Switching schemata

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Abstract
The importance of schemata in reading has been highlighted by many studies. However, one aspect of schemata, namely schema switching, has largely been ignored in the literature. For most texts several schemata are activated in turn, and readers' willingness to switch schemata may affect their comprehension. This paper investigates schema switching by looking at the referents readers assign to an ambiguous *it* in a text. Evidence for schema use comes from readers' identification of words not found in the text as referents of *it*. Most readers switch schemata as they read, with most changes in interpretation of the referent occurring at points where lexical cohesion plays a role. No differences in willingness to switch schemata between native speakers and non-native speakers were found.

Since Kenneth Goodman proposed his influential model of the reading process (1975), much of the research into reading has focused on schemata. A schema can be defined as "an abstract knowledge structure" (Anderson and Pearson, 1984) which provides a framework that facilitates the comprehension of relationships between semantic concepts in a text. Schemata are usually categorised as either content schemata or textual schemata (Carrell, 1988; Kitao, 1990). The latter refers to expectations concerning the organisation of the text and may be related to knowledge of genres (Nwogu, 1991) while the former are generalised expectations of content against which the specific information in a text can be matched. Content schemata are the focus of this paper.

Schemata aid comprehension of a text in two ways. Firstly, the generalised expectations allow the reader to make predictions about the content of the text, thereby facilitating comprehension (Bransford, 1979). This phenomenon is called "expectation driven understanding" (Cook, 1989:71) and allows top-down processing of texts. Secondly, where problems in interpretation, such as ambiguities, occur in texts, schemata help the reader to choose an appropriate interpretation (Bransford and Johnson, 1972).

Schema switching

Schemata, however, should not be seen as fixed. A novel which activates only one schema would probably be very boring. Most texts of reasonable length require the activation of more than one schema for understanding. The reader, then, should be willing to switch schemata as new evidence in the text suggests such a switch is appropriate. Such switching is crucial to understanding most longer texts and is a hallmark of an open mind (Cook, 1997).

Switching between schemata is prompted by information contained in the text (Morgan, 1998). Rumelhart (1980, quoted in Woods, 1996: 62) gives an example of a text requiring switching of schemata:

> Business had been slow since the oil crisis. Nobody seemed to want anything really elegant anymore. Suddenly the door opened and a well-dressed man entered the showroom floor. John put on his friendliest and most sincere expression and walked toward the man.

Rumelhart argues that the first sentence activates a business schema, which is somewhat weakened by the second sentence. The evidence in the third sentence (*well-dressed* and *showroom*) encourages the reader to discard the business schema and replace it with a car-selling schema. This alternative schema is then reinforced by the final sentence, which also allows the generalised expectations of customer and salesman to be instantiated with the specific occurrences of *a well-dressed man* and *John* respectively.

Reading, then, can be seen as a complicated interactive process whereby bottom-up evidence affects the schemata of top-down processing which in turn influence how bottom-up information in the text is interpreted (Driscoll, 1994). In spite of the importance of these effects, since Rumelhart's paper, there has been a lack of research into the ways in which text information affects choice of schema. One of the purposes of this paper is to investigate the kinds of text information which encourage readers to switch schemata.

Native speaker - non-native speaker differences in schema switching

A related area in which there is a noticeable lack of research is whether there is any difference between native speakers (NSs) and non-native speakers (NNSs) in their willingness to switch schemata. Research which has been conducted into NS-NNS differences concerning schemata (summarised in Barnitz, 1985; Carrell and Eisterhold, 1983) has focused on cultural specificity of schemata. Such research has largely involved comparison of NS and NNS responses to passages which activate a single schema, and thus willingness to switch schemata was not an issue in such research.

As we have seen, however, such willingness to switch schemata may be vital for adequate comprehension of texts. It could be posited that NNSs may be less willing to switch schemata since they may be less certain than NSs about the reliability and importance of information in the text. In addition, unknown cultural factors could also have an influence on willingness to switch schemata. If it were found that NNSs were less willing to switch schemata than NSs, this would have an impact on their reading comprehension with possible implications for the teaching of EFL reading. It is therefore important to gain evidence concerning any difference between NSs and NNSs in their willingness to switch schemata, and this is one of the purposes of this paper.

The study

This study then is an investigation of influences on schema switching and of readers' willingness to switch schemata. Before these are investigated, however, evidence that readers are using schemata to aid comprehension of the given passage is needed, and this is the focus of the first research question. The second question examines where in a

passage readers (irrespective of whether they are NSs or NNSs) switch schemata. The third question compares NS and NNS willingness to switch schemata.

Subjects

There were 60 subjects in the study, comprising 30 NSs (of British, American, Australian and New Zealand origin) and 30 NNSs. All subjects were professional graduates aged between 23 and 55. The majority of NS subjects were male, and the majority of NNSs were female. Although this difference may have some influence on the results, I believe that whether a subject is an NS or an NNS is far more important in determining their willingness to switch schemata. For the purpose of this research, then, it is assumed that there are no differences in willingness to switch schemata between males and females. The NNSs were all Thai and all were experienced English teachers with, presumably, a reasonable level of language competence to avoid problems of insufficient language competence affecting activation of schemata, at least for the text under consideration.

Method

Although Rumelhart's sentence-by-sentence description of a reader's interpretation described above provides a useful depth of data, the qualitative nature of the data makes inter-subject comparisons and analyses difficult. In this paper, then, the design was constructed so as to elicit responses which could be categorised as illustrative of one of two schemata.

The following passage (from *The Sandcastle* by Iris Murdoch) was used:

> (1) He pushed his plate aside. 'Aren't you going to eat that?', said Nan. 'Do you mind if I do?' She reached across a predatory fork and took the meat from Mor's plate. 'It's too hot to eat', said Mor. (2) He looked out of the window. (3) The tower of the school was idling in the heat, swaying a little in the cracked air. (4) From the arterial road nearby came the dull murmur, never stilled by day, of the stream of traffic now half-way between London and the coast. (5) In the heat of the afternoon it sounded like insects buzzing in the wood. (6) Time was longer, longer, longer in the summer.

The passage was split into six sections as indicated. The first section includes the relevant context up to the word *it* which is the focus of this study. After that, following Rumelhart's sentence-by-sentence approach to analysing schemata, the following five sections each comprise one sentence of the text. The six sections were presented to the subjects in turn. After reading each section, the subjects were asked what *it* in section 1 referred to. It was assumed that there are two possible referents for *it*: *meat* and *weather*, and subjects' responses were categorised as one of these. The study, then, is predicated on the assumption that the reader's interpretation of *it* will be dictated by the active schema being used.

Results

Evidence for schema use

Are the subjects using schemata in reading the passage? Before we can investigate schema switching, we must first find evidence that the subjects are using schemata in processing the passage. The subjects' responses to the question concerning the referent of *it* provide such evidence. Table 1 shows a breakdown of the 58 responses after section 1 which were categorised as *meat*. (Two subjects only gave responses which could be categorised as *weather*.)

Table 1: Responses categorised as *meat*

Response	No. of subjects
meat	31
food	18
other	9

The 18 responses of *food* (31% of the responses categorised as *meat*) are suggestive of schema use. The word *food* does not appear in the passage whereas *meat* does. If schemata were not influencing the readers' interpretations, we could expect all responses to be *meat*, taken literally from the passage. Since many responses were *food*, we can conclude that top-down processing indicative of schemata is involved. Further evidence comes from responses categorised as *other* in Table 1. These included "whatever it is that Nan is going to eat", "something she wanted to eat - I don't know what it is" and "whatever is on the plate". Responses such as these imply that an eating schema was activated with the instantiation of the food slot by *meat* being overlooked.

Similarly, of the 42 subjects' responses categorised as *weather* (41 subjects whose final responses were *weather* and 1 subject whose response was *weather* after stage 3 but who later switched back to *meat*), only three were taken literally from the passage (*heat* in section 3 of the passage) whereas the rest (29 responses of *weather*, 10 responses of *temperature*) imply use of schemata. We can therefore conclude that the subjects were using schemata in reading the passage.

Influences on schema switching

After which section do subjects switch schemata and what text information induces most switches? Table 2 below shows the responses of all 60 subjects after each section categorised as either *meat* or *weather*. We can see that, overall, the subjects' responses gradually changed from *meat* to *weather* as they progressed through the passage. At each of the five opportunities to switch schemata, more of the subjects interpreted *it* as referring to *weather* than previously, suggesting that the later sections of the passage continually reinforce a *weather* schema.

Table 2: Subjects' responses after each section

	meat	*weather*	No. of subjects switching schemata
After section 1	58	2	-
After section 2	48	12	10
After section 3	33	27	15
After section 4	32	28	1
After section 5	27	33	5
After section 6	19	41	8

If such schema switching were relatively independent of information in the text, we would expect the rate at which subjects switch to remain constant between all sections (i.e. we would expect 7.8 subjects to switch schemata after each section). By comparing the rates observed in the study with this expected rate, we find that the observed rates of schema switching are significantly different from a constant rate ($\chi^2 = 14.22$, $p < 0.01$). This implies that there is information in the passage which has a significant influence on the schemata activated.

The comparatively large number of subjects switching from *meat* to *weather* after section 3 of the passage suggests that section 3 contains information likely to induce a schema switch in readers. I would suggest that the word *heat* in section 3, which Hoey (1991) would classify as a complex lexical repetition of *hot* in *'It's too hot to eat'*, provides a close link between sections 1 and 3. *Heat* in section 3 clearly refers to the weather, and thus *it* in section 1 is reinterpreted as referring to *weather*.

Similarly, section 2 also induces a higher than average amount of schema switching. Unlike section 3, in section 2 there are no explicit links to the weather, so the high number of switches is somewhat surprising. However, van Dijk (1977) analyses exactly the same event of a character looking out of a window as a link between two schemata. The *window* provides the link between schemata concerning inside activities and those concerning outside activities. Thus, after section 2, the reader may evaluate the active eating schema as being irreconcilable with outside activities and consequently switch schemata.

On the other hand, section 4 would appear to contain very little information likely to induce a schema switch. Although concerning outside activities, section 4 has no explicit links to the weather. Following section 3, which explicitly reinforces a weather schema, section 4 provides no additional information to induce readers to switch schemata and thus is the stage at which the fewest switches are made.

Differences between native speakers and non-native speakers

Do NSs and NNSs differ in their willingness to switch schemata? Assuming that willingness to switch schemata is closely correlated with schema switching, investigating any differences between NSs and NNSs in the amount of schema switching will be

indicative of differences in their willingness to switch schemata. Table 3 shows the number of NS and NNS subjects for each kind of schema progression between sections.

Table 3: Comparison of NS - NNS schema progression

Section	s = 1		s = 2		s = 3		s = 4		s = 5		All sections	
	NS	NNS	NS	NNS	NS	NNS	NS	NNS	NS	NNS	NS	NNS
M_{s+1}/M_s	23	25	13	19	14	16	12	15	6	13	68	88
W_{s+1}/M_s	5	5	10	6	0	3	2	3	6	3	23	20
M_{s+1}/W_s	0	0	1	0	0	2	0	1	0	0	1	3
W_{s+1}/W_s	2	0	6	5	16	9	16	11	18	14	58	39

M = *meat* W = *weather*
M_{s+1}/M_s = number of subjects who responded *meat* after section s+1, having already responded *meat* after section s. For example, for the first column, where s=1, M_{s+1}/M_s refers to the number of subjects who responded *meat* after section 2 having already responded *meat* after section 1. Thus, for example, 23 NS subjects responded *meat* after both sections 1 and 2; 5 NS subjects responded *meat* after section 1 but *weather* after section 2; no NS subjects responded *weather* after section 1 and then switched to *meat* after section 2; and 2 NS subjects responded *weather* after both sections 1 and 2.

To see whether the differences between NSs and NNSs shown in Table 3 are significant, we can take the interpretations of the NSs to be the expected norm and compare the observed results of the NNSs against these. For schema progression in all sections and for the progression between each of the sections, there are no significant differences between NSs and NNSs (all sections, $\chi^2 = 7.50$; s = 1, $\chi^2 = 2.08$; s = 2, $\chi^2 = 3.22$; s = 3, $\chi^2 = 7.10$; s = 4, $\chi^2 = 2.46$; s = 5, $\chi^2 = 4.08$). We can therefore conclude that there are no differences in schema switching between NSs and NNSs.

Discussion
The study presented here provides additional evidence for schema use by investigating the words readers use in identifying referents. If a reader identifies a referent by using words taken directly from the text (such as *meat* in the text considered here), there is no reason to believe that schemata are necessarily involved in identifying the referent. If, on the other hand, the reader uses a paraphrase or words which do not appear in the text (for example, using *food* rather than *meat*), this may be indicative of the use of content schemata. Looking at how readers identify referents, then, may provide an alternative method for future investigations into schemata.

The results from the second question concerning schema switching highlight the importance of lexis and of links between schemata. With switching occurring most frequently after section 3, where *heat* is a complex lexical repetition of *hot*, the importance of lexical cohesion in processing texts identified by Hoey (1991) is supported in this study, since lexical repetition is the most influential kind of text information in inducing schema switching. In addition, the influence of sentences which may link

different semantic supersets or topics (van Dijk, 1977; Watson Todd, 1997), such as section 2, which provides a link between the inside and outside worlds in the text, is also highlighted. These influences on schema switching could be incorporated into the teaching of reading to aid learners in more efficient processing of texts.

Lastly, the lack of any support for differences between NSs and NNSs in schema switching could be viewed as a non-result. There is a tendency for non-results to be underreported in literature in many areas, but they are often as important as significant positive results. Above, I posited two possible influences on willingness to switch schemata, namely, cultural factors, and certainty about reliability and importance of information in the text. For Thais, at least, cultural factors do not appear to be a consideration. For Thais with advanced English language skills such as the subjects in this study, certainty about the information in the text also does not appear to be a factor. Although these findings might not be generalisable to non-Thais or to lower-level Thai learners, they do suggest that willingness to switch schemata may be one thing the reading teacher does not have to worry about, and thus may well be of importance to some readers of this journal.

This paper examined content schemata which may seem of more concern to background knowledge than language, and so of little relevance to language teachers. However, several points highlighted by this study are of importance in the language classroom. Firstly, content schemata play an important role in the comprehension of texts, and thus either texts should be selected which fit with learners' existing content schemata or teachers should be prepared to contextualise texts in terms of providing background knowledge crucial to understanding. Secondly, when looking at the discourse level, teachers need to consider whether to teach how lexical cohesion and links between semantic supersets can aid comprehension, in addition to teaching more usual language foci such as discourse markers. Thirdly, the ways in which meaning is assigned to an ambiguous *it* in this paper may inform the teaching of assigning referents to pronouns.

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