 (*Continued*).

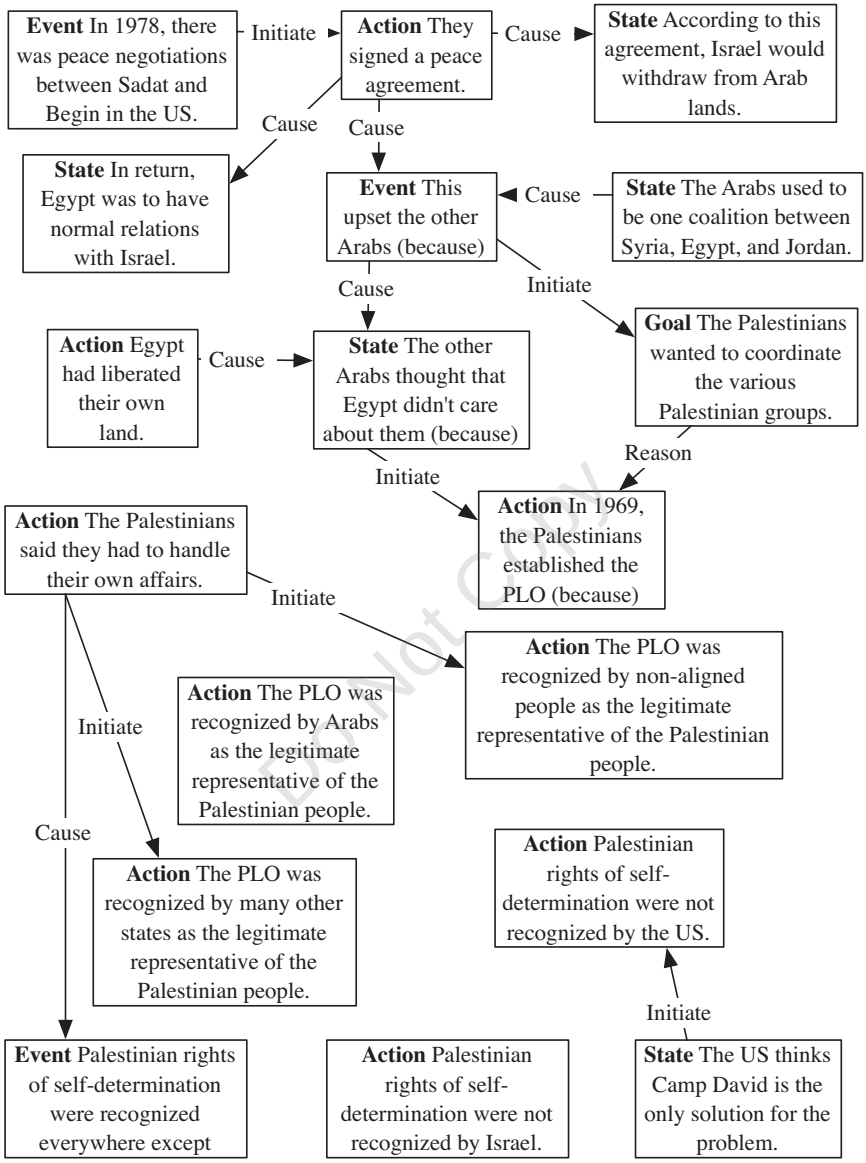

FIGURE 4 (*Continued*).

TABLE 6
Mean Proportions of Each Statement Node in the Total Protocol

Group	*S*	*E*	*G*	*DA*	*OA*	*TA*	*TS*	*TE*	*TG*
Experts	$.49_{b}$	$.21_{a}$	$.07_{b}$	$.19_{m}$	$.05_{a}$	$.24_{b}$	$.44_{b}$	$.32_{a}$	$.24_{b}$
Intermediate (graduates)	$.51_{b}$	$.12_{b}$	$.10_{b}$	$.13_{mb}$	$.14_{b}$	$.27_{b}$	$.52_{b}$	$.19_{b}$	$.29_{b}$
Intermediate (undergraduates)	$.55_{b}$	$.13_{b}$	$.11_{b}$	$.10_{b}$	$.11_{b}$	$.21_{b}$	$.55_{b}$	$.19_{b}$	$.27_{b}$
Novices	$.59_{b}$	$.04_{d}$	$.12_{b}$	$.07_{b}$	$.17_{d}$	$.24_{b}$	$.63_{b}$	$.08_{d}$	$.29_{b}$

Note. S = states; E = events; G = goals; DA = discrete actions; OA = ongoing actions; TS = total states, sum of states, and ongoing actions; TE = total events, sum of events, and discrete actions; TG = total goals, sum of goals, discrete actions, and ongoing actions; TA = total actions, sum of discrete, and ongoing actions. Vertically adjacent categories with differing subscripts are significantly different at $p < .05$. Vertically adjacent categories that share the subscript $_{m}$ are marginally significantly different at $p < .10$.

The psychology graduate students and the intermediate-knowledge undergraduates were virtually identical. However, contrasts between the intermediate-knowledge undergraduates and the novices revealed differences similar to those between the experts and the psychology graduate students. The intermediate-knowledge undergraduates used proportionally more events, proportionally more total events, and proportionally fewer ongoing actions.

In sum then, increasing expertise is accompanied by a shift from a predominantly static view of the situation, relying mostly on states and ongoing actions (which are states due to the outcome of a goal), to a more dynamic view of the situation, relying significantly more on events and discrete actions, which detail the changing nature of states and relations among actors.

Such findings would suggest two things. First, political experts may be more likely to take a more historical analysis of the situation, relying more heavily on past events. Those with less expertise, on the other hand, may be much more present focused, relying on present static structures to explain the conflict. Second, experts may be more likely to engage in causal reasoning, using it to describe the changing nature of the problem. To test these possibilities, two analyses were done: one on the relative focus on past, present, and future; and the other, an analysis of the relationships or arc structures among nodes.

Time analysis: Past, present, and future. Each statement was coded as past, present, or future, largely based on the tense of the verb (i.e., *was* = past, *is* = present, and *will be* = future). By definition, *ongoing actions* refer to present issues and thus were included in the proportion of total nodes referring to present issues, and *discrete actions* refer to some change in the situation and thus can refer to either past or future issues. Thus, the appropriate proportions of past and future discrete actions were included in the total proportions devoted to past and future issues.

TABLE 7
Time Analysis in the Total Protocol

Group	*SPa*	*SPr*	*SF*	*EPa*	*EPr*	*EF*	*GPa*	*GPr*	*GF*	*DAPa*	*DAF*
Expert	$.52_a$	$.47_a$	$.02_b$	$.83_a$	$.07_b$	$.10_b$	$.71_a$	$.29_a$	$.00_b$	$.92_b$	$.09_b$
Intermediate (graduates)	$.14_b$	$.82_b$	$.04_b$	$.53_b$	$.24_b$	$.23_b$	$.22_b$	$.77_b$	$.01_b$	$.87_b$	$.13_b$
Intermediate (undergraduates)	$.11_b$	$.87_b$	$.03_b$	$.63_b$	$.14_b$	$.23_b$	$.15_b$	$.83_b$	$.02_b$	$.82_b$	$.18_b$
Novices	$.08_b$	$.92_b$	$.00_b$	$.30_b$	$.44_a$	$.26_b$	$.16_b$	$.82_b$	$.02_b$	$.95_b$	$.05_b$

Note. S = state; E = event; G = goal; DA = discrete action; Pa = past; Pr = present; F = future. Vertically adjacent categories with differing subscripts are significantly different at $p < .05$.

Mean proportions for all the different types of nodes in the total protocol can be found in Table 7. With greater knowledge there was a trend toward the greater proportionate use of past states, $F(1, 32) = 32.59$, $p < .001$; past events, $F(1, 32) = 4.23$, $p < .001$; and past goals, $F(1, 32) = 7.12$, $p < .04$. In contrast, with greater knowledge there was a decreased proportionate use of present states, $F(1, 32) = 28.00$, $p < .001$; present events, $F(1, 32) = 2.88$, $p < .10$; and present goals, $F(1, 32) = 6.84$, $p < .01$. There were essentially no differences on use of future nodes.

These trends are essentially due to differences between the experts and everyone else. Compared to the psychology graduate students, experts were more past oriented, focusing more on past states, past events, and past goals. The psychology graduate students, on the other hand, were significantly more present focused, focusing more on present states and present goals. The only other significant contrast was that novices used more present events than did the intermediate-knowledge undergraduates.

Reasoning Within the Total Protocols

Arcs are used to represent the types of reasoning that tie nodes together. In Graesser and Clark's (1985) coding system, there are several types of arcs: consequence (causal), implies, reason, initiate, outcome, and manner. Arcs were coded to determine (a) the preferred styles of reasoning used, (b) the overall connectedness of the network, and (c) the centrality of the network.

The preferred style of reasoning was analyzed by determining the mean numbers and proportions of arcs falling into each category. Proportions of arcs were calculated both when outcomes present in action statements were counted and when they were removed. Such outcome arcs are automatically coded for actions in Graesser and Clark's (1985) coding system, and as such, they do not represent conscious reasoning. That is, people state the action (discrete or ongoing) as a whole and thus do not consciously reason that the goal resulted in the outcome of

the event or state. Because it was also important to examine proportions based on conscious reasoning, separate analyses were done when action outcomes were removed to enable the authors to examine specific, conscious reasoning used to connect goals with states and events.

Mean numbers of arc types. Not surprising, with increasing expertise there was an increased use of each arc type in both the initial and total protocols (initial protocol: expert $M = 198.25$, psychology graduates $M = 42.57$, intermediate undergraduates $M = 29.5$, novices $M = 7.22$; total protocol: expert $M = 499.63$, psychology graduates $M = 280.86$, intermediate undergraduates = 188.58, novices $M = 45.22$). Again this simply confirms the greater knowledge of the expert subjects.

Proportions of arc types. An analysis of the proportion of arcs in each arc category should help reveal the nature of expert–novice differences in specific reasoning styles. It was hypothesized that experts should rely more on causal and goal-based reasoning to understand the scenario. Mean proportions are shown in Table 8, both with and without removing action outcomes. As predicted there was a significant trend toward the greater proportionate use of causal reasoning, Fs(1, 32) = 12.57 and 15.10, ps < .001 (for mean proportions based on calculations including and excluding action outcomes, respectively); and one type of goal-based reasoning, initiating relationships, Fs(1, 32) = 4.28 and 3.20, ps < .04 and .08. There is also a decreased proportionate use of implicational reasoning, Fs(1, 32) = 3.70 and 6.01, ps < .06 and .02; and a marginal decrease in explanations based on

TABLE 8
Mean Proportions of Arc Types in the Total Protocol Both With and Without Removing Action Outcomes

	Action Outcomes					
Group	*C*	*Im*	*R*	*I*	*O*	*M*
With action outcomes						
Experts	$.41_a$	$.11_b$	$.03_b$	$.17_b$	$.25_b$	$.04_b$
Intermediate (graduates)	$.29_b$	$.12_b$	$.06_b$	$.18_b$	$.26_b$	$.08_b$
Intermediate (undergraduates)	$.32_b$	$.16_b$	$.06_b$	$.15_b$	$.25_b$	$.07_b$
Novices	$.29_b$	$.18_b$	$.06_b$	$.11_b$	$.28_b$	$.08_b$
Action outcomes removed						
Experts	$.52_a$	$.14_b$	$.05_b$	$.22_b$	$.03_b$	$.05_b$
Intermediate (graduates)	$.39_b$	$.15_b$	$.08_b$	$.24_b$	$.03_b$	$.11_b$
Intermediate (undergraduates)	$.40_b$	$.19_b$	$.07_b$	$.20_b$	$.07_b$	$.09_b$
Novices	$.36_b$	$.23_b$	$.08_b$	$.15_b$	$.08_b$	$.12_b$

Note. PConn = proportion of nodes connected to at least one other node. C = cause; Im = implies; R = reason; I = initiate reason; O = outcome; M = manner. Vertically adjacent categories with differing subscripts are significantly different at $p < .05$.

how things occur (coded as manner arcs), Fs(1, 32) = 2.76 and 2.91, ps < .11 and .10. In addition, a marginally significant trend toward a decreased use of outcome arcs (but only when action outcomes had been removed) was found, $F(1, 32) = 3.89$, $p < .06$.

Planned contrasts between the experts and the psychology graduate students revealed again that the biggest difference between the two is an increased proportionate use of causal reasoning by the experts. Also, the experts rely less on an analysis of how things occur, as seen in the marginal proportionally less use of manner arcs, ts(32) = –1.68 and –1.60, ps < .12. No other significant differences were found between the two groups. No significant differences were found between the psychology graduate students and the intermediate knowledge undergraduates or between the intermediate-knowledge group and the novices. Thus, there was support for the hypothesized trend with greater expertise, with greater causal reasoning and one type of goal-based reasoning, initiating relationships, and a decrease in the proportionate use of implicational reasoning.

Connectedness and Centrality Measures

Several measures of the overall connectedness and centrality of the networks were calculated as well (see Table 9). The measures of connectedness and centrality used derive from work on social networks and communication patterns (although they proved useful here as well). Connectedness and centrality are largely unrelated attributes of communication networks. *Connectedness* measures the extent to which members of a network communicate with one another versus don't communicate or are isolated. *Centrality,* in contrast, measures the extent to which communication in a network is organized around a set of central individuals. Thus, it is possible for a network to be highly connected but decentralized, in that everyone communicates with at least several other people in the network and messages can be transmitted between any two individuals, but there are no central communication nodes through which all communication must pass. Analogously, one can

TABLE 9
Mean Connectedness Measures in the Initial Protocol

	With Action Outcomes		*Without Action Outcomes*	
Group	*Connectedness*	*PConn*	*Connectedness*	*PConn*
Experts	$.69_a$	$.83_b$	$.62_a$	$.73_a$
Intermediate (graduates)	$.56_b$	$.77_b$	$.42_b$	$.59_b$
Intermediate (undergraduates)	$.54_b$	$.73_b$	$.42_b$	$.58_b$
Novices	$.55_b$	$.75_b$	$.42_b$	$.56_b$

Note. PConn = proportion of nodes connected to at least one other node. Vertically adjacent categories with differing subscripts are significantly different at $p < .05$.

imagine a set of knowledge structures in which most nodes are connected with at least one other node, but there are few, if any, central concepts around which knowledge is organized.

Connectedness was determined both by (a) dividing the number of arcs by the number of nodes (connectedness), which gives the average number of links per node; and (b) determining the proportion of nodes that were found to be connected to at least one other node, a measure referred to in Table 9 as *PConn*. In addition, for each participant, the mean length of each topic discussed before moving on to another target (referred to as *topic length* in Table 10) and the average length of each topic discussed as a proportion of the total protocol (called *topic proportion* in Table 10) were determined. The former measure is more of a measure of the connectedness of the networks, as it indicates the extent of reasoning about any specific topic and the extent to which people skip from topic to topic. The latter measure is more a measure of centrality, as it represents the extent to which information is centralized around a few or a large number of topics.

Connectedness. Analyses were done only for the initial protocol because it represents knowledge that is spontaneously generated by the participant. Moreover, because of practical constraints, experts were asked only about a random sample of their initial protocols in generating their total protocols. This could artifactually make the experts' total protocols look disconnected. As previously noted, there were two measures of total nodes, one with action outcome arcs included and one with them excluded. As a result, the connectedness and PConn measures were calculated both when the action outcome arcs were included and when they were not.

Linear trends analyses indicated that with greater expertise there is greater connectedness within the initial protocol, as seen in Table 9. This was true for both measures of connectedness, Fs$(1, 32) > 8.30$, ps $< .01$; and also for both measures of PConn, $F(1, 32) = 3.23$, $p < .08$ and $F(1, 32) = 6.46$, $p < .02$, respectively. Examination of Table 9 suggests that the expert group was different from the other groups, which were roughly equivalent to one another. Specifically, experts' networks were more connected according to analyses for connectedness both with

TABLE 10
Mean Topic Length (in Statement Nodes) in the Initial Protocol

Group	*Mean Topic Length*	*Mean Length as Proportion of the Initial Protocol*	*Mean Number of Topics*
Experts	7.54_a	$.05_a$	20.00
Intermediate (graduates)	7.05_a	$.13_a$	7.69
Intermediate (undergraduates)	4.92_b	$.12_a$	8.33
Novices	3.19_b	$.38_b$	3.33

Note. Vertically adjacent categories with differing subscripts are significantly different at $p < .05$.

and without action outcomes, and for analyses of PConn (the proportion of connected nodes) without the action outcomes.

The average topic length was calculated as a measure of connectedness to determine if experts, as hypothesized, would reason more extensively about each topic in their initial protocol (see Table 10). Topic length was determined by examining the transcripts, determining when participants switched to a new topic, and counting the number of statements for each topic. Linear trends analyses determined that with increasing knowledge there was greater topic length, $F(1, 32) = 24.75$, $p < .001$. However, as expertise increases, each topic area represents a decreasing proportion of the initial protocol, $F(1, 32) = 22.91$, $p < .001$. The latter measure, calculated by dividing the number of statements by the number of different topics, indicates that as knowledge increases the centrality of each specific topic decreases in the explanation of the problem.

Planned contrasts revealed no significant differences between the experts and the psychology graduate students in average topic length. The average topic lengths of the psychology graduate students were, however, found to be significantly longer than those of the intermediate-knowledge undergraduates. Topic lengths of the intermediate-knowledge undergraduates were found to be marginally longer than those of the novices, $t(32) = 1.70$, $p < .10$, and significantly smaller as a proportion of the total number of nodes in the initial protocol.

Centrality measures. Three other measures of centrality were calculated using Freeman's UCINET computer program (MacEvoy & Freeman, 1987). Specifically, density, Freeman's between-based measure of centrality, and Niemenen's degree-based measure of centrality were calculated. The density measure represents the proportion of all possible relationships between the nodes that are used by the participant to explain the situation. Freeman's between-based measure is a measure of the degree to which specific nodes lie on a path from one node to another. Niemenen's degree-based measure determines centrality by calculating both the number of arcs drawn to a node from other nodes and the number of arcs from that node to other nodes.

Because the networks of five of the experts were too large for the memory capacity of the program, the Freeman and Niemenen measures could not be calculated for the initial protocols as a whole. Therefore, separate centrality measures had to be calculated for each topic area, and the average centrality measure for each topic measure was also calculated. Means can be found in Table 11.

Linear trends analyses revealed decreased centrality as knowledge increased, $F(1, 32) = 45.61$, $p < .001$ for the density measure; $F(1, 32) = 7.61$, $p < .01$ for the Freeman measure; and $F(1, 32) = 12.83$, $p < .01$ for the Niemenen measure. Planned contrasts showed the experts to differ significantly from the intermediate-knowledge groups on both the density measure and the Niemenen measure. Moreover, the novices differed from the other groups on all three measures. Thus, it ap-

TABLE 11
Mean Centrality Measures in Each Topic Area of Initial Protocol

Group	*Density*	*Freeman*	*Niemenen*
Experts	$.009_a$	$.000_a$	$.011_a$
Intermediate (graduates)	$.050_b$	$.000_a$	$.072_b$
Intermediate (undergraduates)	$.024_b$	$.000_a$	$.072_b$
Novices	$.110_c$	$.049_b$	$.143_c$

Note. Vertically adjacent categories with differing subscripts are significantly different at $p < .05$.

pears that the protocols of the less expert individuals are significantly more centralized and structured around fewer concepts than those of the more expert.

DISCUSSION

Not surprising, experts know more about all of the studied topics. More important, both the content and the structure of the experts' knowledge differed substantially from the knowledge of less expert subjects. Thus, there seem to be particular patterns of changes in thinking that accompany the novice–expert shift.

First, experts were much more likely to focus on changing or dynamic aspects of the conflict, using relatively more events and discrete actions in their protocols, and fewer states. This suggests that as political expertise increases, explaining the changing nature of the situation becomes more important to its overall understanding. Second, experts were more likely to give an historical analysis, relying more heavily on past states, events, and goals in their explanations. Third, and perhaps most important, experts and novices differed in how they structured their explanations. Increasing political expertise was accompanied by both the increased use of causal reasoning and one type of goal-based reasoning (i.e., initiating reasoning) to tie the knowledge together and by decreased use of implicational reasoning. Fourth, the protocols of experts were more connected, although there was a decrease in the mean centrality of any particular unit of knowledge.

Part of the reason why experts rely more on events in their overall explanations of complex political situations (both in the initial and the total protocols) may be that they are far more likely than novices to take a historical focus. Over 50% of the average protocol of an expert is devoted to past states, events, goals, and actions. In contrast, roughly 27% of the average protocol of an intermediate-knowledge subject and only 12% of the average protocol of a novice are devoted to information about the past.

A typical expert would start with the earliest historical aspects of the situation and describe how one event led to another, typically through an extensive use of

causal reasoning, tying the present events as well as the expected future events to the overall causal analysis. To a lesser extent this was true of the intermediate-knowledge groups, who, although having significantly less historical knowledge than the experts, also revealed a greater proportionate use of total knowledge about the past. This suggests that an overall historical analysis of the situation is a major characteristic of political experts and that the increased use of historical information is one of the major characteristics of the novice–expert shift in political expertise.

Accompanying the increased use of event knowledge and a reliance on historical factors is an increased use of causal relationships and one type of goal-based reasoning, the identification of goal initiators, along with a decreased use of implicational links. This suggests that one of the hallmarks of developing political expertise is an increased reliance on causal reasoning as a way of tying large and diverse bits of knowledge to a detailed, coherent causal scenario. Thus, the novice–expert shift in political expertise is accompanied by an increasing proclivity to become a storyteller when one is asked to explain the nature of a complex political conflict.

One possible reason for the greater proportionate use of implicational reasoning among novices is their reliance on states to explain the nature of the situations, particularly states of being. Statements such as "Gorbachev is a great man" and "Apartheid is a horrible thing" were particularly characteristic of the protocols of novices.

Interestingly, in contrast to the work on expertise in well-structured domains, here the protocols of the experts were less centralized than those of the novices. This may occur because the networks of political novices revolve around relatively few bits of knowledge. In contrast, the networks of experts consist of hundreds of nodes, each of which is significantly less central to the understanding of the situation than is each node to the understanding of political novices.

An additional reason why political experts did not rely on highly central structures in their explanations is that to a large extent the explanations for states, events, goals, and actions are highly specific and may not be determined by central constructs. That is, in a causal analysis of the nature of a political problem, particularly an historical one as were the cases in this study, one has specific knowledge as to the specific, immediate cause of each event or goal. Each specific effect is seen to have a cause that is limited to that specific effect and relatively few other effects. Thus, for example, even if the participant believes there to be important historical events that are necessary to the complete understanding of the current political situation, those events are seen as causing a few other events, which in turn cause other events and initiate other goals and so on. Thus, in explaining network structures, experts are more likely to refer to immediate causes rather than the initial or central cause of the longer causal chain.

However, it may be that this decrease in centrality with expertise is an artifact of the experimental procedure. No effort was made to trace each explanation in the question-answering session all the way back to determine if there were in fact more central explanations that were used to tie everything together. Such a procedure (e.g., laddering) would be a useful one for future analysis, but for our work it was deemed impractical due to time constraints. Furthermore, the specific measures of centrality that were used—the density measure, the Freeman measure of centrality, and the Niemenen measure of centrality—may also have had something to do with the results that were obtained. These measures were developed for measuring the centrality of communication networks, which are typically a great deal smaller than those used for our analysis. In fact, the huge sizes of the experts' protocols were beyond the memory capacity of the program and had to be broken down into topic areas. Perhaps other measures of centrality would have revealed different results.

However, it seems unlikely that the decrease in centrality with expertise is simply an artifact. A measure of centrality that doesn't share these problems, the proportion of the total protocol taken up by each topic, also suggests that centrality decreases with expertise. The proportion taken up by each topic declines with increase in expertise. This indicates that each topic area is less central to the overall understanding of the political problem.

Although the protocols of experts were less centralized than those of novices, they were more highly connected. This is consistent with the expert–novice literature on well-structured problems (e.g., Chase & Simon, 1973; Chi et al., 1982; Chi & Koeske, 1983) and also corroborates evidence for the greater connectedness of experts' political beliefs (e.g., Judd & Downing, 1990; Judd & Krosnick, 1989; Lusk & Judd, 1988; Sears et al., 1986).

The work that is most similar to our study is that by Voss and his colleagues (Voss, Greene, et al., 1983; see also Voss, Tyler, et al., 1983) who compared political experts' and novices' representations of social science problems. However, their work differs in several important ways. First, they focused on expert–novice differences in problem solving. Thus, they explicitly proposed a problem (e.g., how to solve the Soviets' agricultural problems) and asked their participants to think aloud as they developed possible solutions. Then they developed a representation of the problem-solving process and the steps involved in that process, but they did not directly examine the representation of knowledge. To the extent that any information was revealed about knowledge representation, it was only indirectly revealed in the problem representation. In contrast, our focus was on the knowledge representation: We did not propose a problem but instead asked participants to tell us what they knew about a particular domain. Further, based on initial think aloud protocols we then engaged in detailed question asking. Next, we developed representations of both the initial think aloud protocols, as well as the responses to the questions. Thus, our participants were engaging in quite different tasks, and we coded different aspects of what they did.

Second, our coding systems differed considerably. Voss and his colleagues (Voss, Greene, et al., 1983; Voss, Tyler, et al., 1983) modified a system for representing argumentation developed by Toulmin (1958; Toulmin, Rieke, & Janik, 1979) and added to it components for representing the control processes involved in problem solving. This system is focused on representing the structure of arguments and steps in the problem-solving process, rather than on representing the causal and goal-based structure of a domain. Thus, their coding system only secondarily represents causal and goal relations. In contrast, the system we used from Graesser and Clark (1985) is explicitly focused on representing the causal and goal structure of a knowledge domain. As a result, we were able to more explicitly represent and analyze differences in the causal and goal structures of our different groups.

Third, we used a number of different quantitative measures of the degree of connectedness and organization of the knowledge representations, whereas Voss and his colleagues (Voss, Greene, et al., 1983; Voss, Tyler, et al., 1983) did not. They provided extensive protocols and problem representations of their experts, but their overall summaries of these are qualitative, rather than quantitative. Thus, we provide explicit quantitative measures and statistical tests of both the frequency of different kinds of concepts and the degree of connectedness and organization of our subjects' knowledge representations, unlike Voss et al. Finally, Voss's expert group was more expert than ours, being political science professors rather than advanced political science graduate students.

Despite these differences in procedure, there were some general similarities in outcomes. First, not surprising, Voss et al.'s (Voss, Greene, et al., 1983; Voss, Tyler, et al., 1983) experts did develop much more detailed and extensive chains of argument in developing their problem representations. This is consistent with the much more extensive causal networks characteristic of our experts. Second, most of Voss et al.'s experts gave detailed outlines of the history of the problem, which is consistent with our experts' greater emphasis on the history of the domains that they were asked about. Third, it seems clear that the problem representations of Voss et al.'s participants were characterized by extensive causal reasoning, although this is not explicitly represented in their representational system. Similarly, a tremendous amount of our participants' knowledge representations consists of causal and goal-based relations.

CONCLUSION

Political experts take a more dynamic and event-centered view of political conflicts than do novices. They focus on the history of the conflict and rely extensively on causal reasoning to create a coherent causal scenario or narrative that organizes their understanding of the political issue.

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