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Towards a Hierarchy of Inferences: Are Some Inferences more challenging for second language readers?

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Abstract:

Readers make several inferences in the course constructing texts and meaning in both written and spoken texts. While some inferences seem easier to make, others call for more cognitive processes to arrive at logical conclusions and most of the process is subconscious. The study was explored whether some inferences were more difficult than others to make for SL readers. Could we identify a hierarchy of inferences? Using culturally familiar and unfamiliar texts we tested pronominal, pragmatic, textually explicit and textually implicit inferences in 8 secondary schools in Kenya with learners in their final year. There were 40 questions for each inference category. The results of the test show that in terms of difficulty judgement, only the pronominal inferences seemed to be the easiest. Performance showed that there is a hierarchy inferences. Ability to make one type of inferences varies in readers and judgement of question difficulty is not well developed.

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I. INTRODUCTION

The question that the paper is asking is whether there are inferences that are more difficult to make in terms of cognitive effort required for second language readers in testing situations than others. Readers make several inferences as they read: words have to be woven together to provide sentence meanings which in turn are linked together 'behind the eyeball' (Gough, 1985) to provide meanings of paragraphs. Paragraphs are then interwoven to provide textual meaning for whole texts such as stories, poems, articles and other written works or spoken texts. All this interaction with texts take place fairly automatically for effective readers, but will depend on text familiarity, or difficulty.

II. BACKGROUND

Inference making has been described as the 'cornerstone of reading comprehension' (Winne et al, 1993), while Oakhill (1988) and Chikalanga (1991) claim that it is the reader's inferences that give life to words, sentences and paragraphs of a page.

As most of what is in a text is not explicit, understanding implied meaning will be predicated on understanding, first, what is explicit and the reader's ability to identify main ideas depends on several other skills such understanding relations between parts of a text (Mathews, 1990) for example, if we consider the two statements below:

i. Ashen-faced he painfully clutched at his chest.
ii. Thirty minutes later, the stethoscope did not register a heartbeat.

Several inferences, all logical, can be made from each sentence. From sentence (i). We can construct the following:

a. That 'he' is in shock - signaled by '*ashen faced*
b. That 'he' is in pain –signaled by *painfully clutched*
c. That 'he' is probably having a heart attack –hence the ashen-ness of the face and clutching of the chest from pain and shock.

From sentence (ii), we can make the following inferences:

a. That someone else was there with 'he'
b. That a nurse or doctor or some other medical person has been called or 'he' has been taken to a medical facility - signaled by the stethoscope.
c. That the time lapse between texts (i) and (ii) is thirty minutes- signaled by thirty minute later.
d. That some kind of examination had been done- signaled by the presence of a stethoscope.
e. That 'he' is already dead –signaled by *–did not register a heartbeat.*

To arrive at some of the inferences that are textual the reader has to:

i. Make connections between the two sentences that make the text through a process called text integration (Hughes, 1993) and identify logical relations between propositions or events expressed in the text.

To fill in gaps in the text, the reader will:

ii. Use their knowledge of diseases and how health facilities function. In particular, their knowledge of heart attacks or stroke will come in handy. Their knowledge of the world and how people will act in situations of medical emergency will also come to fill the gaps that are not textually explicit. In addition, the reader will make use of knowledge of how language works to draw 'reasonable' inferences or interpretations (Amer, 1992, Haviland and Clark, 1974, Kintsh, 1974)

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III. LITERATURE REVIEW

Types of inferences:

In the course of reading are a reader will make several and different kinds of inferences: lexical, propositional, logical, informational, elaborative and evaluative.

Lexical inferences:

Are also called pronominal inferences and refer to textually explicit information. The category may also refer to scriptally implicit words meanings when we relate questions and answers on them (Kembo, 1997 and Chikalanga, 1994)

Propositional inferences:

Refer one to Logical informational and logical explanatory inferences. These inferences are arrived at from the semantic content of a text. All available evidence will point to the same inference or interpretation. They are also 'convergent (Smith et al, 1974). They are also deemed to be logical as they follow from a writer's explicit message.

Elaborative informational Inferences:

Include referential and spatio-temporal inferences which refer to space and time.

Logical Explanatory inferences:

Logical explanatory inferences can be divided into motivational, causative and enablement inferences. Pragmatic inferences or scriptal inferences are broadly divided into three categories: elaborative informational, elaborative explanatory, and evaluative. Elaborative explanatory inferences include the following sub-types: motivational, causative and enablement. The final category of inferences are called evaluative (Warren et al, 1979).

Evaluative inferences

These inferences assess significance, normality, validity of events and actions, characters' actions, and motivations within a given text. The inferences depend, to a large extent, on the breadth of relevant schema that a reader brings to bear on a particular text. In other words, they depend on the breadth of a reader's world knowledge.

IV. THE STUDY

The study was conducted among secondary school pupils in Kenya and used reading texts written in English that were culturally familiar and unfamiliar. All the readers in the study were in their final year of study, Form four and had learned English as a Second Language from Primary four, and used it for instruction, at least for 11 to 12 years. 300 (three hundred) students were randomly selected from eight schools. The students in the sample came from 11 linguistic groups of the 42 groups in Kenya then.

V. MATERIALS

The study administered two inference tests in two different sessions. Inference Test 1 was culturally familiar, while Inference Test 2 was unfamiliar. While the familiar texts were not culture specific, they were deemed to be easier for Kenyan students to relate to than the unfamiliar texts. The unfamiliar texts were deemed to be those which would have been easier for British students to relate to based on Schema theory. Kenyan students should have adequate background knowledge to bring to bear on the familiar texts. Furthermore, the texts used were also considered because their question yield for all the four types of inferences being tested.

To get an adequate sample learners' reading ability each test had three separate texts selected on the basis of linguistic accessibility, question yield for the four sections. Questions for learners to answer were set on each text.

VI. THE TASKS

Each reader was asked to read the passages in each test and answer questions set on them from four different sections. Section A questions tested pronominal inferences: personal pronouns and lexical inferences that were text based. Factors considered were divorcement between the pronoun and its antecedent or referent, and the number of possible antecedents being tested. Section B of the test examined Elaborative informational and Elaborative explanatory or Pragmatic inferences whose interpretation depended on textual and prior knowledge of the readers, and whether they were able to instantiate appropriate world knowledge to bring to bear on textual information. Section C tested Logical informational inferences – that is text based inferences that are textually explicit, while section D examined logical explanatory inferences that were textually implicit. Section 'D', textually implicit inferences required readers to 'reason' with the text to arrive at an appropriate response.

At the end of each section, readers were also asked to rate the

Very Easy	Easy	Between Easy and	Difficult	Very difficult
1	2	3	4	5

section on perceived difficulty on a five-point scale as shown below by putting a tick inside the appropriate box.

Short- answers of generally not more than one sentence were required from learners. This was to guard against extended writing which would influence responses of the subjects. Short answer questions also limit the reader's chance of guessing and problems that arise from linguistic proficiency (Weir, 1993 and Carrel et al, 1989). The scores of the students on each section were compared to their ratings of perceived difficulty of the sections.

The tests were administered separately on separate days to each school group in each school. Learners were not timed but had three hours for each test. Most the readers finished their work within 212/ hours. The researcher made sure that readers knew what was expected of them before they began and went round to ensure that pupils were obeying instructions, answering questions and also rating each section for difficulty. All the scores for the reading tests were done out of 100%.

VII. RESULTS AND DISCUSSION

Table 1 summarizes the results from both tests by Inference category for familiar and unfamiliar texts.

Table 1: Performance by Section in familiar and unfamiliar tests by inference category

Section	Min	Max	Range	Mean	Min	Max	Range	Mean
	Familiar Texts				Unfamiliar Texts			
Pronominal (section A)	41	99	58	70	33	93	60	70
Pragmatic (section B)	43	96	53	72	11	80	69	47
Textually Explicit (C)	32	96	64	68	22	87	65	68
Textually Implicit (D)	18	92	74	84	07	83	77	56

Key: Min=minimum; Max = maximum

From Table 1 above, it will be observed that students giving correct response varied greatly across the inference categories. There are huge variations in the learners' responses to questions. The variability of scores was greater in the pragmatic and textually implicit (D) sections. This is followed by the textually explicit (C) sections and the pronominal sections (A) respectively. In addition, the pragmatic section had an average acceptability percentage of 47%, and textually explicit had an acceptability mean of 56 %. Pronominal and textually explicit response sections and acceptability means standing at 70% and 68% respectively. Of interest is the observation that on 15% of the pragmatic questions in unfamiliar texts learners giving acceptable inferences were less than 20%. From Table 2 below, it will be observed that both the minimum and maximum scores are lower than for the unfamiliar texts. The variability was greatest in pragmatic (section B) and textually implicit (section D) inferences for both familiar and non-familiar texts. The range of marks for both tests was over 50% points, which is high for learners who had been taught reading for more than nine (09) years.

VIII. ASSESSMENT OF SECTION DIFFICULTY

The table below shows how learners rated difficulty of inference sections according to their own perceptions of difficulty in the tests. The following tables show that reader judgments of section difficulty did not give the study an unequivocal return of which type of inferences they found easy or difficult. There was huge variation in reader judgments of difficulty as attested to by the standard deviations below. The majority of students judged Implicit inferences (Section B) the most difficult with ratings between (3) and (4), while it also had the largest number of ratings of (5) 'very difficult' for familiar test.

Table 2: Learners' assessment of section difficulty for familiar texts

Section	Minimum	Maximum	Range	Mean	SD
Pronominal (A)	1.00	5.00	4.00	2.587	0.689
Pragmatic (B)	1.66	5.00	3.40	3.322	0.608
Textually Explicit (C)	1.00	5.00	4.00	3.149	0.614
Textually Implicit (D)	1.00	5.00	4.00	3.140	0.662

Table 3: Learners' assessment of section difficulty for unfamiliar Texts

Section	Minimum	Maximum	Range	Mean	SD
Pronominal (section A)	1.00	5.00	4.00	2.551	0.781
Pragmatic (section B)	1.66	5.00	3.40	3.281	0.629
Textually Explicit (C)	1.00	5.00	4.00	3.234	0.720
Textually Implicit (D)	1.00	5.00	4.00	3.590	0.738

In the Unfamiliar test the fewest ratings for 'difficult' (4) and very difficult (5) were returned for Section A, the pronominal inferences. The pragmatic inferences had very few ratings of very difficult (5) with the majority of ratings being between '2', Easy and '3' 'between easy and difficult'. Textually Implicit inferences were judged the most difficult with most ratings between (3) and (4), and a large number of readers rating the section as being very difficult (5). The SD of 0.662 for familiar texts and 0.738 for unfamiliar texts, we can observe that there was a lot of variation in learner judgement of difficulty for this category of inferences. The means show that pronominal inferences, with means of 2.587 for the familiar and 2.551 for unfamiliar tests respectively, were generally judged as being the easiest. This was followed by Textually Explicit categories with 3.149 and 3.234.

Observation of the deviations in each category across the familiar and unfamiliar texts reveal that there was wide variation in the readers' judgements of section difficulty for each category.

IX. PERFORMANCE IN THE INFERENCE CATEGORIES

The actual mean scores for the various inference categories, shown in Table 4 show the actual difficulty in the performance of each section.

Table 4: Performance on sections of Tests by inference Category

Test	Section	Mean Score
Familiar	A (Pronominal)	14.93
	B (Pragmatic)	10.23
	C (Explicit)	12.34
	D (Implicit)	12.20
Unfamiliar	A (Pronominal)	15.03
	B (Pragmatic)	7.75
	C (Explicit)	13.67
	D (Implicit|)	9.47

It will be observed in Table 4 above that the performance of students across the inference categories varied, but the pragmatic inferences Section B) across the unfamiliar and familiar texts had the lowest mean scores at 10.23 and 7.75. This was followed by Implicit categories (section D) in both tests which had 12.20 and 9.47 for familiar and unfamiliar texts. The highest scores were those of the pronominal category (section A) with means of 15.03 and 14.93 out of maximum points of 20 each. This was followed by the textually explicit, which had means of 12.34 and 13.67.

To gauge the differences in the performance of each section against others, Analysis of Variance was carried out. For the familiar tests the following results were received f= 135.30 (n=300, df =1196, p=0.000), while for unfamiliar test the following results were received f=246.36 (n=300, df =1196, p=0.000). The values received proved that overall there were huge and significant differences in performance across the inference categories.

While pronominal inferences caused the least inferencing difficulties for the testees, the readers had more difficulty arriving at reasonable inferences in pragmatic inferences and

textually implicit inferences in sections 'B' and 'D', respectively. In the continuum of (Easy) and (Very Difficult), it seems that from performance and ratings we can begin to argue that: pronominal inferences are generally the easiest to make, followed by Textually Explicit inferences. Textually Implicit Inferences and Pragmatic inferences seem to hold an almost equal position as the most difficult for the group of students. It must also be pointed out that there were large variations in readers performance across the categories and within the categories with some students making more acceptable inferences in the difficult categories and doing less well on the easier categories above.

X. DISCUSSION

While judgements on section difficulty and performance varied greatly across and within the inference categories and readers, it is possible to begin to explain that indeed readers find some inferences more difficult than others to arrive at.

Readers generally had little difficulty in making acceptable inferences at pronominal level which deal with pronouns that refer to people, things and places that have been mentioned before. Where there is ample divorcement between the referent and the antecedent, the readers had more difficulty. The separation between a referent and its antecedent creates problems, because the reader has to process more sentences to be able to link them up.

The second category that was next to 'Easy' was the Textually Explicit Inferences (Section C) in both the familiar and unfamiliar texts. The reasons that make this category less difficult than the implicit category or pragmatic category could be: one, that all information is in the text and the reader only needs to identify it, especially in a testing situation where what is demanded must be identified. Two, another reason for the variation in performance in this category could be that although all the information is in the text, the reader must identify what has the best fit to answer a given question asked. This called not just for understanding the textual information, but also for the metacognive skill of testwiseness. (Amer, 1994) Three, learners may not have developed the skill required to hold important information as they add more to it. Maintaining local coherence requires the reader to map incoming information onto information that is currently active in memory" (Cook, A. E. Halleran, Jennifer G. and. O'Brien, Edward J. 1998: 2), that is textual information already processing.

Implicit Inferences (Section B) come next in terms of performance. They are the more difficult inferences to make. These inferences are also called 'Elaborative Inferences' as the reader has to add 'some' knowledge to construct meaning (Warren, Nicholas and Trabasso, 1979). In making inferences in this category, readers have to look at what, sometimes, is only implied in the text before they can arrive at an inference. For example, if we look at the following text:

i. *Ashen-face he painfully clutched at his chest*
ii. *Thirty minutes later the stethoscope did not register a heartbeat*

Question: If we have the question: Where is the patient?

The inference we shall make will demand a 'reasoning with the text' as well as incorporation of information from our background knowledge of the world of disease and treatment procedure, because there is nothing explicitly stating where 'he' is. But we have an indicator or flag, the 'stethoscope' indicating the presence of a doctor or clinician. If a reader said 'home', his interpretation of the text would suggest that someone else has called in a doctor. If another reader were to state, 'hospital', he would be implying that someone else had taken 'he', the subject, to a hospital or health center. The reader thus establishes coherence by filling in gaps in the text. To fill in gaps with reasonable ideas and knowledge, the reader must instantiate appropriate schemata and incorporate them in the text to reach an interpretation. Cook , Halleran & O'Brien (1998: 2) have this to say:

The development of a coherent situation model requires the reader to maintain coherence at both a local and global Maintaining local coherence requires the reader to map incoming information onto information that is currently active in memory"

It may be that second language readers with their limited vocabulary may not hold 'read' information long enough to map what is coming onto them (Calvo, 2004), hence the failure to do well even when all information is in the text.

The inferences can prove difficult because many readers and even teachers of reading (Cain, et al, 1999) claims that reading is mostly poorly taught) suffer from the misconception that all information is in the text and may think that anything outside a given text is, therefore, irrelevant in responding to given tasks. Leaners can also respond to tasks inappropriately because they have not understood the lexical and sentencial propositions of the text correctly in the first instance. This disables their ability to elaborate possible meanings. This may be caused by the language proficiency and/or reading proficiency especially where the learner is reading in a second language.

The tests of variance show that there were significant variation in the performance of the four categories of inferences. The variance was, however, greater in the unfamiliar texts. There may be several reasons for this: one, that testees tend to rely more on textual bottom up processing when dealing with culturally unfamiliar texts than they would do with familiar. Two, where students do not instantiate appropriate knowledge bases for the reconstruction of meaning, and they are also unable to find the best fit text to respond to an inference question, their responses may not be adequate.

Based on reader judgements of question difficulty we are not able to unequivocally state that there is definite hierarchy of difficulty, except that pronominal inferences are less difficult than other categories. From the performance of the different inference categories, we can state that: there seems to be a hierarchy, with Pronominal Inferences being the easiest inferences to make a mean of 14.98 for the two tests. They are followed by textually explicit inferences with a mean of 13.50 for the two tests, then 10.83 for the implicit inferences and lastly the most difficult, the pragmatic inferences with a mean of 8.99 across the two tests.

XI. CONCLUSION

From this study, a table of inference difficulty will appear as follows:

Table 6: Inference difficulty by category

Inference category	
Pronominal	Easy
Textually Explicit	Between Easy and difficult
Textually Implicit	Difficult
Pragmatic inferences	Very difficult

The ratings above are based on the variability in performance and the fact that even in the easy category, there were many readers who found even the easy pronominal inferences difficult. The table is also based on the fact that many readers were unable to gauge accurately how each section of inferences was difficult for them and therefore may have failed to apply the necessary effort required to arrive at appropriate responses. Even though we can talk about a possible hierarchy, it does not explain why a reader would do poorly in textually explicit inferences than implicit inferences or even pragmatic inferences. There is still more that we do not understand about reading and meaning making.

More studies are required on reading as it is a gateway to knowledge especially as students get into colleges and tertiary education where they are expected to gainfully study on their own (Bryant and Bradley, 1985).

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