# Some Issues in Studying the Role of Schemata, or Background Knowledge, in Second Language Comprehension[1]

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Several recent studies have examined the effects of schemata, or background knowledge, in second language comprehension, specifically ESL reading comprehension. This research has been based on earlier research into the role of schemata in first language comprehension. In some cases, this first language research has been cross-cultural in the sense of studying the effects of different origins on subjects who read or heard them in their native language. In this first language research, both the cross-cultural as well as the remainder, a theoretical distinction is often drawn between "content" schemata (background knowledge of the content area of the text) and "formal" schemata (background knowledge of the rhetorical structures of different types of texts). This paper raises and discusses two unresolved issues found in both the first language and the second language-ESL research. Those issues are: (1) the extent to which the previous research has either maintained or has confounded the theoretical distinction between "content" and "formal" schemata, and the general nature of the relationship and interaction of these two types of schemata in naturally occurring texts; and (2) the extent to which the effects measured by the cross-cultural research are related to more general situations of the presence or absence of appropriate background knowledge which may not be culture-specific.

## INTRODUCTION

Research on the psychological processes involved in comprehension clearly shows that what we understand of something is a function of our past experiences, our background knowledge, or what are sometimes more technically called our *schemata* (Bartlett 1932, Rumelhart & Ortony 1977, Rumelhart 1980). Different researchers use different labels for the concept of background knowledge; in addition to *schemata*, other terms commonly used are *frames* (Fillmore 1976), *scripts* (Schank & Abelson 1977), *event chains* (Warren, Nicholas & Trabasso 1979), and *expectations* (Tannen 1978). These terms, which are referred to broadly as "schema-theoretical" orientations, are not all identical. They have important differences. Yet, they share some fundamental assumptions and yield some of the same important insights into comprehension. For the purposes of this paper, these various schema-theoretical orientations will not be distinguished and will be referred to as *schema(ta)*.

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Schemata may be thought of as "interacting knowledge structures" (Rumelhart & Ortony 1977:100) stored in hierarchies in long term memory. Schemata have also been called the "building blocks of cognition" (Rumelhart 1980). We have stored away all sorts of schemata - for scenes, events, activities, etc. We have schemata for going to restaurants of different types (fast food places, elegant French restaurants, Chinese restaurants, etc.), for attending and presenting papers at professional meetings, for visits to doctors' offices, for rooms in our houses and for the kinds of furniture and the way we expect that furniture to be arranged in these rooms.

According to schema-theorists, dating from as far back as Immanuel Kant in 1781, and Sir Frederick Bartlett in 1932, up to more contemporary schema-theorists like David Rumelhart in 1980, we comprehend something only when we can relate it to something we already know - only when we can relate the new experience to an existing knowledge structure. The process of interpretation, according to schema theory, is guided by the principle that every input is mapped against existing schema and that all aspects of that schema must be compatible with the input information. This principle results in two basic modes of information processing, called "bottom-up" and "top-down" processing. Bottom-up processing is evoked by the incoming data; the features of the data enter the system through the best-fitting bottom level or specific schemata. As these schemata converge into higher level, more general schemata, these too are activated. The bottom-up processing mode is called "data-driven." Top-down processing occurs as the system searches the input for confirmation of predictions made on the basis of higher order, general schemata. Top-down processing is called "conceptually-driven."

Schemata have been shown to guide the comprehension not only of events and scenes and activities like those previously mentioned (e.g. going to a restaurant, attending a professional meeting, going to a doctor's office) but also guide the interpretation of the linguistic representations of these events, scenes, activities - i.e. of oral and written texts. It is this aspect of schema theory that is relevant to those of us interested in the processing of linguistic texts and in comparing the processing in English as a native language and in English as a second or foreign language.

An important aspect of schema-theoretic accounts of language comprehension is that top-down and bottom-up processing should be occurring at all levels of analysis simultaneously (Rumelhart 1977). The data that are needed to instantiate or fill out the schemata become available through bottom-up processing; top-down processing facilitates their assimilation if they are anticipated or consistent with the listener or reader's conceptual set. Bottom-up processing ensures that the listener or reader will be sensitive to information that is novel or that does not fit her or his ongoing hypotheses about the content or structure of the text; top-down processing helps the listener or reader to resolve ambiguities or to select between alternative possible interpretations of the incoming data. Thus, a fundamental assumption of the schema-theoretic view of language comprehension is that the process of comprehending a text is an interactive one between the listener or reader's background knowledge of content and structure, and the text itself. The text alone does not carry meaning. Rather, a text only provides guidance for listeners or readers as to how they should construct the intended meaning from their own previously acquired knowledge. Since comprehension involves not only the information in the text, but also knowledge the

listener or reader already possesses, efficient comprehension requires the ability to relate the textual material to one's own knowledge (Adams & Collins 1979). Comprehending words, sentences, and discourse, then, involves much more than just relying on one's linguistic competence. In fact, one's linguistic competence is just one part of one's total background knowledge.

The following mini-text, from David Rumelhart, illustrates the effects of schematic interpretation and the simultaneity of top-down and bottom-up processing.

> "Mary heard the ice cream man coming down the street. She remembered her birthday money and rushed into the house...." (Rumelhart 1977:265)

Most people arrive at a pretty uniform, consistent interpretation for this text after just these few lines. They assume it's probably a warm day and Mary is probably a little girl who hears the bell ringing on the ice cream man's vehicle. Because she wants some ice cream, she runs into the house (her home) to get her birthday money so she can buy the ice cream. Notice that the text doesn't actually say any of this, but that's the schema that is activated by most people and against which they interpret the text. Notice what happens if the text were to continue:

> "...and locked the door." (Fillmore 1980)

The sense of discomfort, disruption, disorientation - of having been led down the garden path,or whatever we call what the reader experiences upon encountering this additional piece of text - shows that the new piece of text is incompatible with the schematic interpretation developed up to this point in the text. The reader needs to go back and revise her interpretation, activate another schema against which to make the text compatible. Perhaps, for example, Mary is afraid that the ice cream man will steal her birthday money.

## THE ISSUES

By now, several empirical studies have been carried out showing the effects of schemata, or background knowledge, on both native language comprehension (Bransford & Johnson 1972; Thorndyke 1977; Anderson, Reynolds, Schallert & Goetz 1977; Kintsch & Greene 1978; Mandler & Johnson 1977), and second or foreign language comprehension (Johnson 1981, 1982; Steffensen, Joag-dev, & Anderson 1979; Carrell 1981a, 1981b, 1983a; Hudson 1982). However, in both the first language and the second language-ESL empirical research, there are at least two theoretical issues which have each been confounded, and which, I believe, must be addressed more carefully and clearly if we are to truly understand the comprehension process. The first of these issues involves the theoretical distinction which is often drawn between *content* schemata (background knowledge of the content area of a text), and *formal* schemata (background knowledge of the rhetorical structures of different types of texts). The second issue involves the extent to which schemata are culture-specific or may be cross-cultural and even universal. I shall deal with each of these issues in order.

## CONTENT OR FORMAL SCHEMATA?

One type of schema we human language processors are claimed to possess is background knowledge about the formal, rhetorical, organizational structures of

different kinds of texts. In other words, part of our background knowledge includes information about, and expectations of, differences among rhetorical structures - e.g. differences in genre, differences in the structure of fables, simple stories, scientific texts, newspaper articles, poetry, etc. Our schema for simple stories, for example, includes the information that the story should have, at minimum, a setting, a beginning, a development, and an ending. Also for simple stories, Mandler (1978) distinguishes between schemata for causally-connected and temporally-connected stories. For expository texts, Meyer (1975, Meyer & Rice 1982, Meyer & Freedle, in press) recognizes five different types of expository rhetorical organizations, each of which, she claims, represents a different abstract schema of ways writers organize and readers understand topics. These five different types are: collection-list, causation-cause and effect, response-problem solution, comparison-compare and contrast, and description-attribution.

In schema theory research, this type of *formal* schematic knowledge is usually contrasted with *content* schematic knowledge, which is claimed to be background knowledge about the content area of a text - e.g. a text about washing clothes, celebrating New Year's Eve in Hawaii, building a canoe, or about the economy of Mexico, the history of Canada, problems of nuclear breeder reactors, etc.

In empirical tests of these two different types of schemata, it is fairly easy to separate out and to test for the effects of formal schemata. For example, one can test for the effects of formal schemata by keeping the content of a text constant, varying its rhetorical organization, and having comparable groups of subjects process each different rhetorical pattern. (See the column labeled FORMAL in Figure 1 for examples of this kind of research.) Then one measures differences between the groups

*Figure 1* Some Empirical Research Studies of Formal and Content Schemata

| | FORMAL | CONTENT | FORMAL/CONTENT CONFOUNDED |
|---|---|---|---|
| L1 (English) | Mandler & Johnson (1977) | Pearson, Hansen, & Gordon (1978) | Bartlett (1932) |
| | Meyer (1975) | Stevens (1980, 1982) | Kintsch & Greene (1978) |
| | Meyer & Rice (1982) | Anderson, Reynolds, Schallert, & Goetz (1977) | Mandler, Scribner Cole & DeForest (1980) |
| | Meyer & Freedle (in press) | Bransford & Johnson (1973) | |
| | Thorndyke (1977) | | |
| L2 (EFL/ESL) | Carrell (1981a) | Steffensen, Joag-dev & Anderson (1979) | Carrell (1981b) |
| | | Hudson (1982) | |

on some dependent measure(s) expected to be affected by the differences in comprehension due to the manipulation of form. (Some dependent measures which have been used in this type of research are: scoring recall protocols or summarizations for the number and types of propositions or idea units they contain compared to the original text, or looking at the way different types of literal and inferential questions about the text are answered.) These kinds of studies of the interaction between a reader's formal schemata and a text's logical organization can be performed either with texts which are specifically contrived for the purposes of the experiment (but which are presumably based on naturalistic texts of the type of ultimate interest to the researcher) or with texts which are naturally occurring originally, but which are then experimentally manipulated to derive the different rhetorical patterns to be tested. Mandler & Johnson (1977), Thorndyke (1977), Meyer (1975), Meyer & Rice (1982), Meyer & Freedle (in press), and Carrell (1981a) are examples of this type of research.

In the Carrell (1981a) study, which was based on the previous L1 research of Mandler (1978), ESL subjects read different types of simple stories - one type well-structured according to a simple story schema, and the other type deliberately violating the story schema. Results showed that when stories violating the formal story schema were processed by learners of English as a second language, both the quantity of recall and the temporal sequences of recall were affected. In other words, when the content is kept constant, but the rhetorical structure varied, second language comprehension, like first language comprehension, is affected.

Likewise, one can test for the effects of content schemata (see the column labeled CONTENT in Figure 1) by keeping the formal rhetorical structure of a text constant, manipulating its content, and having comparable groups of subjects, (or, in this case, they could be the same subjects since they're processing different content) process (read or listen to) each different content. One could again measure differences on some dependent measure(s) expected to be affected by differences in comprehension due to the manipulation of content. A study by Steffensen, Joag-dev, and Anderson (1979) is a good example of this type of empirical research. In that study, two groups of subjects with different cultural heritages were investigated, a group of Asian Indians living in the USA and a group of Americans. Each subject was asked to read and recall two personal letters, both of which were constructed with similar rhetorical schematic organization. However, the cultural content of the two letters differed; one described a traditional Indian wedding and the other a traditional American wedding. Syntactic complexity of each letter, which was written by a member of that culture, was controlled. Since the wedding is a ceremony of great social significance, it was assumed by the authors that all adult members of a society would have a well-developed system of background knowledge about the marriage customs of their own culture, and a comparative lack of knowledge about the customs of more distant cultures. The authors were interested in identifying the characteristics of the subjects' recall of material that was culturally familiar as well as that of material that was culturally unfamiliar.

They found that both the Indian and American groups read the material dealing with their own cultural background faster and recalled more of the culturally familiar text. There was also a significant effect for nationality/language - i.e. the Americans read faster and recalled more overall than the Indians, a reflection of the fact that they were

reading in their native language while the Indians were reading in their second language. Both groups engaged in elaborations and distortions: elaborations were culturally appropriate extensions of the text which occurred when a member of the culture provided additional culturally correct information not found in or logically inferable from the text. As might have been expected, non-members of the culture did not provide such elaborations. Distortions were culturally inappropriate modifications of the text, frequently outright intrusions from one's own culture, where unfamiliar ideas in the foreign letter were interpreted, remembered and recalled in light of the subject's own background. The authors concluded that the implicit background knowledge of content underlying a text exerts a profound influence on how well the text will be understood and later recalled.

Another variation of the empirical investigation of content schemata is to keep the text constant, in both form and content, and vary the background knowledge of the readers either by experimentally controlling the amount of content background knowledge given to different groups of subjects, or by recognizing pre-existing differences in prior background knowledge of content. Experiments of the former type - in which one experimentally controls the amount of background knowledge given to subjects - have been conducted in first language by Bransford and Johnson (1973) and Stevens (1982), and in second language by Hudson (1982). (See the CONTENT column of Figure 1.) The Stevens (1982) study showed that prior teaching of related (but not identical) content background knowledge (e.g. teaching experimental groups of tenth grade boys a unit on the Texan War, versus teaching control groups a unit on the US Civil War) had subsequent facilitating effects on the reading comprehension of a text (e.g. a text about the Battle for the Alamo). The Hudson (1982) study showed the facilitating effects on reading comprehension in ESL of one cluster of pre-reading activities as a way of building background knowledge of content.

Experiments of the latter type - keeping both form and content of a text constant and recognizing pre-existing differences in prior background knowledge - come mainly from first language research: Pearson, Hansen & Gordon (1979), Stevens (1980), Anderson, Reynolds, Schallert & Goetz (1977). For example, Stevens (1980) identified high and low background knowledge topics for each of the subjects in her study; each subject was subsequently given paragraphs to read corresponding to these high and low knowledge topics. Possessing high knowledge of the topic significantly aided the comprehension of the paragraphs. The Steffensen, Joag-dev, and Anderson (1979) second language study which was previously described from the perspective of the varying cultural contents of the texts, would also be an example of this type of investigation of content schemata when looked at from the perspective of the differences in the pre-existing background knowledge of the Indian readers versus the American readers.

Thus, we know from these various empirical studies that both formal and content schemata may each affect comprehension in the processing of texts in one's native language or in English as a second language. However, what we don't know is the joint or interactive effect of these two types of schemata. Since texts occur simultaneously with both a form and a content, and since the research just reviewed shows that human beings approach the comprehension task with both formal and content schemata, it would seem important to determine how much each of these types of schemata

contributes toward comprehension. To my knowledge such studies, which would not be difficult to design and execute with experimental texts, have yet to be done.

However, the more serious problem is how to measure the separate or interactive contributions of both content and formal schemata when considering the processing of naturally-occurring texts processed in natural (or at least naturalistic) settings. In other words, real people in real language-processing situations encounter texts which have simultaneously a content expressed in a given rhetorical form. What we would need to know in these natural situations with naturally-occurring texts is what the relative contributions are of both prior knowledge of the content area as well as of prior knowledge of the rhetorical form. How facilitative of overall comprehension of the text is each type of background knowledge?

Many of the empirical studies to date which have used naturally-occurring texts in examining schematic effects have confounded content and formal schemata. (See the column labeled FORMAL/CONTENT CONFOUNDED in Figure 1.) A study by Kintsch and Greene (1978) was intended to be a demonstration of the effect of rhetorical structure as a function of the cultural origin of a text. Kintsch and Greene argue that simple story schemata are culture-specific, that the simple structural story schemata described earlier (settings, beginnings, developments, endings) hold primarily for stories from European background. Story-telling conventions in other cultures, they argue, may diverge greatly from these European-based schemata. More specifically, they argue that stories from American Indian culture diverge greatly from European schemata. In two empirical tests of this hypothesis, Kintsch and Greene report differences in the comprehension by American college students of texts of European origin (e.g., Grimm's fairy tales) and texts of American Indian origin (e.g. Apache Indian tales). They conclude from their results that the subjects' prior familiarity with the European-based rhetorical organization and their lack of familiarity with the rhetorical organisation of the American Indian tales - i.e. their formal schemata - is the cause of the American students' better comprehension of the European texts. However, there are two major criticisms one needs to make of their study. First, there was no control group of American Indian subjects against whom to compare the American subjects. Presumably, the American Indian readers would have found the American Indian text easier to comprehend than the European text, for the same reason of prior familiarity with the rhetorical organization of their native-culture texts. Kintsch and Greene pointed out, however, that including American Indian subjects in their study would not have been feasible, since today's Apaches are bicultural and would be familiar with Western story schemata. To conduct this experiment in the ideal, one would have to study two groups of subjects from two different rhetorical traditions, each one unfamiliar with the other one. A second major criticism of this study, and the one relevant to the point here, is the failure of Kintsch and Greene to distinguish content from formal schemata. Not only did the European and American Indian texts differ in rhetorical organization, but they also had quite different cultural contents. One cannot rule out the possibility that the American subjects were simply more familiar with the cultural content of the Grimm's fairy tale - the objects and events the tale was about - than they were with the content of the Apache text.

Jean Mandler's research (Mandler, Scribner, Cole & DeForest 1980) takes a position opposite to that of Kintsch and Greene, arguing that at least some types of rhetorical formats appear to be universal. (See again the last column in Figure 1.) Mandler, Scribner, Cole and DeForest told Liberian subjects European stories, translated into Vai, their native language. They report that the Liberians found the stories to be perfectly acceptable as local tales, and that the patterns of recall of the stories among the Liberians were similar to those of a group of Americans tested. Thus, on the face of it, it appears that the lack of any differences between the Americans and the Liberians is due to the two groups' sharing the same formal schemata for these tales. However, because Mandler, et al. translated certain foreign concepts into locally meaningful ones (e.g., *dragons* became *water people, princesses* became *chiefs' daughters),* their findings are seriously compromised by the same problem as Kintsch and Greene's, namely, the failure to take content into account. However minor the translation of the foreign terms into "locally meaningful ones," the content schemata activated during the processing of the texts cannot be discounted as a factor in comprehension.

Finally, a study conducted by Carrell (1981b) with groups of Japanese and Chinese subjects reading English translations of folk-tales from their own native culture, as well as from Western European culture, and from American Indian culture, suffers from the same confounding of content and formal schemata. (See the final column in Figure 1.) Although that study found differences in performance related to the cultural origin of the texts, it cannot distinguish to what extent these differences are due to content schemata or formal schemata.[2]

Thus, there are studies which have investigated formal and content schemata separately, and there are studies which have badly confounded them. But there are no extant studies that this writer is aware of, in either English as a native language or English as a foreign or second language which show the joint or interactive effects of content and formal schemata in comprehension. This type of research is sorely needed, and as mentioned earlier, would not be difficult to design and execute experimentally. Only after the experimental research is done will we understand the relative contributions of these two types of schemata to the comprehension of naturally-occurring texts processed naturalistically.

## CROSS-CULTURAL OR CULTURE-SPECIFIC SCHEMATA?

As will have been noted by now, much of the research in schema theory concerns cross-cultural research and the question of the cultural-specificity of various schemata. The extent to which formal schemata are culture-specific was the issue of debate between Kintsch and Greene (1978), on the one hand, and Mandler, et al. (1980), on the other.

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[2]I have omitted from consideration the two Johnson (1981, 1982) studies on background knowledge in second language. Johnson (1981) says of the two naturally occurring folktales she used (a Mullah Nasr-el-Din story from Iranian folklore, and a story about Buffalo Bill from American folklore) that: "both contained similar motifs which were culturally distinct yet were equivalent in plot construction." (1981:170). One cannot tell from this description whether the texts, which are not published with the article, have the same rhetorical structure, or whether indeed formal and content schemata were confounded in the study. Johnson (1982) used two experimentally contrived texts and says only that the texts contained "the same number of types (lexical and relational) of propositions." (1982:507). Again, without access to the original texts, one cannot determine whether they are rhetorically equivalent or whether formal and content schemata have been confounded.

The confounding of formal with content schemata by both Kintsch and Greene (1978) and by Mandler, et al. (1980) leaves the question open as to the cross-cultural universality or cultural-specificity of certain formal schemata. However, it seem reasonable to conclude as Mandler, et al. (1980) do that while certain formal schemata may be culture-specific, there may well be other formal schemata which may be universal. Indeed, several different types of formal schemata for narrative texts may exist both within as well as across different cultures. One cannot safely generalize that, for example, all Apache Indian tales will assume the same schematic organization, or that all Western European folktales will assume a different schematic organization. Some Apache Indian tales are rhetorically more like some European folktales than they are like other Apache Indian tales, and vice versa for European folktales. The same may be true of expository texts.

The extent to which content schemata are culture-specific was the central focus of the Steffensen, et al. (1979) study described earlier, and that study showed that content schemata may indeed be culture-specific. However, the existence of cross-cultural differences in content schemata must be approached cautiously by those who wish to use this research in second language-ESL text comprehension situations - for example, in EFL/ESL reading classes. Certainly, the Steffensen, et al. (1979) research on cultural specificity of texts shows we must be sensitive to potential comprehension difficulties which EFL/ESL readers may encounter with a text, due to lack of familiarity with the culture-specific content presumed by the text. Over and above any difficulties presented by the linguistic structure of the text (difficult syntax, vocabulary, etc.), EFL/ESL readers may have additional comprehension difficulties due to their lack of prior familiarity with the content area of the text. However, lack of prior familiarity with the content area of the text, absence of the appropriate content schemata in the reader, especially an EFL/ESL reader, need not necessarily signal cultural specificity of the content schemata. In other words, the absence of appropriate background content schemata need not be equated with cultural-specificity of the schemata. Absence of content schemata may be independent of culture-specificity of content. Content schemata may be absent within as well as across cultures.

Schema theory research with monocultural American groups (Bransford & Johnson 1973; Anderson, Reynolds, Schallert & Goetz 1977) has clearly shown that people within the same culture may differ greatly in their background knowledge in certain content areas, and that those schematic differences within a single culture may affect comprehension and recall. A study by Anderson, et al. (1977) took two texts, one that had been shown in pre-testing to have a dominant interpretation as being about a prison break, but that also had a secondary interpretation as being about wrestling, and another text that had been shown to have a dominant interpretation as being about card playing, but that also had a secondary interpretation as being about rehearsing musical instruments, and showed that a group of physical education students and a group of music education majors interpreted the texts relating to their discipline area according to their specialized background knowledge. The PE majors gave the *Prison/Wrestling* text the secondary interpretation, not the dominant interpretation (however, they gave the *Card/Music* text the dominant interpretation). Conversely, the music education majors gave the *Card/Music* text the secondary interpretation, not the dominant interpretation (however, they gave the *Prison/Wrestling* text the dominant interpretation). Furthermore, most subjects gave

each passage only one distinct interpretation or the other, and reported being unaware of any other perspective.

Therefore, if American college students, native speakers of English from a single "cultural group" can differ sufficiently in content schemata to be measurable on reading comprehension tests, then why shouldn't we expect the same differences in content schemata among EFL/ESL students? For example, a group of Japanese ESL readers with a lot of background knowledge about world history, political science, economics, etc. may understand a text about the Second World War better than or at least differently from those who lack such knowledge. Similarly, a group of older Japanese ESL readers, old enough to have been alive during the war, may understand such a text differently from a younger group, just as a group of native English-speaking readers with such background knowledge will understand that same text differently from those who lack such knowledge. Presence or absence of content schemata in these examples is independent of cultural group membership.

Content schemata may also be independent of cultural group membership in areas such as the teaching of English for Special Purposes/English for Academic Purposes/English for Science and Technology. Obviously, the background knowledge of specific content areas that each ESL student brings to the comprehension task will depend primarily on that student's individual prior preparation in the subject matter area (physics, chemistry, biology, engineering, medicine, computer science, business) and not directly on his/her cultural group membership. (See the recent paper by Alderson & Urquhart 1983.)

Even if whole groups or subgroups of ESL readers can be shown to lack an appropriate content schemata, this still would not necessarily mean the schemata are culture-specific, unless it can also be demonstrated that members of different cultural groups or subgroups generally possess the relevant schemata. In other words, the situation is not as simple as saying that some schemata are universal and other schemata are culture-specific; we must allow for subgroup and individual differences among content schemata.

## CONCLUSION

Schema theory has much to offer toward our understanding of the many intricacies and subtleties of language comprehension, especially of first and second language reading comprehension. In the short time it's been on the scene, much has been done and many insights have been gained (cf. for example, all the literature reviewed in this paper). However, future research and the applications of that research to EFL/ESL reading pedagogy must be sensitive to the two issues raised in this paper. First, we need to unconfound formal and content schemata and to study them jointly and interactively; and, second, we need to be cautious about studying and interpreting the culture-specificity of both formal and content schemata.

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