# Reading comprehension and spoken language about multi-semiotic texts

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## Abstract

*This paper is based on findings following more than one hundred interviews with Aboriginal and non-Aboriginal students from remote, provincial and metropolitan areas about their strategies for reading multi-semiotic texts (texts containing both visual and verbal semiotic resources). These student groupings are being investigated because Aboriginal males in remote schools have lower mean scores on state-wide reading tests. The research is part of an Australian Research Council Linkage project, between the University of New England and the NSW Department of Education and Training, which aims to develop a model of 'image-language' relations.*

*Strategies used by the students to answer questions about multi-semiotic texts appearing in the reading sections of the NSW 2005 Basic Skills Tests for Year 3 and Year 5 students have been analysed and then compared with the students' reading comprehension. Some students, who were unable to connect the visual and verbal meanings, experienced difficulty comprehending complex sentences used in the texts. It was also noted that many of these students' interview transcripts lacked complex syntactic (grammatical) structure. Academic or specialist written language often differs in both vocabulary and syntactic structure from vernacular or spoken language (Gee 2008:96) and may not resonate with or be able to bridge to a child's vernacular (Gee 2008:101). Much research has concerned the relationship between spoken vocabulary and reading comprehension but there has been little research into how oral syntactic structure (grammatical complexity) might relate to reading comprehension. To see if there is any relationship between these two factors, students' oral language was analysed to determine its level of complexity and then compared with their reading comprehension. Findings from correlations are presented together with a few examples from case studies.*

## Introduction

This paper concerns one part of PhD research which was initiated in response to three observations about reading assessment data from the Basic Skills Tests (BST) which are conducted with all Year 3 and Year 5 students, who are approximately 8 and 10 years of age, in the state of New South Wales (NSW), Australia.

The first observation is that some questions about multi-semiotic aspects of texts are the most difficult questions in the BST. The greater difficulty is evidenced by the fact that many questions in the BST which involve connecting visual and verbal aspects of texts are answered correctly by a lower percentage of students than most other questions. Accordingly, the PhD research focuses on the nature of image/language relations in texts and which types of relations cause most difficulty. The thesis also investigates the students' strategies when answering questions about those relations and their separate interpretation of images and comprehension of written text.

The second observation is that the mean reading score for male Aboriginal and Torres Strait Islander (ATSI) students in remote schools is well below the mean score for other groups of students. To investigate these differences in outcomes, the PhD research ensures there is a range of gender, geographic location and Aboriginal background and looks for any correlations between students' reading scores and their reading strategies in relation to these socio-cultural groupings.

The third observation is that the BST, as a literacy test, only focuses on assessment of the comprehension and production of written language. The concern about this arises from anecdotal reports from some teachers in NSW schools that the focus on written

texts in state-wide tests can lead to covert pressure to spend more time on reading and writing. As a consequence some teachers are spending less time on speaking and listening and yet as Lemke (1988:136) says, oral language is 'the medium in which we understand and comprehend'. To further investigate the relevance of this 'medium' to reading comprehension, the complexity of oral language used by students when talking about texts has been analysed and correlated with the students' reading comprehension levels and this is the main concern of the paper.

In response to the first two observations order the PhD research investigates the differential comprehension of image/language relations in texts by taking into account the nature and difficulty of the relations as well as the strategies used by different groupings of students to access inter-semiotic meanings. The third observation is relevant to differential reading comprehension because 'children's oral and early language proficiency underpins the emergence of children's formal reading' (Hay & Fielding-Barnsley 2007:195) and understanding language is a necessary part of understanding image-language relations. Reading also influences language development, so there is a 'reciprocal relationship between language and reading' (Hay & Fielding-Barnsley 2006:117). Although Hay and Fielding-Barnsley (2006) note that 'children with early reading delays need more exposure to and more practice with both expressive and receptive areas of language, such as vocabulary development and syntactic and semantic development' (p. 117), most research in this area has been related to vocabulary rather than syntactic development. Also most of the research has been in early childhood or Year 1 students (Hay & Fielding-Barnsley 2007:193). It is therefore important to investigate whether for older students there is a relationship between levels of syntactic complexity in oral language and levels of reading comprehension, to know whether teachers should focus more on the development of oral language complexity for students with delayed reading.

## *PhD research on multi-semiotic reading comprehension and oral language*

The first stage of the research focused on multi-semiotic reading texts from the 2005 Basic Skills Test (BST). Analysis of the texts was carried out using the structure of the clause complex (Halliday 1985:82) and emerging theoretical descriptions of image-language relations (Unsworth 2008). Unsworth's model (2008) is a social semiotic framework based on Halliday's (2004) Functional Grammar and Kress and van Leeuwen's (1996) Visual Grammar. Image and language are both semiotic resources (signs that are used for communication) so both of these grammars are based on three metafunctions of images and language in society and linguistic systems. These are the ideational, interpersonal and textual/compositional metafunctions. This research study focuses on the ideational metafunction in the construction of meaning and, in relation to this metafunction, Unsworth's (2008) model of image-language relations concerns relations of *concurrence* and *complementarity* between words and images in multi-semiotic texts.

*Concurrence* is a relationship where one semiotic resource elaborates on the meaning of the other by further specifying or describing it while no new element is introduced by the written text or image. The elaboration can take four forms:

- *Exemplification*, where the image may be an example or instance of what is in the text, or the text may include an example of what is depicted more generally in the image, as where the statement, 'mammals have hair' is accompanied by the picture of a specific example such as a cat;
- *Exposition*, which refers to the re-expression or reformulation of the meanings of the image or the text in the alternative semiotic resource with both the written text and image representing the same level of generality for example, an explanation or procedure about how something happens or is made together with a picture showing the finished phenomenon or product (words and image have the same participants and processes);
- *Equivalence*, where there is ideational redundancy since the ideational content corresponds across semiotic resources, for example a drawing of a cat with the label 'cat'; and

- *Homospatiality*, as discussed by Lim (2004),
  which refers to texts where two different semiotic resources co-occur in one spatially bonded, homogenous entity, as when the word SN-AP is drawn in the shape of a stick that has been snapped by bending until it breaks apart.

Partial or complete examples of all of these relations except homospatiality were evident in the 2005 BST test materials.

*Complementarity* is a relationship where a new element (participant or process) is introduced by either the written text or image. It can be in the form of extension, enhancement or projection.

*Extension* can be through relations of augmentation, distribution or divergence, as follows:

- *Augmentation* is where a new participant is introduced in one semiotic resource
- *Distribution* is where a new process or action is introduced.
- *Divergence* is where the image and verbal text diverge in meaning.

*Enhancement* is a relationship of conjunction whereby an element in one semiotic resource is enhanced by information in the other semiotic resource showing spatial, temporal or logical details. *Projection* is a relation where one semiotic resource projects the other as in the case of a cartoon image projecting words. There were assessment items for comprehension of relations of augmentation and distribution in the 2005 BST but there were no assessment items for how students comprehended other relations of complementarity.

Texts and questions from the 2007 Year 3 and 5 BST and the Year 7 ELLA (English Language and Literacy Assessment) were analysed and questions that assessed understanding of the following types of image-language relations were identified:

- Concurrence – equivalence, partial
- Concurrence – equivalence, complete
- Concurrence – exposition, partial
- Complementarity – distribution (additional processes/actions in image or written text)
- Complementarity – augmentation (additional participants in image or written text)

Statistical (Rasch) analysis of the state-wide student results provided test item thresholds, which are calculated through the differential performance of students on test items. These thresholds, commonly known as item facility indicators or logits of difficulty, were obtained for each of the questions about image-language relations from all five tests. The higher the logit the lower the percentage of students who successfully answered the question and therefore the greater degree of difficulty experienced. The mean difficulty of items testing understanding of different types of image-language relation was then calculated and the following mean logits were obtained for the 64 questions across five tests:

- 14 items about concurrence – complete equivalence, -0.967
- 14 items about concurrence – partial equivalence, -0.742
- 12 items about concurrence – partial exposition, -0.142
- 16 items about complementarity – distribution, 0.578
- 8 items about complementarity – augmentation, 1.170

It is quite clear that the mean logits for items testing understanding of concurrence are negative. This indicates the items about concurrence are easier than the items testing understanding of relations of complementarity, for which the mean logits are positive because fewer students answered these items correctly. However, to determine whether the difference between the different types of image-language relations is significant, a univariate analysis of variance (ANOVA) was carried out. Multiple comparisons were conducted and the mean differences in logits between equivalence (partial and complete) and both augmentation and distribution are significant at the .05 level, while the mean differences in logits between expositon and both augmentation and complete equivalence are also significant at the .05 level. In contrast, the mean

differences in logits between partial equivalence and both exposition and complete equivalence are not significant.

Overall these results show that the questions about complementarity in image-language relations, were significantly more difficult than questions about concurrence. This is probably because meanings in image and language reinforce each other in relations of concurrence but in relations of complementarity different meanings must be connected and a relation inferred. This makes sense when one considers that in reading assessments of comprehension of written language, questions assessing directly stated information are easier than questions assessing the connection of information in different parts of a text and the latter questions are easier than questions requiring the inference of implicit information. The next stage of the investigation was to see what strategies students used to comprehend these different types of image-language relations.

Accordingly, in 2006, sixty-five Year 4 students, then around 9 years old and sixty-three Year 6 students, then around 11 years old, were interviewed about the multi-semiotic texts from the 2005 BST and the reading strategies they used when answering questions that involved understanding image-language relations in the texts. The sample of students had similar numbers of metropolitan, provincial and remote students, of male and female students and of Aboriginal or Torres Strait Islander (ATSI) students and non-ATSI students. It was intended to have a similar numbers of students with low, medium and high BST reading scores but there were very few students in remote schools or ATSI students in any areas with high BST reading scores. During the interviews students were asked to think aloud about the meaning of words and images during their reading of the multi-semiotic texts. Then they answered the BST questions about image-language relations and were asked how they decided on their answers.

The strategies used by students to select their answers were coded and compared with those expected by the test developers and the findings will be reported in the doctoral thesis. However, during analysis of the interviews it was also noted that students who chose the wrong answers tended to respond with simple sentence or short answers to the most difficult questions about augmentation and distribution in image-language relations. The text analysis showed that a 2005 BST question about augmentation also required comprehension of verbal parts of texts characterized by high structural (grammatical) complexity, namely, ‘The sailfish is believed to be a cunning fish, able to feed amongst the various fish traps and nets shown by the dark areas, without being caught’. In view of this extra level of complexity in the question it was decided to analyse all of the questions about augmentation and distribution to identify their individual reading logits and the reading skills required to answer each one.

The logits for questions about distribution ranged from 1.79 to -1.38. The hardest question required students to identify who was the hidden speaker in a comic strip and the second hardest question required students to sequence stages in a process by relating information in a **complex sentence** to a diagram, whereas the easiest question about distribution required students to relate a clear iconic image to information written in *simple sentences*.

The logits for questions about augmentation ranged from 2.04 down to -1.74. The hardest question required students to infer the existence of a character who spoke but was not illustrated in a comic strip. The next hardest question required students to interpret an image by locating directly stated information in a **complex sentence** within a caption that described the image, whereas the easiest question involved interpreting an obvious image and *simple written text*. The range of both logits and skills indicated that items requiring understanding of complex sentences were more difficult than items requiring understanding of simple sentence structures even though these questions involved similar image-language relations. It seemed possible that sentence structure was posing another level of complexity within the more difficult image-language relations of complementarity.

In order to investigate any relationship between complexity in the students spoken language and their understanding image-language relations involving complex sentence structures, three questions that required students to relate information in a

complex sentence to an image were identified.
The second hardest question (logit 1.55) and another question (logit 0.84) about distribution both required understanding of a complex sentence in the text, *Telling the Time Using Water*. The second hardest question about augmentation (logit 2.01) required understanding of an even more complex sentence in the text, *Tobwabba Art Gallery.*

The latter question seemed particularly appropriate for assessing the correlation between grammatical complexity and the understanding of image-language relations because there was another question about the same text that required students to relate another image to a part of the text with a low level of grammatical complexity. As the questions are from the same text, their relative difficulty should not be affected by differences in the level of student interest or engagement.

The more difficult of the two questions concerned an image-language relation of 'augmentation', that is, the verbal and visual information were different because one contains additional participants (the dark shapes in the picture are identified in the written text as 'various fish traps and nets'). Only 44% of the state chose the correct answer for this question (see Figure 1).

28 In this artwork which shape shows a fish trap or net?

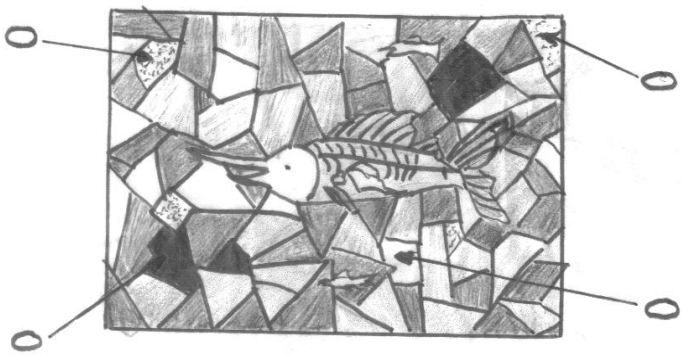

**Figure 1: Question about *Escaping the Nets* by Moe Cunningham from *Tobwabba Art Gallery* text in 2005 Year 5 BST. Drawing after http://www.tobwabba.com.au**

Students needed to understand the following structurally complex part of the text in order to know they should identify the darkest of the four shapes indicated:

*The sailfish is believed to be a cunning fish,* (clause α)

*able to feed amongst the various fish traps and nets* (clause β + ellipsis)

*shown by the dark areas,* (embedded relative clause + ellipsis + passive voice)

*without being caught.* (adverbial clause modifying β clause + passive voice)

This structurally complex part of the text, about the sailfish, involves an embedded clause and hypotaxis (clauses, β, that are dependent on an independent clause, α).

The relatively easier question, for which a higher percentage (66%) of the state had the correct answer, asked students where the artist had painted the fresh grass on the artwork, *Koori Food Source*. This question involved understanding an image-language relation of 'partial equivalence' between the image and text. The written information was contained in the simple sentence, 'The kangaroos are feeding on the fresh grass after the rain' and part of the picture showed kangaroos on a green area (see Figure 2). However, students would have needed to look back at the test booklet to be aware of the green area as the image in the test booklet was greyscale. Both of the pictures have iconic images of animals on abstract backgrounds and both of the questions are about the abstract background areas (nets and grass) and not about the iconic images of animals. The iconic image of water weed looks more like grass than the green dot

background behind the kangaroos, so it is a fine line as to whether the image-language relations being tested in the following question should be categorised as partial equivalence (only if green colour around kangaroos can be recognised as grass despite position at top) or augmentation (green area at top of image named as 'grass' in the written text).

30. In the artwork called *Koori Food Source,* where has the artist painted the fresh grass?

**Figure 2: Question about *Koori Food Source* by Terry Johnstone from *Tobwabba Art Gallery* text in 2005 Year 5 BST. Drawing after http://www.tobwabba.com.au**

This question was easier despite the fact that it had a very plausible visual 'distractor', the water weed with the platypus at the bottom of the picture, which 27% of children chose instead of the correct answer, because as one student explained, 'it looks like grass and it's close to the bottom'.

In order to investigate any relationship between complexity in the Year 5 students' spoken language and their understanding of image-language relations involving complex sentence structures, responses to the identified questions about *Tobwabba Art Gallery* and *Telling the Time Using Water* were analysed. The students were given a score of 0 to 3 for their answers to these three questions and then this score was correlated with the complexity of their spoken language. The complexity of spoken language was measured by the percentage of dependent clauses out of the total clauses uttered during 'think-aloud' responses to the complex section of text and while talking about how they chose answers to the identified questions.

## Results

Two-tailed Pearson Correlations were conducted between the percentage of dependent clauses and the original 2005 BST scores on the three questions, the 2006 post-test scores on the three questions and the overall BST score in 2005. There were strong correlations (significant at the 0.01 level of probability) between percentage of dependent clauses and the original 2005 BST scores for all students in the sample and for subgroups of ATSI, non-ATSI, metropolitan and provincial students but not for remote students. There were strong correlations between the percentage of dependent clauses and reading scores for the three questions in the original 2005 BST for all students in the sample and for subgroups of metropolitan and non-ATSI students. However, the correlation with the 2006 post-test scores on the three questions (when students answered the questions more than a year after the original test) was only significant at the 0.05 level of probability for all students and was not significant for any of the subgroups of male, female, metropolitan, provincial, remote, ATSI and non-ATSI students.

Students were also scored 0 to 3 on whether they chose the expected strategy (using both written text and image) to answer the questions. This score correlated with the students' 2006 post-test scores on the three questions at the 0.01 level of significance for all students and for the subgroups of ATSI, non-ATSI and provincial students and at

the 0.05 level of significance for metropolitan and
remote students. However, there were no correlations between use of expected strategy and the students' scores on these three questions when they completed the BST in 2005.

### *Discussion of results*

The lack of correlation between reading scores and syntactic complexity in spoken language for students in remote schools was probably due to the low number of students, only one of whom had a high reading score, in the remote schools sample of 14 students.

The stronger correlation between spoken language complexity and the 2005 BST scores than with the 2006 post-test scores indicates students were scoring differently in the post-test. This is consistent with research findings that using 'think-aloud' protocols improves comprehension (Lang & Kamhi 2002:442), that dialogue allows for 'bridging between formal and colloquial language' (Lemke 1988:140) and that dialogic home literacy interventions were successful in the short term (Hay & Fielding-Barnsley 2006; 2007). The correlation between use of expected strategy that was stronger for the 2006 post-test reading scores than the 2005 BST reading scores could indicate that the interview situation and think-aloud protocols encouraged students to relate text and image more frequently than they did in the original test situation.

The idea, that using complex sentence structure in oral language is related to capacity to understand complex written sentence structure, is implied by Gray (1990:113):

> it is doubtful if children can produce and understand written texts in any depth unless they can orally produce texts of that type themselves. We know also that children from literacy-oriented homes come to school with considerable experience in producing such texts, eg, Painter (1986), Wells (1982), Scollon & Scollon (1981), Heath (1982).

### *Student responses to complex language in texts*

The spoken language during the whole of the students' interviews was analysed and it was found that the ratio of dependent clauses to independent clauses spoken was related to the reading scores of students, regardless of the total number of clauses spoken. This can be seen in the data in Table 1 for Year 6 students in provincial schools who had either similar clause ratios or a similar total number of clauses spoken.

| Student M=male F=female A=Aboriginal | % correct in Reading Section of 2005 BST | Level of Reading (position in NSW State) | Ratio of Dependent to Independent Clauses | Total number of clauses spoken |
|---|---|---|---|---|
| M1 | 63% | Middle 50% | 1:7 | 89 |
| *M2* | *87%* | *Top 25%* | *1:5* | *93* |
| *F1* | *85%* | *Top 25%* | *1:5* | *65* |
| **F2** | **54%** | **Lowest 25%** | **1:18** | **57** |
| F3 | 76% | Middle 50% | 1:7 | 53 |
| **AF4** | **39%** | **Lowest 25%** | **1:14** | **89** |
| AF5 | 74% | Middle 50% | 1:8 | 98 |

**Table 1: Reading levels and clause ratios for 7 students from provincial schools**

### *Examples of complex spoken language used in interviews*

A Year 6 metropolitan male Aboriginal student, with a 2005 reading score in the top 25% of the state, could unpack the meaning of the complex sentence using relative clauses. He said, 'It's about a sailfish [that is cunning] and is able to get around the nets and fish traps [that people have set]'. This student also connected words (shown in italics in the following quote) from two dependent clauses to the picture saying, 'It's showing what looks like a swordfish with two other fish swimming in the water around *dark* coloured *nets*'. He had the highest percentage of dependent clauses: 38 out of a total of 114 being 33%. The following excerpts from his interview provide examples of adverbial clauses (preceding independent clauses) and relative, embedded and non-finite clauses.

| | |
|---|---|
| Student: | Because if you go around the place it takes longer where if you just go straight it takes much less time. |
| Student: | They are colours that have been used through the generations. |
| Student: | A float that moves up and down to move the larger, longer one. |

At the other end of the scale, where students had low BST reading scores, no dependent clauses were used by six females in Year 3 or by one male and one female in Year 5. Of these students four were Aboriginal or Torres Strait Islander and four were not, with two coming from metropolitan schools, three from provincial schools and three from remote schools, showing that there was an even spread among the social groupings. Many other students with low reading scores only used one or two dependent clauses.

There seems to be a similar level of complexity in the verbal reasoning required to comprehend and connect meaning in the expansion in clause complexing and the inferential reasoning required to connect meanings in image and verbal text in relations of augmentation. It would be interesting to investigate whether there is a relationship between these two kinds of textual complexity but it would be necessary to have a greater quantity and range of examples than exist in this study to do so.

### *How can teachers support reading comprehension through oral language?*

The early success of the National Accelerated Literacy Program (Wills, Lawrence & Gray 2006) suggests that developing students' oral language can aid their reading comprehension. In Accelerated Literacy (Gray 2007), scaffolding of highly literate texts unpacks the complex language which brings the texts closer to the child's own productive level of language so that the texts can be more easily comprehended. The scaffolding of discussion about the texts also increases students' productive level, thus bringing it closer to the level of the text and doing what Lemke (1988:140) recommends by helping students speak text meanings out loud. The importance of 'the child's own productive linguistic capabilities' for comprehending or 'processing input' is substantiated by George and Tomasello (1984:125) who found that even though 'young children partially comprehend linguistic input somewhat above their own productive level, comprehension at an inferential level is best when input is closer to the child's own productive level.'

## Conclusion

A relationship between students' reading test scores and the amount of syntactic complexity in their oral language when talking about texts in the tests has emerged in the current research. An implication of dialogic reading research has been that 'caregivers in low socio-economic status communities need to be encouraged to use with their children the types of oral language interactions that should help prepare their children for the instructional demands of the classroom' (Hay & Fielding-Barnsley 2007). However, these types of language interactions, especially explanatory language, may not be in the vernacular (Gee 2008:101) of the parents of children with language

delay. It would be more equitable if 'the instructional demands of the classroom' could accommodate children from low education backgrounds rather than expecting these children to arrive at school with the same language capabilities as students whose parents have higher levels of education.

Hay and Fielding-Barnsley (2006:118) also suggest that teachers enhance their dialogue with children in their classrooms by using four levels of language complexity and student-teacher dialogues (Blank 2002). Staging the complexity of questions and instructions is particularly valid for young students but it is also important to ensure that older students are supported to use and understand the complex language of literate and technical texts. The success of Accelerated Literacy, which involves students talking about literate texts before and during reading, suggests that it is possible for teachers in a whole class situation to develop spoken language about texts which leads to reading success for students of all ages.

This research into syntactic complexity in oral language further consolidates the clear calls by researchers for attention to oral language development in addressing the role of grammatical understanding to enable students to understand structural connections within texts leading to comprehension of more complex reading material (Unsworth 2002). As Painter (1996:81) points out, language development 'occurs in dialogue' and 'the language-learning experiences of different children will not be uniform'. Teachers need to recognise that some struggling readers may not have experienced the type of dialogue that prepares students for the formal academic language of literate texts. For students with less complex structures in their oral language, this is not a deficit in those students but a difference which must be acknowledged so that the 'forms of language and interaction that the child finds at school can resonate with and bridge to the child's vernacular cultural ways' (Gee 2008:101).

The current research shows a relationship between oral language complexity and reading comprehension in the specific context of talking about multi-semiotic texts. It does not prove any causal link. In the current study, most students uttered some dependent clauses, so the issue is not one of competence, but one of performance whereby students might benefit from further linguistic input and practice to give them greater familiarity with complex language structures. It is important for teachers to ensure that the level of oral language used in primary classrooms is not limited to what the children can read and write.

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