THE ROLE OF LEXICAL COHESION IN THE ASSESSMENT OF EFL READING PROFICIENCY

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This study argues that lexical cohesion plays a fundamental role in the concept of reading reflected on a widely accepted English proficiency test, the Test of English as a Foreign language (TOEFL®). Results stemming from the lexical cohesive analysis of a corpus of 608 fixed-response TOEFL® reading comprehension test items indicate that all question types on the test involve the identification of different instances of lexical repetition, or 'lexical links' (Hoey, 1991), connecting question stems and/or correct options to specific sentences in the related passages. Equivalent results found for TOEFL ® PBT (paper-based test), CBT (computer-based test), and iBT (internet-base test) items suggest that lexical links are in evidence across different versions of the test, even though these editions may, in certain instances, test certain reading skills by means of different question types.

INTRODUCTION

The use of standardized EFL reading comprehension proficiency tests is a relatively common practice. These tests are, more often than not, applied within educational settings with the purpose of identifying prospective undergraduate or graduate students who might be at academic risk if admitted to an institution where the medium of instruction is English because of the limited level of their reading ability in that language.

The aim of this study is to explore the implications of the text-forming function of lexical cohesive patterns in English for the assessment of effective EFL reading comprehension. Because of its worldwide reputation as one of the most widely accepted proficiency tests of English, it was felt that the Test of English as a Foreign Language (henceforth, the TOEFL® test) would be a trustworthy source of material representative of standard assessment of effective reading skills in English. A system for the analysis of lexical patterns in a corpus of 608 TOEFL® reading comprehension items was designed, based largely on Hoey's (1991) lexical repetition model.

The following section of this paper will offer a brief general description of the content and method of the TOEFL® reading comprehension tests in this corpus. This will be followed by an outline of the system used in the analysis of individual test items. The final two sections will discuss the results of the analysis and address its limitations, as well as introduce pedagogical implications involved and possible avenues for further research.

THE CORPUS

The corpus in this study is formed by official TOEFL® reading comprehension practice tests in the three different versions available at the time of data collection for this study, namely the Paper-based TOEFL® Test, the Computer-based TOEFL® Test, and the Internet-based TOEFL® (henceforth the TOEFL® PBT, CBT, and iBT, respectively)[i]. What is meant here by the term 'official practice tests' is that these have been produced by the Educational Testing Service (henceforth the ETS), the non-profit organization that develops and administers the TOEFL® test, and have been "taken from actual test forms given to examinees at worldwide test administrations" (ETS, 1998a, p. 4).

The TOEFL® PBT edition tests in this corpus have been taken from *Practice Tests Volume 1* (2 tests) and *Practice Tests Volume 2* (2 tests), both official guides from ETS (1998a, 1998b, respectively). The TOEFL® CBT edition tests selected for this research have been taken from the *Powerprep CD-ROM* (2 complete tests), the *TOEFL® Sampler CD-ROM* (1 test), and *Online Reading Skills Builder Volume 1* (3 tests), all of which produced by the ETS (2000, 2002b, 2005b, respectively, the last of which only available online on the TOEFL® website: http://www.toefl.org). Finally, the TOEFL® iBT edition tests in this study have been taken from *Helping Your Students Communicate with Confidence* (ETS, 2005a), *The Official Guide to the New TOEFL iBT* (ETS, 2006), and the *Complete Online iBT Practice Test* (http://www.toefl.org).

According to the ETS, the reading comprehension section of the TOEFL® test is designed to measure a student's ability to read and understand short passages in English. Reading comprehension is the third section in both the TOEFL® PBT and the TOEFL® CBT, and the first section in the TOEFL® iBT edition of the test. It consists of several passages, each followed by a group of fixed-response questions.

The passages in the test are excerpts taken from college-level textbooks that would be used in introductions to a discipline or topic. They cover a range of very general academic topics broadly classified as related to the Arts, Humanities, Social Sciences, Physical Sciences, or Life Sciences. The ETS (2002a) explains that the subject matter of the passages is general in nature "so as not to give an advantage to specialists in particular fields of study, or to people with particular kinds of background knowledge," thus contributing to the fairness of the test (p. 56).

The length of the passages varies across editions of the TOEFL® test. In both the TOEFL® PBT and the TOEFL® CBT, passages are between 250 and 350 words long, whereas in the new TOEFL® iBT, they are about twice as long, with an average of 700 words each. In all cases, however, the ETS (2002a) maintains that "sufficient context is provided by the passages so that examinees who read and understand them can answer the questions without relying on subject-specific knowledge outside the passage" (p. 56).

The reading comprehension questions based on each of the passages serve a number of different testing purposes. The types of questions vary somewhat across versions of the TOEFL® test. The following comparative table

(Table 1.1) shows a complete list of the test items in the three versions of the test, and indicates which ones overlap.

Table 1.1. Comparative Table of TOEFL Reading Comprehension Questions

QUESTION TYPES		PBT	CBT	iBT	TOEFL-format Examples
1	Main Idea	✓	✓		With what topic is the passage primarily concerned?
2	Factual Information*	✓	✓	✓	According to the passage, in what circumstances …
3	Sentence/Clause Relation	✓	✓		The word X in line # indicates that what follows is …
4	Inference	✓	✓	✓	Which of the following can be inferred from the phrase …
5	Vocabulary	✓	✓	✓	The word X in line # is closest in meaning to …
6	Reference	✓	✓	✓	The word X in line # refers to …
7	Rhetorical Purpose**	✓	✓	✓	Why does the author mention …
8	Organizational Structure	✓	✓		The passage is organized by …
9	Prediction	✓	✓		The paragraph following the passage most probably discusses
10	Negative Factual Information***	✓	✓	✓	The passage mentions all of the following EXCEPT …
11	Locate Information	✓	✓		Where in the passage does the author mention …
12	Tone	✓	✓		Which of the following best describes the author's tone in the last paragraph of the passage?
13	Insert Text		✓	✓	The following sentence could be added to the passage. … Where would it best fit in the passage?
14	Sentence Simplification			✓	Which of the following best expresses the essential information in the highlighted sentence?
15	Prose Summary			✓	An introductory sentence for a brief summary of the passage is provided.Complete the summary
16	Fill in a Table			✓	Complete the table by matching the phrases below. …

* Also called Stated Detail questions
** Also called Information Purpose questions
*** Also called Unstated Detail questions

The following section will describe the system used in this study to identify and analyze lexical relations in all of the test items in this corpus.

ANALYSIS OF LEXICAL RELATIONS

In his widely acclaimed book, *Patterns of Lexis in Text*, Hoey (1991) proposed that different forms of lexical repetition combine to organize text. His study has provided evidence that instances of lexical cohesion mark points of reference, or 'links', between sentences. The same research has also demonstrated that the observation of repetition patterns in text allows for, among other things, the identification of both adjacent and non-adjacent sentences which have a significant semantic connection.

In a small-scale study involving university entrance examinations in Brazil, Batista (2002) suggested that the principles in Hoey's (1991) reading model may be applied to the analysis of multiple-choice reading comprehension tests. In the present study, a modified version of Hoey's (op.cit.) categories of cohesion has been devised and applied to the identification of bonds between test items and specific portions of the passages in question. The resulting taxonomy, represented in Figure 1.2, below, involves seven types of lexical relations, as well as one set of cohesive devices which are not lexical in nature but which also make it possible for repetition to take place.

Table 1.2. Link Taxonomy

LINK TAXONOMY	
Lexical Relations	
Lexical Repetition	• Simple
	• Complex
Synonymy	• Simple
	• Complex
Antonymy	• Simple
	• Complex
Superordinate Repetition	
Hyponymic Repetition	
Co-Reference	
Labeling	
Non-lexical Relations	
Substitution	• By pro-forms
	• By ∅ (Ellipsis)

The manner in which each of these types of links contributes to the identification of semantic bonds between test items and passages will now be examined. Sentences are numbered for ease of reference.

The first type of link considered in the study, Lexical Repetition, may be

classified as either simple or complex. Simple Lexical Repetition (henceforth, simple repetition) involves items which Hoey (1991) defined as "formally identical" (p. 55), i.e., items sharing the exact same form or the same morpheme with minimum alterations, such as those marking the plural form of a noun, or those marking the 3rd person singular, simple past, past participle or gerund forms of a verb. Complex Lexical Repetition (henceforth Complex Repetition), on the other hand, occurs "either when two lexical items share a lexical morpheme, but are not formally identical (as defined in our discussion of simple repetition), or when they are formally identical, but have different grammatical functions" (Hoey, 1991, p. 55). The following are examples of Simple Repetition and Complex Repetition. Unless otherwise noted, all examples have been drawn from the sample text in Hoey (1991), p. 52.

Simple Repetition

[1] A drug known to produce violent reactions in humans has been used for sedating grizzly **bears** *Ursus arctos* in Montana, USA, according to a report in *The New York Times*.

[3] Many wild **bears** have become 'garbage junkies', feeding from dumps around human developments.

Complex Repetition

[4] To avoid potentially dangerous clashes between them and humans, scientists are trying to rehabilitate the animals by **drugging** them and releasing them in uninhabited areas.

[5] Although some biologists deny that the mind-altering **drug** was responsible for uncharacteristic behaviour of this particular bear, no research has been done into the effects of giving grizzly bears or other mammals repeated doses of phencyclidine.

The second category of repetition, Synonymy, involves the repetition of the idea represented by a given lexical item, rather than its form. In common with lexical repetition, instances of synonymy may be either simple or complex. Simple Synonymy occurs whenever "a lexical item may substitute for another in context without loss or gain in specificity and with no discernible change in meaning" (Hoey, 1991, p. 62). One example of Simple Synonymy is:

Simple Synonymy

[1] A drug known to produce violent reactions in humans has been used for **sedating** grizzly bears *Ursus arctos* in Montana, USA, according to a report in *The New York Times*.

[4] To avoid potentially dangerous clashes between them and humans, scientists are trying to rehabilitate the animals by **drugging** them and

releasing them in uninhabited areas.

Complex Synonymy involves synonyms which are not part of the same word class, as in the following example:

Complex Synonymy

[1] A drug known to produce violent reactions in humans has been used for **sedating** grizzly bears *Ursus arctos* in Montana, USA, according to a report in *The New York Times*.
[2] After one bear, known to be a peaceable animal, killed and ate a camper in an unprovoked attack, scientists discovered it had been **tranquillized** 11 times with phencyclidine, or 'angel dust', which causes hallucinations and sometimes gives the user an irritational feeling of destructive power.

The third type of lexical relation considered in this study, Antonymy, is also classified as either simple or complex. Simple Antonymy involves the repetition of the concept of a given item by means of an antonymous term which is part of the same word class. An example is:

Simple Antonymy

[1] A drug known to produce **violent** reactions in humans has been used for sedating grizzly bears *Ursus arctos* in Montana, USA, according to a report in *The New York Times*.
[2] After one bear, known to be a **peaceable** animal, killed and ate a camper in an unprovoked attack, scientists discovered it had been tranquillized 11 times with phencyclidine, or 'angel dust', which causes hallucinations and sometimes gives the user an irritational feeling of destructive power.

Note that Hoey's (1991) original analytical system does not include a separate antonymy category. In his taxonomy, antonyms formed by the addition of a prefix to the same morpheme as the items with which they form links are categorized as instances of Complex repetition. Examples offered by Hoey (op.cit) include *happy – unhappy*, *audible – inaudible*, and *contented – discontented*, all of which would fall under the simple antonymy category in the present study (p. 64). Moreover, following Jones (2002), the term *antonymy* is here used in "its broader sense, referring to any pair of words which could intuitively be recognized as 'opposites'" (p.1). Therefore, in this study, the antonymy category includes not only gradable pairs, such as *cold/hot*, but also non-gradable pairs, such as *dead/alive*, the latter being a category which certain linguists, including Lyons (1977) and Cruse (1986) have termed *opposites*.

Complex Antonymy involves antonymous terms which are part of different word classes, as in the following example:

Complex Antonymy

[2] After one bear, known to be a peaceable animal, killed and ate a camper in an unprovoked attack, scientists discovered it had been tranquillized 11 times with phencyclidine, or 'angel dust', which **causes** hallucinations and sometimes gives the user an irritational feeling of destructive power.

[5] Although some biologists deny that the mind-altering drug was responsible for uncharacteristic behaviour of this particular bear, no research has been done into the **effects** of giving grizzly bears or other mammals repeated doses of phencyclidine.

Superordinate and Hyponymic Repetition account for cases when two items are interpreted as having identical referents. These links occur when the items sharing the same referent are connected by a lexical relation of class membership. Superordinate Repetition involves a general term which may be said to designate a class of which the earlier item is a member, as in the following example:

Superordinate Repetition

[2] After one bear, known to be a peaceable animal, killed and ate a camper in an unprovoked **attack**, scientists discovered it had been tranquillized 11 times with phencyclidine, or 'angel dust', which causes hallucinations and sometimes gives the user an irritational feeling of destructive power.

[5] Although some biologists deny that the mind-altering drug was responsible for uncharacteristic **behaviour** of this particular bear, no research has been done into the effects of giving grizzly bears or other mammals repeated doses of phencyclidine.

Conversely, hyponymic repetition involves a specific term which may be said to be a member of, or included in, the class designated by the earlier item forming the link. The following is an example of a hyponymic repetition link:

Hyponymic Repetition

[4] To avoid potentially dangerous clashes between them and humans, scientists are trying to rehabilitate the **animals** by drugging them and releasing them in uninhabited areas.

[5] Although some biologists deny that the mind-altering drug was responsible for uncharacteristic behaviour of this particular bear, no research has been done into the effects of giving **grizzly bears** or other mammals repeated doses of phencyclidine.

Co-reference links, in common with Superordinate and Hyponymic Repetition, involve items sharing the same referent. Unlike those, however, co-reference items do not hold a lexical relation, and, thus, the link between them is

context-dependent. An example of a Co-reference is:

Co-Reference

[1] A **drug known to produce violent reactions in humans** has been used for sedating grizzly bears *Ursus arctos* in Montana, USA, according to a report in *The New York Times*.
[2] After one bear, known to be a peaceable animal, killed and ate a camper in an unprovoked attack, scientists discovered it had been tranquillized 11 times with **phencyclidine, or 'angel dust'**, which causes hallucinations and sometimes gives the user an irritational feeling of destructive power.

The Labeling category is based on Francis' (1994) description of 'retrospective labels'. The term 'retrospective label' refers to a nominal group which encapsulates a stretch of discourse and indicates to the reader how it should be interpreted. The same author (op.cit.) pointed out that these labels are more often than not formed by deictics, such as *this*, *that* or *such*, followed by a head noun, which is unspecific in nature, such as Halliday and Hasan's (1976) 'general nouns' (p. 27). Francis (1994) added that a large number of retrospective label head nouns are "**metalinguistic** in the sense that they label a stretch of discourse as being a particular type of language" (p. 89, original emphasis). The following is an example of a labeling link drawn from the sample text in Hoey (1991), p. 94:

Labeling

[17] What, then, is the advantage which we may hope to derive from a study of the political writers of the past?
[18] A view prevalent in earlier ages would have provided a simple answer to **this question**.

Finally, Substitution is the only type of link in this taxonomy which incorporates grammatical members of closed system whose function is to stand in, or substitute, for lexical items. It should be noted that the term *substitution* is here used following Hoey (1991) and Quirk et al. (1972). Most of the items accounted for by this category are described by Halliday and Hasan (1976) as instances of reference. Citing Emmott (1989), Hoey (1991) justified his choice by arguing that "a pronoun, for example, does not refer to an earlier item, but co-refers with the earlier item to something real or imaginary outside the text" (p. 71). However, the differences between Halliday and Hasan's reference and Hoey's substitution go beyond the realm of terminology. In addition to personal and demonstrative pronouns, Halliday and Hasan (1976) include demonstrative adjectives, modifiers, and the definite article *the* in their reference category. Because the function of these additional items is largely to draw attention to the givenness of one or more lexical items, rather than to stand in for them, they have

not been included in Hoey's (1991) categorization, or the present study. One exception in this regard is the use of the demonstrative adjectives *this, that, these,* and *those* to modify a noun which is not a lexical repetition or a paraphrase of a previous item. These instances fall under the labeling category discussed above.

Halliday and Hasan (1976) used the term 'substitutes' to refer to a small class of items, some of which are also included in Hoey's (1991) categorization. One of these items is *one*, when used as a nominal head accompanied by modifiers, as in *the first one* and *another one*. When used by itself, however, *one* would not count as a Substitution link. Rather, it would be treated as accompanying Ellipsis (discussed below).

Other items accounted for in the substitution category are *do (it/the same/this/likewise/so);* the clausal *so* and *not*, as in *they said so* and *they said not;* and *(the) same*, when not accompanying an item (repeated or otherwise).

One final instance of substitution considered in this study is ellipsis, where Ø substitutes for a lexical item. Consider the following example drawn from the sample text in Hoey (1991), p. 227:

Ellipsis

> **[1]** It is possible to predict three **reactions** every time a major company, like Barclays Bank, decides to withdraw from the South African economy.
> **[2]** The first **Ø** is that the disinvesting firm will insist that its aim is primarily economic and only secondarily political because few businessmen want to admit to yielding to political pressures.

Here, *Ø*, stands in for *reaction* and acts as the second member of the substitution link formed with *reactions*, in Sentence 1.

Hoey (1991) argued that substitution items, "while connecting certain sentences, obscure the connections between other sentences" (p.42). Thus, in order to allow for a thorough analysis to be carried out, all sentences in the text must be effectively rendered contextually more neutral. This may be done by replacing non-lexical cohesive features, as well as ellipsis, with the full forms for which they are a shorthand. To exemplify, consider the following sentence (Hoey, 1991, p. 95) followed by its adapted, formatted version (Hoey, 1991, p. 251) with full forms in square brackets:

> **[26]** If it were correct, the writers of political theory would need to be themselves past masters in the art or governing, and statesmen would need to apprentice themselves to them in order to learn their job.
> **[26]** If <***it***> [the entire conception of politics as an art and of the political philosopher as the teacher of it] were correct, the writers of political theory would need to be themselves past masters in the art or governing, and statesmen would need to apprentice themselves to them in order to learn their job.

The link taxonomy discussed above is a refined version of an analytical system originally devised for the identification of semantic bonds between both adjacent and non-adjacent sentences in mainstream non-narrative texts. The following section will demonstrate how this system was applied for the purposes of this study.

ANALYSIS OF LEXICAL COHESIVE PATTERNS IN THE READING COMPREHENSION SECTION OF THE TOEFL® TEST

The refined version of Hoey's (1991) repetition model, described in the previous section, has been applied in this study to the identification of bonds between multiple-choice reading comprehension test items and relevant sentences in the passages in question, as well as bonds connecting those sentences to correct options[ii]. To exemplify, consider the following TOEFL-format test item. It should be noted that while this corpus is composed of original TOEFL® tests, the ETS, the copyright owner, does not allow for the dissemination of test materials in electronically distributed journals. Therefore, TOEFL-format alternatives have been designed for illustrative purposes in this paper. This example, as well as all subsequent TOEFL-format questions in the section that follows, are based on Chapters 2 and 3 of *Geodesy for the Layman*, maintained by the U.S Defense Mapping Agency and available from the National Geodetic Survey web page: www.ngs.noaa.gov.

Factual Information Question

According to paragraph 2, why may the curvature of the earth be disregarded in plane-table surveys of cities?

a. Because the Pythagorean spherical concept is not suitable for simple mathematical calculations.

b. Because it does not affect accuracy in determining the relative distance between specific points in small areas.

c. Because a flat surface is an acceptable representation of the true figure of the earth in geodetic surveys.

d. Because a plane surface provides a more exact figure in astronomical and navigational computations than the sphere does.

This is an example of a factual information question type, present in all versions of the TOEFL® test, which requires test-takers to "understand some of the details contained in the passage" (ETS, 2002, p. 56). Each of the options can be joined to the question to form a statement the validity of which can be assessed by means of the identification of a considerable number of links which bond with one or more sentences in the excerpt indicated in the question, namely Paragraph 2. Paragraph 2 is formed by Sentences 6 to 12. The statement formed by the correct option, Option *b*, bonds with one of the sentences in this excerpt, Sentence

10, by means of as many as nine links, as demonstrated below. Individual links are numbered for ease of reference.

[b] The **curvature**[1] of the **earth**[2] may be **disregarded**[3] in **plane-table surveys**[4] of cities because it does not affect **accuracy**[5] in **determining**[6] the **distance between**[7] **specific points**[8] in **small areas**[9].
[12] For such **small areas**[9], **exact**[5] **positions**[8] can be **determined**[6] **relative to each other**[7] **Ø**[4] **without considering**[3] the size and **shape**[1] of the total **earth**[2].

1. curvature → shape (Superordinate Repetition)
2. earth → earth (Simple Repetition)
3. disregarded → without considering (Simple Synonymy)
4. plane-table surveys → Ø> [in plane table surveys] (Ellipsis)
5. accuracy → exact (Complex Synonymy)
6. determining → determined (Complex Repetition)
7. distance between → relative to each other (Complex Synonymy)
8. specific points → positions (Simple Synonymy)
9. small areas → small areas (Simple Repetition)

Each of the 608 TOEFL® reading comprehension questions in this corpus have been analyzed in terms of the presence of bonds connecting test items to specific portions of the related passages. The following section will briefly discuss the results of the analysis.

RESULTS AND DISCUSSION

The results of the lexical cohesive analysis of the 608 fixed-response TOEFL® reading comprehension questions in this corpus indicate that the observance of instances of lexical cohesion is involved in the successful completion of 100% of the test items. In 62.5% of the cases (380 items), bonds have been observed connecting test items to specific points in the related passages. In the remaining 37.5% of the corpus (228 items), the connection between the correct option and the passage was marked by a single lexical link, rather than a bond involving several different links.

Cases involving bonds between test items and passages account for all examples of 14 (out of 16) question types in the corpus, namely Main Idea, Factual Information, Sentence Relation, Inference, Rhetorical Purpose, Organizational Structure, Prediction, Negative Factual Information, Locate Information, Tone, Insert Text, Sentence Simplification, Prose Summary, and Fill in a Table questions. In the majority of these question types, bonds are formed between the 'test item statement' (i.e., statement formed by the combination of question stem and correct option) and one or more specific sentences in the related passage, as discussed in Section 4, above. In certain cases, however, when question stem and correct option do not form a test item statement, bonds are formed between correct option and passage only, as in the following Sentence Simplification question:

Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? *Incorrect* choices change the meaning in important ways or leave out essential information.

[c] Although[1] acceptable[2] in many **astronomical and navigational computations[3]**, the **sphere[4]** is not an **exact[5]** enough **figure[6]** to be used by **geodesists[7]** in **measuring[8] cross-continental[9] distances[10]**.

[13] While[1] the **sphere[4]** is a close approximation of the true figure of the earth and **satisfactory[2]** for many **purposes[3]**, to the **geodesists[7]** interested in the **measurement[8]** of long **distances[10]**—**spanning continents[9]** and oceans—a more **exact[5] figure[6]** is necessary.

1. Although → While (Simple Synonymy)
2. acceptable → satisfactory (Simple Synonymy)
3. astronomical and navigational computations → purposes (Superordinate Repetition)
4. sphere → sphere (Simple Repetition)
5. exact → exact (Simple repetition)
6. figure → figure (Simple Repetition)
7. geodesists → geodesists (Simple Repetition)
8. measuring → measurement (Complex Repetition)
9. cross-continental → spanning continents (Simple Synonymy)
10. distances → distances (Simple repetition)

Certain question types in this corpus involve the identification of several bonds between the test item and the passage. This is the case of Prose Summary, Fill in a Table, and Negative Factual Information questions. The first two of these question types have multiple correct options, each of which forming an individual bond with the passage. The last of these question types, however, involves the identification of the one option that is untrue according to the passage. For this reason, bonds were observed connecting each of the three distractors, rather than the correct option, with the passage. The following is an example of a Negative Factual Information question:

All of the following are mentioned in paragraph 2 as uses for astronomic positioning EXCEPT

a. Locating method in areas for which maps are not yet available.
b. Navigation method in sea and air travel.
c. Basis for obtaining triangulation and trilateration survey data. [Correct Option]
d. Partial data in the calculation of exact geodetic positions.

[a] Astronomic[1] positioning is **used[2]** as a **locating[3] method[4]** in **areas[5]** for which **maps are not yet available[6]**.

[12] Explorers have often **used[2]** the **astronomic[1] method[4]** to **locate[3]** themselves in **uncharted[6] areas[5]**.

1. astronomic → astronomic (Simple Repetition)
2. used → used (Simple Repetition)

3. locating → locate (Simple Repetition)
4. method → method (Simple Repetition)
5. areas → areas (Simple Repetition)
6. maps are not yet available → uncharted (Complex Synonymy)

[b] **Astronomic positioning**[1] is **used**[2] as a **navigation**[3] method in **sea**[4] and **air travel**[5].
[11] It[1] has been **used**[2] for many years by **mariners**[4] and, more recently, by **airmen**[5] for **navigational**[3] purposes.
1. astronomic positioning → it> [astronomic positioning] (Substitution)
2. used → used (Simple Repetition)
3. navigation → navigational (Complex Repetition)
4. sea travel → mariners (Complex Synonymy)
5. air travel → airmen (Complex Synonymy)

[d] Astronomic[1] **positioning**[2] is **used**[3] as **partial**[4] **data**[5] in the **calculation**[6] of **exact**[7] **geodetic**[8] **positions**[9].
[13] Geodesists[8] must **use**[3] **astronomic**[1] **positions**[2] **along with other**[4] types of survey **data**[5] such as triangulation and trilateration to **establish**[6] **precise**[7] **positions**[9].
1. astronomic → astronomic (Simple Repetition)
2. positioning → positions (Complex Repetition)
3. used → use (Simple Repetition)
4. partial → along with other (Complex Synonymy)
5. data → data (Simple Repetition)
6. calculation → establish (Complex Synonymy)
7. exact → precise (Simple Synonymy)
8. geodetic → geodesists (Complex Repetition)
9. positions → positions (Simple Repetition)

Finally, certain test items involve the identification of a single lexical link. This proved to be the case in all examples of Vocabulary questions, as well in 89.8% of the Reference questions in the corpus. The following is an example of a Vocabulary question:

The word [*elaborate*] in the passage is closest in meaning to
[b] complex[1]
[17] While geodesists use **elaborate**[1] and very precise techniques for determining astronomic latitude, the simplest method, in the northern hemisphere, is to measure the elevation of Polaris above the horizon of the observer.
1. elaborate → complex (Simple Synonymy)

It should be noted that all of the Vocabulary questions in this corpus involved the identification of a Simple Synonymy link, as in the example above.

The majority of the Reference questions in the corpus required the identification of a single Substitution link, as in the following example:

> The word [*this*] in the passage refers to
> **[c] surface**
> **[2]** The actual topographic **surface** Ø> [of the earth] is most apparent with its variety of land forms and water areas.
> **[4] It** is not suitable, however, for exact mathematical computations because the formulas which would be required to take the irregularities into account would necessitate a prohibitive amount of computations.

In certain cases, however, Reference questions involve the identification of a bond marked by an instance of Labeling, as in the following example:

> The phrase "**This concept[1]**" in paragraph 9 refers to
> **[d]** the idea that **fluctuations[1a]** in **satellite[1b] orbits[1c] point to[1d]** irregularities in the **shape[1e]** of the **earth[1f]**.
> **[31]** A second theory, more complicated than triaxiality, proposed {that **satellite[1b] orbital[1c] variations[1a] indicate[1d]** a [**flattening at the south pole accompanied by a bulge of the same degree at the north pole**]**[1e]**}.
> **[33] This concept[1]** suggested that a slight pearshaped earth was the subject of much public discussion.
> 1. this concept → that satellite orbital variations indicate a flattening at the south pole accompanied by a bulge of the same degree at the north pole (Labeling)
> 1a. fluctuations → variations (Simple Synonymy)
> 1b. satellite → satellite (Simple Repetition)
> 1c. orbits → orbital (Complex Repetition)
> 1d. point to → indicate (Simple Synonymy)
> 1e. irregularities in shape → flattening…bulge… (Hyponymic Repetition)

Here, the nominal phrase in question (*this concept*), in Sentence 33 in the passage, forms a Labeling link with its lexicalization, a clause within Sentence 31. The lexicalized form of *this concept*, in turn, bonds with the correct option (Option *d*) by means of five embedded links (1a, 1b, 1c, 1d, and 1e).

These considerations on the lexical analysis of the TOEFL® reading comprehension tests in this corpus suggest that the observance of lexical cohesion in text should play a fundamental role in the demonstration of effective reading skills in English, as far as this assessment instrument is concerned. The following section will discuss the implications and limitations of this conclusion.

CONCLUSION

It has been suggested in this study that lexical cohesion plays a fundamental role in the construct of reading reflected on the TOEFL® test. It would be of interest, therefore, to consider, firstly, the extent to which the explicit teaching of this skill might benefit students preparing for the TOEFL® test, and, secondly, whether this conclusion would be replicable in real-life reading practices within the criterion environment, namely academic settings where the language of instruction is English.

The first of these inquiries regards the pedagogical implications of the conclusions reached in this study. Decades of research on reading, and on reading comprehension in a foreign language, indicate that effective reading is largely dependent on the purpose of reading (Nuttall, 1996, p. 44-61; Carrell & Eisterhold al., 1988, p. 74-75; Grellet, 1981, p. 6). In other words, "provided that a reader can satisfy his purpose in reading or using a given text, we can conventionally say that that person has understood the text" (Alderson, 1996, p. 226). In their study focusing on the strategies used by examinees to cope with the reading tasks in the TOEFL® iBT, Cohen and Upton (2006) concluded that subjects approached the new TOEFL® reading section as a test-taking task that required that they perform reading tasks in order to complete it. In other words, the primary goal of the subjects was to get the answers right, not necessarily to learn, use or gain anything from the texts read. (p. 117)

The most frequent test-management strategies used by the subjects in the same study include "read[ing] the question and then read[ing] the passage/portion to look for clues to the answer, either before or while considering options," "select[ing] options through vocabulary, sentence, paragraph, or passage overall meaning (depending on item type)," and "[d]iscarding option(s) based on vocabulary, sentence, paragraph, or passage overall meaning as well as discourse structure" (Cohen & Upton, 2006, p. 36, 43). This means that these students attempted to selectively process portions of the passage in search of potentially relevant sentences in relation to the question. It should also be noted that the strategies used by these subjects are intended to reflect the practices of successful EFL readers, since Cohen and Upton (op.cit., p. 106) described their level of language proficiency as high.

Hoey (1991) has highlighted the fact that "repetition in text is a measure of mutual relevance" (p. 226). There is no clear indication in Cohen and Upton's (2006) study that the respondents' approach to selecting relevant portions of the passage included the identification of bonds these text excerpts form with question stems and correct options through lexical repetition. On the other hand, it should be apparent from evidence provided in this study, in line with previous related studies (Batista, 2002; MacMillan, 2006), that the observance of lexical cohesion may be said to provide appropriate clues in this regard. Therefore, a pedagogic experiment that might prove to be beneficial to EFL students preparing for the TOEFL® test would be to devise a simplified version of the lexical cohesive analytical system used in this thesis for use in the classroom. This simplified tool could be used to systematize the explicit teaching of the

observance and production of lexical links. A comparison of students' performance when writing TOEFL® reading comprehension practice tests before and after a period of practice of this system would provide insights as to the extent to which success levels might have improved.

A second possible inquiry, arising from the conclusions reached in this research, concerns their replicability in actual academic reading. Because the TOEFL® is a high-stakes test, used as a gatekeeping mechanism for international education, and administered to an extremely wide number of candidates all over the world, the ETS, the organization responsible for the design and administration of the TOEFL® test, takes great pains to ensure that this assessment tool is as reliable as possible. The ETS supports a continuing program of research related to the TOEFL®, which is carried out under the direction of the TOEFL® Research Committee. In terms of the TOEFL® Reading Comprehension Section, research efforts are reflected in a number of revisions made to that section since the introduction of the TOEFL® test in 1963; these include, among other changes, the intention of making the test "more reflective of communicative aspects of language behavior" (Swain, 1984, as cited in Schedl, Thomas & Way, 1995, p. 1).[iii] Among the latest efforts of the TOEFL® research program, the TOEFL® 2000 project may be cited, which involved a series of studies (e.g., Hudson, 1996; Biber et al., 2004) culminating in the design and implementation of the TOEFL® iBT. Here, it is claimed that the reading section is intended to "more fully reflect the construct of academic reading" (Hudson, 1996, p. 1).

Over the years efforts have been made aimed at ensuring that the TOEFL® Reading Comprehension Section replicate, as far as possible, the conditions under which engagement with communicative content is made within the criterion setting. Nevertheless, there are obvious limitations involved. Thus, the constraints imposed by the need for a procedure that is fair to all candidates, and elicits a scorable performance, entail accepting, to a greater or lesser degree, the artificiality of the test situation (McNamara, 2000, p. 27-30). In the case of the TOEFL® test, this involves the use of the conventional and, admittedly, inauthentic fixed-response test format. For this reason, the conclusions in this research regarding the role played by lexical cohesion in reading comprehension should, a priori, be subject to the limitations of the construct of reading reflected on the TOEFL® test.

In terms of future research, which may expand upon and improve the present project, one clear avenue would be to investigate the role of lexical cohesion in the reading comprehension portion of other standardized proficiency tests of English involving different response formats (e.g.: the IELTS, International English Language Testing System; and the CPE, Certificate of Proficiency in English). In conclusion, it is hoped that the present study may inspire further patterns of investigation on the testing of EFL reading.

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[i] It was announced on the official TOEFL® website (www.toefl.org) that after September 30, 2006, the Computer-based version of the TOEFL® test (TOEFL® CBT) would no longer be offered. At the time of writing, the TOEFL program is phasing in the Internet-based version of the TOEFL® test (TOEFL® iBT). In areas where the TOEFL® iBT is not yet available, the Paper-based version of the TOEFL® test will be offered to continue to provide access for TOEFL test takers in these areas.

[ii] In the present study, a minimum of three points of reference has been used as the criterion for the identification of bonds between test items and specific sentences in the passages in question.

[iii] One of these revisions involved the incorporation of vocabulary items within the Reading Comprehension Section of the test. These items had been previously grouped together in a separate Vocabulary Section in which they were tested within isolated sentences. The change was intended to provide these items with an extended passage context, in line with studies reflecting a communicative approach to the teaching and testing of reading, including Drum and Konopak (1987), Sternberg (1987), and Barnett (1988).