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Reading and the Response Towards Unknown Single Words and Formulaic Sequences by English Second Language Learners

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Sequences by English Second Language Learners

by

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Abstract

With advancements in technology, reading task can take place on a computer, where a gloss is only a click away. A gloss can be consulted to find the meaning of any single word (SW) or formulaic sequence (FS). So how does this influence the L2 reader? In an attempt to understand the L2 reader, this study will use a within subject design to look at clicking behaviors, reading comprehension, and characteristics of the individual L2 readers as they complete the task of reading on the computer. This study focuses on 20 targeted lexical items equally distributed between single words (SW) and formulaic sequences (FS). In addition, 50% of these targets take the form of underlined, blue text to consider the properties of typographical saliency. One reading passage, embedded with hyperlinks for single words (SW) and formulaic sequences (FS), was given to 107 participants to read on the computer along with a multiple choice reading comprehension paper test of 20 questions. Statistical analysis surprisingly finds similarities and differences between single words (SW) and formulaic sequences (FS) in both clicking behaviors and reading comprehension scores. These results, demonstrates a need for further evaluation on how L2 readers perform in a reading task, involving single words (SW) and formulaic sequences (FS).

Acknowledgement

A wish of thanks goes out to all of the participants who took time out of their busy academic schedules to be a part of my study. I would also like to thank the teaching staff of the English for Academic Purposes (EAP) and the Intensive English Center (IEC) programs at St. Cloud State University, who allowed me to elicit participants from their classrooms. My expression of gratitude goes to Dr. Cobb, who acknowledged the special requirements of my study and for his assistance in the use of the Hypertext2 tool that is available on his website, Compleat Lexical Tutor (http://www.lextutor.ca/hyp/2/). In addition, my work could not have been completed without the staff of the English Department and the Intensive English Center. Their assistance and use of the IEC computer lab was instrumental in the completion of this time sensitive study. A wish of thanks goes out to Dr. H. Bishop who has been a resource in my research. Lastly, I would like to express my appreciation to each of my committee members for their valuable time, guidance, and support; with a special thanks to my chairperson, Dr. C. Kim, for her assistance in running statistical analysis reports.

"The more that you read, the more things you will know.
The more that you learn, the more places you'll go."

— Dr. Seuss, I Can Read With My Eyes Shut!

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Chapter 1: Introduction

Second language (L2) learners, are individuals who accept the challenges in learning a second language found among the tasks of reading, listening, writing, and speaking. The ultimate goal among these tasks is to reach a level of comprehension which is dependent on various cognitive processes and strategies. In addition, any second language (L2) learner can tell you, acquiring vocabulary is also an essential component in learning a language. It is only with vocabulary that one can hope to effectively read, listen, write and speak whether it's one's first or second language. "The study of vocabulary, which previously focused on acquisition, representation and storage of words, has begun to expand it focus beyond the word to formulaic sequences…" (Bishop, 2004b, p. 1). Therefore, the issue of vocabulary acquisition has an added layer of complexity in that the number of words, available in any language, is astronomical in size, and includes both single words (SW) and formulaic sequences (FS). In addition, research considers vocabulary size, breadth, and depth with success in reading; as marked by a high level of reading comprehension.

With advancements in technology, reading on computers has triggered research studies that look at language learning differently. One area that has received such attention is in the influence of typographic saliency in reading. Research has found typographic saliency to promote reader's attention, and the process of noticing can lead to changes in behavior in both learning and comprehension (Peters, 2012; Bishop, 2004b; De Ridder, 2002; Laufer & Hill, 2000). It is my intention to separately look at SW and FS as two forms of the lexical unit, in respect to saliency, and how these interacting units impact reading comprehension among L2 readers. Focus will be

placed on participants' clicking behavior and reading comprehension test scores as the

L2 reader negotiate the lexical units of SW and FS, which begins with "noticing" a word.

Chapter 2: Literature Review

Noticing a Word

Reading is both essential for all language learners and a complex cognitive process. Many decisions have to be quickly made while viewing different combinations of written letters that form words. "Typically, language learners think of knowing a word as knowing what the words sounds like (its spoken form) or looks like (its written form) and its meaning" (Nation, 2013, p. 73). However, it is not just form and meaning but also the connection that is needed for a word to become a part of one's acquired language.

"In the reading process, the comprehension system will try to match a word form and a meaning" (De Bot, Paribakht, & Wesche, 1997, p. 315). Based on Levelt's L1 Speech Processing Model, De Bot, Paribakht, and Wesche (1997) present a multi-step approach for L2 lexical processing of written text, which involves three mental lexicon levels (concepts, lemmas, and lexemes) and the interaction between bottom-up information and top-down information (p.316). Once a word is noticed, the primary goal is to find a match with a lexeme that will in turn activate the lemma. If a match is not found and the word is determined to be unknown, then a different path is taken based on the reader's level of interest in that word (Bishop, 2004b). Figure 2.1 is a visual representation based on my understanding of these processes that occur when noticing a word, as described by deBot, Paribakht, and Wesche (1997).

Figure 2.1 Steps in Noticing a Word
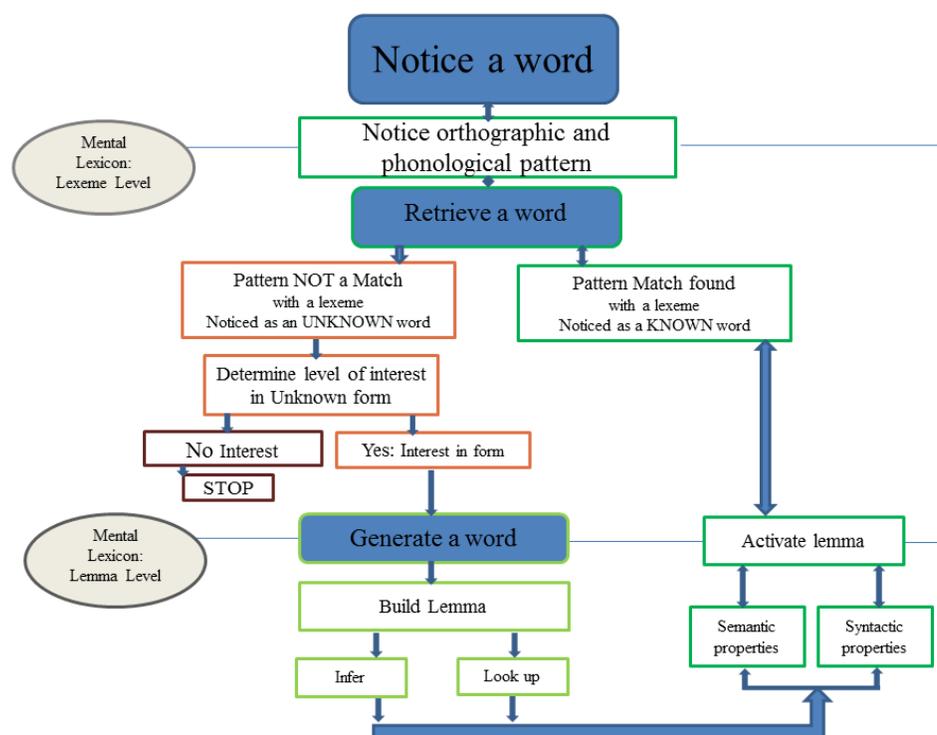
Vocabulary Size

The percentage of words that a reader needs to know for adequate reading comprehension has been addressed by the Lexical Threshold Theory, which reveals that a reader needs to know 95% to 98% of all words in a text for comprehension (Prichard & Matsumoto, 2011, p. 207). Hsueh-Chao and Nation's (2000) research also supports the Lexical Threshold Theory with the findings that students were able to independently comprehend text material when 98% of the words or vocabulary used within a text is known (p.403). In addition, the research of Schmitt, Jiang, and Grabe (2011) supported a gradual linear relationship between vocabulary coverage and

reading comprehension with "50% comprehension at 90% vocabulary coverage to 75%

comprehension at 100% vocabulary coverage" (p. 35).

Vocabulary: SW and FS

Vocabulary provides the foundation of a language and consists of lexical units.

A lexical unit is a term originally introduced by Cruse (1986, p. 24) in which Bogaards

(2001) defines:

> Lexical unit are the smallest parts that satisfy the following two criteria:
> a. A lexical unit must be at least one semantic constituent.
> b. A lexical unit must be at least one word. (p. 325)

Referring to a lexical unit allows for a greater degree of understanding in the

acquisition of each type of lexical unit (Conklin & Schmitt, 2008; Bishop, 2004b;

Bogaards, 2001). Therefore, for the purpose of this study consideration has been

made on two types of lexical units: single word and formulaic sequences abbreviated

as SW and FS, respectively.

The definitions for these two lexical units, SW and FS, have been defined in

research by Carter (1998) and Wray (2000) respectively. Carter (1998) defines a

written word as any sequence of letters bounded on either side by a space or a

punctuation mark" (1998, p. 4). A definition for FS cannot be as clearly delineated for

there are many different definitions, however it is Wray's definition for FS that has been

commonly accepted among researchers. Wray (2000) defines FS as:

> a sequence, continuous or discontinuous, of words or other meaning elements,
> which is, or appears to be, prefabricated: that is, stored and retrieved whole
> from memory at the time of use, rather than being subject to generation or
> analysis by the language grammar (p. 465).

Bishop (2004b) adds to this definition to explain that "Formulaic sequences are holistically processed lexical strings, which pervade language, and which are of considerable importance in language performance" (Bishop, 2004b, p. i).

In fact, Erman and Warren (2000) found 58.6% of spoken text to be FS and 52.3% of written text (p. 37). Vocabulary is indeed a highly valued component of language acquisition and the focus on the single word has temporarily overshadowed FSs, despite their frequency and relevance in oral and written language. As the field of vocabulary expands to identify SW and FS individually, a word of caution is offered. Our attention is needed to assess for any limitations in the vocabulary tools we use, to assure the focus on the SW do not eliminate the FS.

The number of FS and the variation of composition have proven to be difficult for language learners because they vary in size, composed of frequent single words, and are non-distinguishable from groups of grammatical single words in context. From the L2 perspective, FS are difficult to identify for they can consist of single words, multiple-words, or prefabricated chunks of language not distinguishable by punctuation or spacing in a written text. Bishop (2004b) explains "this can be a source of confusion for learners since grammatically generated strings of words can appear identical to formulaic sequences" (p. 15). Despite the difficulty in identifying and defining a FS, there is one thing that researchers can agree. FS have proven to be especially difficult for L2 learners (Bishop, 2004a). With the tasks of reading, vocabulary acquisition, and more specifically the processing of FS there is one tool that can possibly help language learners to acquire FS, and that is typographic salience.

Typographic Salience

Koch (2012) agrees that typography is an area that falls under the graphic design umbrella and it has "an important role in helping people to decipher meanings, prioritize information, and judge the personal relevance of communications by injecting emotion into visual messages" (p. 208). In this case, typographic salience can provide a method to alert the readers with a visual cue, to notice. For example, McAteer (1992) explains, that "the physical salience of a word signals its informational salience, indicating that there is something else to the word than what it would mean, in that context in plain case" (p. 348). There are different ways in which to make text typographically salient. Al-Seghayer (2003) has identified a few of these techniques that can signals readers, with the use of boldface, font color, hot buttons, underlining, and/or asterisks (p. 4).

It is important to note that with the advancement of computers, typographical salience has commonly become a tool applied with the application of hypertext links. As no one standardized convention has been accepted, one form does stands out from the others and that is blue underlined text. This convention was initially determined by the technology and the use of monochrome computer screens at the time (Obendorf & Weinreich, 2003). With the advantages of using typographical salience Obendorf and Weinreich (2003) offer a word of caution in the adoption of underlining of text, for this feature has been found to significantly reduce the readability of text.

Vocabulary and Reading in a Second Language (L2)

Research done by Bishop (2004b), Al-Seghayer (2003), and Azari and Abdullah (2012) considers the issues of typographic salience on text and its impact on the L2

reader to unveil three different aspects: the noticing of FS in "chunks", the encouragement in look-up behaviors, and the promotion of reading comprehension. Bishop (2004b) has found making FS salient promotes learners to notice the FS as a chunk, which in turn lead to increased clicking behavior. Al-Seghayer (2003) found that L2 readers benefit from visually salient text as a means to signal the availability of a gloss (p. 4). Research done by Azari and Abdullah (2012) "revealed that textual glosses are helpful for facilitating L2 reading comprehension and EFL/ESL learners should be provided with textual glossed texts while involved in reading activities. In this way, attention to given a word will be drawn to glosses and glossed texts enhance reading comprehension" (Azari & Abdullah, 2012, p.58).

Reading, in of itself, is a complex cognitive process where many decisions have to be made quickly. Reading comprehension is more than reading words. For the reader needs to be able to negotiate meaning, notice unknown SW or FS, understand and apply information retrieved from other sources such as a dictionary or electronic gloss. In fact, when a student reads and notices an unknown word, there are three options available: skip the word, guess the meaning from context, or look the word up in a dictionary (Folse, 2004, p. 111) as illustrated in Figure 2.1. Indeed, reading is a task that is not easily observed, not to mention the challenges found in evaluating or teaching.

Research Questions

Research that considers the L2 readers as they face the challenges found in the multi-faceted task of reading goes beyond this one study. The focus of this study is to first consider the two facets seen in the observation in clicking behavior associated with

the use of glosses, typographical saliency and the lexical forms of SW and FS.

Secondly, how does clicking behavior impact reading comprehension, if at all. Finally,

this study aims to shed light on the individual L2 learners themselves, who are

commonly aware of the need for a large vocabulary size, and tend to focus on learning

new words (Kim, 2016). In these efforts I hoped to observe L2 readers in order to

understand some of the difficulties they face with vocabulary acquisition, again

considering both SW and FS lexical units in the success of reading comprehension. I

proposed three main questions to look at L2 reader's clicking behavior, reading

comprehension scores, and the individual L2 readers:

1. When will a L2 reader use an electronic gloss to increase reading comprehension as

    observed in the <u>clicking behavior</u> on SW and FS, and does typographical saliency

    play a role?

> 1a. Is there a difference in the readers' behavior of clicking between <u>salient and
>
> nonsalient unknown SW</u>?
>
> 1b. Is there a difference in the readers' behavior of clicking between <u>salient and
>
> nonsalient unknown FS</u>?
>
> 1c. Does providing a gloss with saliency increase learners' awareness of
>
> targeted unknown <u>SW</u> as compared to unknown <u>FS</u> while reading text, which
>
> can be observed in the L2 reader's clicking behavior?

2. What impact does a L2 reader's clicking behavior to request a gloss have on <u>reading</u>

    <u>comprehension</u>?

2a. Does providing a gloss with saliency on targeted SW or FS increase reading comprehension as seen in <u>higher test scores</u> on a multiple-choice test for L2 readers?

2b. Does clicking behavior on salient or nonsalient unknown SW or unknown FS increase reading comprehension with L2 readers as seen in a relationship between <u>clicking behavior</u> and in the number of correct answers to multiple-choice questions?

3. Who is clicking? Are there individual characteristics that can be associated with reading, the use of glosses, or another trait that determines which L2 readers will decide to click on a lexical unit to view a gloss?

3a. Does the reader's attitude, experience, or prior training towards <u>reading</u> have an impact on the reader's clicking behavior to request a gloss while reading on the computer?

3b. Does the reader's attitude, experience, or prior training towards <u>using glosses</u> on a computer impact their clicking behavior within a text?

3c. Is there a <u>demographic trait</u> such as age, gender, class assignments, time studying English as a second language, or time residing in a country where English is a dominant language that will determine if a L2 reader will request a gloss, as seen through clicking behavior while reading on the computer?

To try to answer these questions, I will replicate a study done by Bishop (2004b) who used direct observations of L2 readers' clicking behavior on the computer as they read a passage and completed an assessment. In this study, Bishop (2004b) considered both saliency and the lexical units of SW and FS.

Chapter 3: Method

Participants

The participants for this study consisted of 107 international students enrolled at a 4-year university in the Midwest region of the United States of America or in a separate on-campus English learning program at the university. The participants are International students who represent eight countries with native languages of Arabic, Chichewa, Chinese, French, Kinyarwanda, Kirundi, Korean, and Nepali. The gender distribution of the participants was 52 male and 55 female students between the ages of 18-31 years. These participants have also been living in the United States or in another English-speaking country between 3-63 months. The acquired level of English language proficiency varied with the minimum skills needed to attend the university or be enrolled in the on-campus English program. This study required participants to complete all tasks scheduled on two different days.   On Day 1 there were 135 participants completing the tasks, however 28 of these individuals elected not to participate on Day 2 and in turn their data was omitted from the study.

Materials

In order to find the answers to the questions I proposed on unknown SW and FS, I have employed 10 different tools categorized under Day 1 – Classroom materials and Day 2 – Computer Lab materials. These materials consisted of the following items: a consent form with student reminder, an EFL Vocabulary pre-test, a TOEFL reading pre-test, computer screens, a study packet, example training materials, a reading passage, a set of multiple-choice comprehension questions, a survey and a gift card drawing slip.

Day 1 – Classroom materials

Consent form with student reminder. The consent form was the first item participants received and signed in order to be a participant of this study. With this consent form, a Student Study ID was assigned to each participant with a few demographic questions. These questions asked the participants to identify who they are based on seven general demographics characteristics: gender, age, current class assignment, native language (L1), a list of known languages, the number of years studying English, and the length of time living in a country where English is a prominent language. The second portion of the consent form was a Student Reminder slip with two distinct sections. The top section was a notification to all participants that they will be able to submit their name for a $25 gift card drawing which was to be held at the conclusion of the study. In addition, four different options were given to participants to select a type of gift card for this drawing. The lower section of the Student Reminder provided details about the date, time, location and tasks of Day 2, the Experiment and Post-Experiment portions of this study. The Consent Form with Student Reminder is provided in Appendix A as Figures A1 and A2 respectively.

EFL vocabulary pre-test. The EFL Vocabulary pre-test was given in a paper form that aligned with the design of the EFL Vocabulary Tests created by Meara (2010); which presents a list of 60 vocabulary items for the participant to flag as known. Considering the research and work of Meara (2010), Jiang, and Nekrasova (2007), Bishop (2004b), and Shu, Anderson, and Zhang (1995) this vocabulary pre-test incorporates three main categories: target words, non-target words, and pseudowords that break down into six different types of vocabulary items: SW–target words, SW–

non-target words, SW–pseudowords, FS–target words, FS–non-target words, and FS–pseudowords. The specific target and non-target items for both SW and FS are taken from Bishop (2004b) who looked at L2 readers and the issue of noticing FS. In this study, Bishop (2004b) created a list of 10 target SW, 10 target FS, and 20 synonyms of the targeted FS and SW which were used in the form of a computerized Vocabulary Knowledge Scale (VKS) pre-test. In an attempt to complement this study, the same SW and FS are used in this study's EFL Vocabulary Pre-test along with 20 pseudowords. A list of the SW and FS targets and nontargets can be found in Table 3.1, that were taken from Bishop (2004b, pp. 134-135).

Table 3.1
EFL vocabulary targets and nontargets

Single Words (SW)	Target	NonTarget (distractor)
	expatiate	eliminate
	moderate	endure
	determine	excessive
	perspicacity	discern
	outweigh	distinguish
	disrupt	implement
	consequences	postpone
	obviate	abolish
	concede	persuasive
Formulaic Sequences (FS)	Target	NonTarget (distractor)
	silver tongued	fall out
	pile up	hold forth
	carry out	loom larger than
	do away with	under way
	put off	cut down on
	over the top	cut off
	put up with	come to terms with
	cut out	clearness of mind
	catch on to	come up with
	have an inkling of	throw into disorder

(Bishop, 2004b, pp. 134-135)

The pseudowords consist of two formats which follow the targets: SW and FS. The SW and FS pseudowords used in the EFL Vocabulary pre-test were obtained from two different sources, Meara (2010) and Jiang and Nekrasova (2007) respectively. The SW pseudowords are derived from the Swansea Vocabulary Tests v1.1. 1992 created by Meara (2010) and incorporated into 5 levels of testing. For this study, 10 SW–pseudowords were selected by taking the first two pseudowords that appear in the first vocabulary test of each level (1-5) as seen in Table 3.2 (Meara, 2010, pp. 18, 40, 62, 84, 106).

The 10 FS–pseudowords are the items used in 2 different experiments executed by Jiang and Nekrasova (2007). Table 3.3 is a list of the FS-pseudowords along with the associated formulaic sequence from which it was derived. It is noted that all of the individual vocabulary items used in the FS-pseudowords belong to the VP-Classic (1k, 2k + AWL) 1000 Families list as labelled and verified by the Compleat Web VP! tool Vocabprofile (Cobb, 2008a) found online at http://www.lextutor.ca/vp/comp/.

This pre-test was chosen to look at each participant's acquired receptive vocabulary knowledge. It is believed that an EFL Vocabulary pre-test is able to ascertain the level of vocabulary receptive knowledge for each participant. There are four versions of the vocabulary pre-test that randomize the order of the vocabulary items. Appendix B contains a complete list of vocabulary items (SW, FS, and pseudowords) and the EFL Vocabulary pre-test (version 1) as Figures B1 and B2 respectively.

Table 3.2
EFL vocabulary single word (SW) pseudowords

Single Words – Pseudowords		Source
nonagrate	balfour	Level 1: test 101
galpin	benevolate	Level 2: test 201
adair	gumm	Level 3: test 301
suddery	acklon	Level 4: test 401
litholect	quorant	Level 5: test 501

(Meara, 2010, pp. 18, 40, 62, 84, 106)

Table 3.3
EFL vocabulary formulaic sequences (FS) pseudowords

Formulaic Sequence – Pseudoword	derived from
as mean as	as soon as
in your case	in any case
to tell the price	to tell the truth
on the other bed	on the other hand
to climb up	to sum up
in other fields	in other words
at the church	at the moment
on the man	on the whole
as a women	as a result
in the first year	in the first place

(Jiang & Nekrasova, 2007, pp. 444-445)

TOEFL reading pre-test. A TOEFL reading pre-test consists of a short

passage of 634 words followed by ten multiple-choice reading comprehension

questions. All portions of this reading pre-test are given as a pencil and paper test

(PPT) using the Arial font. The text passage and comprehension questions of this pre-

test have a calculated L1 average reading grade level of 10.7 and 5.9 respectively, as

measured by an online application found at https://readable.io/text/. The complete

TOEFL Reading pre-test with answer key was retrieved online from

Graduateshotline.com and is available at

http://www.graduateshotline.com/sampletoefl2.html#.WKyvDvkrKM_ . Appendix C

contains the reading passage and the TOEFL reading comprehension test as Figures

C1 and C2 respectively.

Day 2 – Computer lab materials

Study Packet. The Study Packet contains four paper items used for data

collection and to help participants navigate through the computer screens. The four

items in this Study Packet include: Example Questions, Reading Questions, 2016

Survey, and Gift Card Drawing Slip. Each of these items maintains a similar format

and uses the Arial font.

Computer Screens. The computer screens used in this study consisted of ten

individual screens with the objective to welcome, introduce, and guide the participants

through the experiment's tasks. The screens are divided into four main sections:

Section I.   Training Example

Section II. Reading Summary

Section III. Survey

Section IV. Gift Card Drawing

To navigate between the various screens, five navigational buttons were used on the

bottom of the screen as applicable. The two most common navigational buttons were:

| PREVIOUS PAGE | | NEXT PAGE |

All computer screens were generated using the online Website Builder Weebly

(https://www.weebly.com/au). A screen shot of each screen has been provided in

Appendix D as Figures D1 – D10.

Computer screen #1 – Welcome to the SW and FS Language study! The first screen is used to welcome the participants to the study, and give a short overview to introduce the four main sections.

Computer screen #2 – Introduction. The second screen reviews the four key items: the study packet of paper materials that corresponds with each task; how to navigate between the computer screens using navigational buttons; an introduction to glossing tools; and lastly the four steps involved in the practice session which begins on the next screen.

Computer screen #3 – Section I. Example: short summary. The objective of this screen is to take the participant through each of the 4 steps. The objective is to provide an opportunity to practice the main tasks of opening a link to a reading passage, use the single click and double click tools, read a passage on the computer, and answer multiple-choice reading comprehension questions related to the reading material. Under Step 1, a button was embedded that opens a new tab containing the reading passage. The reading passage, for this example, is a summary of a TED Talk presented by Topher White (2014) entitled: *What can save the rainforest? Your used cell phone.*

Computer screen #4 – Congratulations. The screen acknowledges participants' work from the previous screens and alerts the user to a new navigational button:

START session

This button signifies an end to the training and moves participants in to Section II of this study.

Computer screen #5 – Read a short summary and complete the reading questions. This screen represents Section II, which involves the main portion of the study. This section involves three steps which mimic the training session just completed by participants. This screen provides the needed instructions with only one navigational button:

<div style="text-align:center">

Let's BEGIN

</div>

Computer screen #6 – REMINDER SPLASH SCREEN. This screen reminds the participants about SINGLE click and DOUBLE click glossing tools available and provides a link to the reading passage that is a summary of the PBS film: *The Brain with David Eagleman: What Makes Me?*

Computer screen #7 – Read a short summary and complete the reading questions (Step 3). This screen directs each participant to their printed study packet in order to complete the 20 multiple-choice reading comprehension questions.

Computer screen #8 – Survey. The objective of this screen is to identify Section III and ask participants to locate and complete the survey that is found in their study packet.

Computer screen #9 – Gift card drawing. This screen is used to identify Section IV of the study, which is optional. Participants are asked to locate and complete the Gift card drawing slip located in the study packet, if they wish to entered in the drawing.

Computer screen #10 – Thank you! This is the final computer screen in the study. Participants are thanked for completing the study and they are asked to hand in their study packet to the proctor before signing out of the computer lab.

Example Reading Passage and multiple-choice reading comprehension questions. A two paragraph summary was written about the Ted Talk presentation titled: *What can save the rainforest? Your used cell phone* (White, 2014). It was the goal to select a topic that would be of interest to a wide range of readers, and in this case, it was cell phones. The summary provides the participants an opportunity to practice and complete similar tasks to those included in the main portion of the study. These tasks include how to open a link to access and read a summary on the computer screen, use the glossing tools to find a definition of a SW or FS, and then complete multiple-choice reading comprehension questions based on the text.

The example reading passage has 394 words and was submitted online to the Compleat Lexical Tutor Hypertext2 tool (Cobb, 2008b) in order to create a resource-linked text. This application is a free online application which builds in dictionary definition links for SW and catalogs the file for easy access to readers. This application determines the colors that appear on the computer screen; dictates the text font style and size, and uses the WordReference.com for dictionary definitions. These default features were maintained with the exception of two elements: target source and target text color. The definition sources, used for the targets (SW and FS), were manually coded into the text to incorporate the online Cambridge Dictionaries, to align with the definitions used by Bishop (2004b). To address the issue of saliency, 50% of the targets were coded to appear in the default hypertext form: blue, underlined text. Therefore, in this training example 4 targets were chosen: 2 SW and 2 FS with only 1 SW and 1 FS highlighted. The targets selected for this example are: cacophony, greenhouse gases, in dire straits, and scalable.

Each of the four targets had a multiple choice reading comprehension question with four possible answers. To keep individual work separate and to discourage cheating, four different versions of the Example questions were created that randomized the order of possible answers. The Example questions are a part of the printed study packet that was given to each participant. Appendix E contains the training materials, as provided in Figures E1 – E6:

E1. Example text;

E2. Example coded text required for the Hypertext2 tool;

E3. Lextutor.ca screen shot of example text, as seen by participants once they
    click the link to open the file;

E4. Lextutor.ca screen shot of example text after clicking on a target;

E5. Example test (version 1) with answer key; and

E6. Assignment of test questions to targets in the example text.

The Reading Passage. The experiment uses a single reading passage with 1,019 words that has an L1 average reading grade level of 10.3 as calculated by the Measure Text Readability online tool, provided by Readable.IO. This tool found the reading passage to be comparable to the TOEFL pre-test which had a score of 10.7. This passage was based on the PBS video, *The Brain with David Eagleman: What Makes Me?* which aired on October 21, 2015 and is temporarily available online at http://video.pbs.org/video/2365587672/. From this video, I created a text passage using the same targeted SW and FS as those used by Bishop (2004b).

The text of the reading passage has been written using primarily the 1000-2000 high frequency word lists and coded to incorporate two specific features: glossing and

a logfile. Due to the topic, some non-targeted words used in the text went beyond the

2000 word list. To maintain the integrity of the topic, without adding to the demand of

receptive reading skills, the entire passage was coded using the Compleat Lexical

Tutor tools Vocabprofile and Hyptertext2.   The Vocabprofile

(http://www.lextutor.ca/vp/eng/) analysis of the passage tells us that 26 non-target

words fall outside of the K1 or K2 frequency word list as seen in Table 3.4.

Table 3.4
List of words that are not in K1000 or K2000 frequency word lists

Academic Word List (AWL)	OffList
available	cells
concludes	classroom
create	cortex
define	cradle
environment	david
research	dependency
revealed	dolphins
	Eagleman
	genetics
	giraffes
	hippocampus
	neurons
	pbs
	personality
	plasticity
	prefrontal
	teenager(s)
	trillion
	zebras

These words hold value and are related to the topic at hand, therefore, they have been

kept in the text and coded with the Hypertext2 tool that adds the feature of glossing.

The glosses for nontarget items are incorporated into the text using a default dictionary,

Wordreference.com, which provides the reader with a definition upon a request with a double click of the mouse. Electronic glossing was manually added to the reading text to access a dictionary definition for any nontarget word that did not automatically create a link using the Hypertext2 tool. There is one exception to this rule, and that is with the surname "Eagleman", which was not coded to open a dictionary definition. To replicate Bishop's (2004b) study all targets were coded to access definitions from the online Cambridge Dictionaries (http://dictionary.cambridge.org/). Readers only need to single click on the item, in order to open an electronic gloss that would appear in the right-side panel of the screen.

Each gloss item uses the default definition format of that dictionary: the word, part of speech, definition(s), the targeted word used in a sentence. Due to restrictions, the feature of the glosses appears as two different tools, which are used to activate a request for a definition: a single click for all targets (SW and FS) and a double click for non-target words. The reading text itself does not contain training instructions, on how to use these tools however each participant is provided training and an opportunity to practice the glossing feature with an example reading passage.

A second feature that is coded into the text is the use of a logfile. This is a hidden feature made possible with the Hypertext2 application that is available from the Compleat Lexical Tutor website (http://www.lextutor.ca/hyp/). This logfile consists of a single data file for a specific reading passage that lists a timestamp, student name, ip number, and a list of words that were clicked on to request the electronic gloss. This data file resides on the website server and is populated every time the reader clicks the "Finished Reading" button on the screen containing the text.

The text of the reading passage is viewed on a computer screen as it is dictated by the Compleat Lexical Tutor application: Hypertext2. This application implements default settings that display the reading passage as black text on a white background, with requested glosses presented to the reader in the right-side panel of the screen. Text saliency is an element of this study and 50% of the SW and FS targets were manually coded to be typographically salient, as underlined blue color text. This leaves the remaining 5 SW and 5 FS unaltered from the general text presentation as well as for any other words that required manual coding to access a gloss.

Reading Comprehension Multiple-Choice Questions. The reading comprehension assessment consisted of 20 multiple-choice reading comprehension questions. This assessment was given on paper allowing the reader to view the passage online, while completing the questions on paper. Each multiple choice question is tied to a targeted item, albeit a SW or a FS, with one correct answer and 3 distractors. Each multiple choice question is numbered and follows the same sequence as the targeted items appear in the reading passage. Like the Example questions, there are four versions of the test questions. Each version of the assessment is composed of the same questions and answers however, the order of the possible answers have been randomized.

The main experiment portion provided on Day 2, involved a reading passage immediately followed by 20 comprehension questions in an attempt to follow the design set by Bishop (2004b). In this 2004 study, participants used a computer to read one passage embedded with the same 20 targets (10 SW and 10 FS); followed by 20 true/false statements. The format of the reading comprehension questions was

changed to 20 multiple-choice questions due to reflections made by Bishop (2004b)

who acknowledged reliability issues with the format of True/False questions (p. 197). A

decision to use the multiple-choice format was based on comments made by Norbert

Schmitt in a personal communication with Cyril J. Weir (2005):

> "Perhaps the best and most valid type of vocabulary test is a reading
>
> passage with comprehension questions, but with the items requiring a full
>
> understanding of particular words of phrases in the text. This would
>
> mimic the real world task of reading for comprehension and also the loss
>
> of comprehension when key vocabulary is not known." (as cited by Weir,
>
> 2005, p. 123).

Appendix F contains the materials that were used in the development of the reading

passage and assessment, as Figures F1 – F8:

F1. A list of targets that appear in the reading passage text;

F2. Reading passage text;

F3. Reading passage text & test statistics – Vocabulary profile;

F4. Reading passage text & test statistics – Readability measures;

F5. Reading passage coded text;

F6. Lextutor.ca partial screen shot with reading passage text;

F7. Reading passage test (version 1); and

F8. Assignment of test questions to targets in reading passage text.

Survey. The survey was given in a paper form and was used to collect

participants' attitudes and experiences toward reading, and glosses. The survey had a

total of seven questions, with six yes/no questions and one question that required

participants to respond using a scale. Three of the survey questions were used to solicit participant's opinions, while three other questions were used to elicit information about their experiences using glosses. The last question of the survey did not collect data, but was included to give participants an opportunity to request test scores and receive general information about the study. Appendix G contains this survey as Figure G1.

Gift Card Drawing Slip. This slip allowed the participants to submit their name for a $25 gift card drawing. This slip was provided in paper form and it could be found in their study packet provided on Day 2. This item is simple and asked participants for their Student Study ID and email address. Appendix H contains the gift card drawing slip as Figure H1.

Procedures

This study consisted of two main segments to involve classroom tasks, and computer lab tasks given over two days. The classroom tasks occurred on Day 1 with the computer lab tasks completed on Day 2. The participants' worked over two days that were separated with one week of time and conducted in two different locations. The participants were given as much time as needed to complete each task in each segment, with no time restrictions. To be considered as a participant, each student had to complete the tasks on both days:

Day 1 – Classroom Tasks

Day 2 – Computer Lab Tasks

Day 1 – Classroom Tasks

The Classroom Tasks involved three different components: the Consent Form with Student Reminder, the EFL Vocabulary Pre-test, and the TOEFL Reading Pre-test. The first step of these tasks began with the signing of the consent form which allowed each individual to become a participant in this study. The study was introduced to participants as a study that involved reading on paper and on the computer. No specific attention was given to the topic of vocabulary. None of participants had any academic ties to the researcher, and I was introduced as a teacher who previously taught classes in the English department. Upon signing the consent form, participants were immediately given an opportunity to sign-up for a time slot for Day 2, which took place in a computer lab. Participants then proceeded to complete two pre-tests: an EFL Vocabulary pre-test and a TOEFL Reading pre-test. All items presented on Day 1 were given to participants on paper with no time restriction to complete each task successfully. It was observed that most participants completed Day 1 tasks within 60 minutes.

One week was allowed between Day 1 and Day 2 to allow time for participants to be distracted and not impact the experiment results (Meara, 2010; Hulstijn, 2003; Shu, 1995). The scoring of the pre-tests was conducted during this week between the Day 1 and Day 2. With a database file each participant's responses were recorded from the consent form, and pre-tests. The selection of these two pre-test components were based on Bishop (2004b) who implemented a TOEFL reading subtest followed by a computerized vocabulary pre-test. These pre-test components provided an avenue

to validate the selection of targets items as they pertain to be known versus unknown by the participants in this study.

Day 2 – Computer Lab Tasks

The Computer Lab Tasks began one week after the classroom tasks. These tasks took place in a computer lab on campus, where each participant had access to a computer and study packet. The computer lab contained 18 computers prepped to display the first computer screen to welcome participants.

In the computer lab, each participant worked independently to complete five tasks: training example, reading of a passage, answer reading comprehension questions, a survey, and enter the gift card drawing. Immediately upon arrival, participants were asked to sign-in, and were provided oral instructions to take a study packet, find a seat at an open computer station, and follow the computer screens for further guidance. In addition each participant was asked not to close any tabs or window screens; if they had any questions, they only needed to raise their hand, at which time I would assist them. At each computer station participants found 10 computer screens to guide them through each task sequentially:

Training Example (computer screens #1-4);

Reading Summary (computer screens #5-6);

Reading Comprehension Questions (computer screen #7);

Survey (computer screen #8);

Gift Card Slip (computer screen #9);

Closure (computer screen #10).

Training Example (computer screens 1-4). Theses screens were used to welcome participants, provide basic instructions, and give an opportunity to practice with a training example. The goal of these screens was to allow the participant a chance to become familiar with the study packet, the navigation between screens, and the use of the two glossing tools of a SINGLE click or DOUBLE click feature that is available for both SW and FS when reading.

Reading Summary (computer screens #5-6). Immediately following the training session the Reading Passage task was presented to all participants using two computer screens. Computer screen #5 reviewed the individual steps needed for the task with computer screen #6 serving as a splash screen to remind participants of the glossing tools available and the provide link that is needed to open the reading passage into a separate tab.

The Reading Passage section of this study was based on a within subject design. All participants were given the same passage with 50% of the targeted SW and 50% of the targeted FS typographically salient. The glosses were available to all participants with no restrictions on the number of times a gloss could be accessed. The participants were allowed to move freely between the screens of the passage. When the participant was finished with the reading passage they clicked on the button: "Finished Reading". This provided the reader with a list of requested glosses and generated a logfile entry, in the background for the participant with a list of requested glosses.

Reading Comprehension Questions (computer screen #7). Following the reading of the passage, participants were asked to locate and complete the multiple-

choice reading comprehension questions in their study packet. Each participant was given one version of the test which contained 20 questions. Participants were also welcomed to keep the reading passage tab open as they completed the questions. Once all the questions were answered by the participant, they were directed to return to the computer screen and click the navigational button to go to the Survey.

Survey (computer screen #8). The survey was used to obtain the participant's opinions on reading and glossing as well as their experience using glosses. Computer Screen #8 directed the participant to locate and complete the survey in their printed study packet.

Gift Card Drawing (computer screen #9). The final computer lab task was the gift card drawing slip. With Computer Screen #9 the participants were directed to locate the Gift Card drawing form in their study packet. This Drawing slip was to be used to submit their name for a $25 gift card. Participants were reminded that submitting one's name for this drawing was available to all participants who completed the tasks, but it was not mandatory.

The drawing for the winners was done after the collection of all participant data necessary from Day 1 and Day 2. This drawing took place on university school grounds in the English Department, by the Office Manager who was able to draw three names for participant winners. The winning students were notified by email that they had won the drawing, and given instructions how to collect the prize.

Closure (computer screen #10). The last computer screen acknowledged the completion of the tasks for Day 2, at which time participants were asked to raise their hand. This act allowed me to verify that each participant had successfully completed

the study packet and clicked on the "Finished Reading" button online, which allowed for data submission. Upon verification, participants were congratulated and asked to submit both their study packet, and gift card drawing slip before signing out of the computer lab.

The Day 2 – Computer Lab Tasks were given to each participant with no time restriction, however it is noted that most participants were finished within 60 minutes. The main experiment portion on Day 2 involved a reading passage followed by 20 comprehension questions and was designed to follow Bishop (2004b). Bishop (2004b) presented a reading passage to participants on the computer which contained electronic glossing using the same 20 targets involving 10 SW and 10 FS; followed by a computerized True/False reading comprehension test.

Chapter 4: Analysis & Results

A database file was created to record each participant's responses to the demographic questions presented in the consent form, EFL Vocabulary pre-test, TOEFL reading pre-test, Example test questions, Reading passage test questions, survey, and the clicking behavior for each target item recorded during the Experiment segment on Day 2. The raw data was collected and recorded in an Excel database file at the end of data collection for Day 1, and again after Day 2. The EFL Vocabulary pre-test responses were recorded with a one value assigned to each item stated as known by each participant albeit a target item, nontarget item or form (SW, FS, or pseudoword).

The multiple-choice responses to each of the tests were recorded separately for each participant. A one point value was assigned for each correct answer and each question was equally weighted. The correct answers for each test were consolidated to determine each participant's score based on a 100 point scale for statistical analysis.

Survey results were recorded with a number value of 1 for each yes response and a value of zero for each no response. Question #3 uses a rating scale which is labeled: Paper book – Both – Computer. A value of 1 through 5 was assigned to the scale and each participant response was recorded.

Clicking behavior that occurred during the training and the reading of the passages tasks were recorded for each SW and FS target by each participant. For each target, a click was recorded as a 1; with a no click response recorded as a 0. A list on nontarget words that were clicked by a participant was also noted.

From this data file, statistical data analysis was executed using SPSS software version 21 in an attempt to answer the eight research questions presented in this study. Each question was considered using the statistical analysis of Paired Sample t-tests, Independent sample t-tests, Pearson's Correlation, one-way ANOVA and Bonferroni post hoc tests as appropriate.

A number of statistical analysis tests were performed to look at the L2 readers' clicking behavior that is associated in each of the three main research questions. The results of these tests are as follows:

Research Question #1

1. When will a L2 reader use an electronic gloss to increase reading comprehension as observed in the <u>clicking behavior</u> on SW and FS, and does typographical saliency play a role?

1a. Is there a difference in the readers' behavior of clicking between <u>salient and nonsalient unknown SW</u>? A Paired Sample T-Test between SW, salient clicks and SW, non-salient clicks showed a statistically significant difference (t [103] = 13.08, $p < .000$) in the direction of more clicking on SW salient click (m = 43.27%) than SW, non-salient clicks (m = 2.31%) as seen in Table 4.1.

1b. Is there a difference in the readers' behavior of clicking between <u>salient and nonsalient unknown FS</u>? A Paired Sample T-Test between FS salient clicks and FS non-salient clicks showed a statistically significant difference (t [103] = 13.38, $p < .000$) in the direction of more clicking on FS, salient clicks (m = 48.46%) than FS, non-salient clicks (m = 1.54%) as seen in Table 4.2.

Table 4.1
Paired samples t-test: Single word (SW) targets clicking behavior and saliency: salient versus nonsalient

Paired Differences							
			95% Confidence Interval of the Difference				
Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
40.962	31.944	3.132	34.749	47.174	13.077	103	.000*

* Correlation is significant at the 0.01 level (2-tailed).

Table 4.2
Paired samples t-test: Formulaic sequence (FS) targets clicking behavior and saliency: salient versus nonsalient

Paired Differences							
			95% Confidence Interval of the Difference				
Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
46.923	35.774	3.508	39.966	53.88	13.376	103	.000

1c. Does providing a gloss with saliency increase learners' awareness of targeted unknown SW compared to unknown FS while reading text, which can be observed in the L2 reader's clicking behavior? Two statistical analyses were executed to answer this question: a review of the mean scores reflecting the number of times a target was clicked based on the statistics derived from the paired sample t-tests from questions 1a and 1b above, and a correlation of Pearson test.

The mean scores appear to be similar when comparing saliency between SW and FS. It is observed that in both lexical units the salient clicks occurred more often

(m = 43.27, m = 48.46) over nonsalient clicks (m = 2.31 and m = 1.54) as seen in Table

4.3.

Table 4.3
Paired samples t-test statistics: Number of clicks comparing single word (SW) versus formulaic sequence (FS) targets

Target	Clicks	Mean	N	Std. Deviation	Std. Error Mean
Single Words	Salient	43.27	104	32.514	3.188
	Nonsalient	2.31	104	8.503	0.834
Formulaic Sequence	Salient	48.46	104	35.765	3.507
	Nonsalient	1.54	104	6.037	0.592

The test of Pearson correlation showed a statistically significant relationship with

the following variables:

(r = .197, p < 0.05) between SW, salient clicks and SW, non-salient clicks.

And there was no statistically significant relationship between the following variables:

(r = .083, p =.402) between FS, salient clicks and FS, non-salient clicks as seen

in Table 4.4.

Table 4.4
Pearson Correlation: Clicking behavior on single word (SW) and formulaic sequence (FS): salient versus nonsalient

		Single Word Nonsalient Clicks	Formulaic Sequence Nonsalient Clicks
Single Word Salient Clicks	Pearson Correlation	0.197*	
	Sig. (2-tailed)	0.045	
	N	104	
Formulaic Sequence Salient Clicks	Pearson Correlation		0.085
	Sig. (2-tailed)		0.402
	N		104

* Correlation is significant at the 0.05 level (2-tailed).

Research Question #2

     2. What impact does a L2 reader's clicking behavior to request a gloss have on reading comprehension?

     2a. Does providing a gloss with saliency on targeted SW or FS increase reading comprehension as seen in <u>higher test scores</u> on a multiple-choice test for L2 readers? Two statistical analysis using Pearson Correlation test and paired sample t-tests were performed to answer this question. Statistical analysis using a Pearson correlation was done based on the correct answers to multiple-choice reading comprehension questions considering four target variables: SW, FS, salient, and nonsalient. The test of Pearson correlation showed a statistically significant relationship with the following variables, as seen on Table 4.5:

     ($r = .273$, $p < 0.01$) between SW, salient multiple-choice answers and SW, non-salient multiple-choice answers.

     ($r = .300$, $p < 0.01$) between FS, salient multiple-choice answers and FS, non-salient multiple-choice answers.

Table 4.5
Pearson Correlation: Comparison of multiple-choice questions with salient versus nonsalient targets

Multiple-Choice Questions		Single Word Nonsalient Target	Formulaic Sequence Nonsalient Target
Single Word Salient Target	Pearson Correlation	.273**	
	Sig. (2-tailed)	.004	
	N	107	
Formulaic Sequence Salient Target	Pearson Correlation		.300**
	Sig. (2-tailed)		.002
	N		107

** Correlation is significant at the 0.01 level (2-tailed).

Two separate paired samples t-tests were performed to look at the correct

answers made on multiple-choice questions which are differentiated by the target's four

variables: SW, FS, salient, and nonsalient. First, a Paired Sample T-Test between the

correct answers made on multiple-choice questions using a SW target: salient versus

nonsalient showed no statistical significance (t [106] = 1.41, p < .161), as seen on

Table 4.6.

A second Paired Sample T-Test between the correct answers made on multiple-

choice questions using a FS target: salient versus non-salient showed a statistically

significance difference (t [106] = -4.42, p < .000) in the direction of more multiple-

choice questions were answered correctly on non-salient targets (m = 46.0%) over

salient targets (m = 33.3%), as seen in Table 4.7.

Table 4.6
Paired Samples T-Test. Comparison of multiple-choice questions with single word
(SW) targets: salient versus nonsalient

Multiple-choice questions with Single Word targets	Mean	N	Std. Deviation	Std. Error Mean
Salient	35.51	107	22.031	2.130
Nonsalient	32.15	107	18.583	1.797

Paired Samples Correlations	N	Correlation	Sig.
Salient versus Nonsalient	107	.273	.004

Paired Differences							
			95% Confidence Interval of the Difference				
Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
3.364	24.646	2.383	-1.359	8.088	1.412	106	.161

Table 4.7
Paired samples t-test. Comparison of multiple-choice questions with formulaic sequence (FS) targets: salient versus nonsalient

Multiple-choice questions Formulaic Sequence targets	Mean	N	Std. Deviation	Std. Error Mean
Salient	33.27	107	23.623	2.284
Nonsalient	45.98	107	26.524	2.564

Paired Samples Correlations	N	Correlation	Sig.
Salient versus Nonsalient	107	.300	.002

Paired Differences							
Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
			Lower	Upper			
-12.710	29.765	2.878	-18.415	-7.005	-4.417	106	.000

2b. Does clicking behavior on salient or nonsalient unknown SW or unknown FS increase reading comprehension with L2 readers as seen in a relationship between <u>clicking behavior</u> and in the number of correct answers to multiple-choice questions? Statistical analysis using a Pearson correlation was done based on clicking behavior considering four variables: SW, FS, salient, and nonsalient compared to participant's correctly answering multiple-choice reading comprehension questions based on a target. The test of Pearson correlation showed a statistically significant relationship with the following variables, as seen on Tables 4.8 and 4.9:

(r = .220, p < .0.05) between SW, <u>non</u>-salient clicks and the correct answers made on multiple-choice questions using a SW <u>salient</u> target.

(r = .256, p < 0.01) between FS, salient clicks and the correct answers made on

multiple-choice questions using a FS, salient target.

(r = .210. p < 0.05) between SW, non-salient clicks and the correct answers

made on multiple choice questions using a SW, non-salient target.

(r = .245, p < 0.05) between FS, <u>salient</u> clicks and the correct answers made on

multiple-choice questions using a FS, <u>non</u>-salient target.

And there was no statistically significant relationship between the following variables:

(r = .188, p =.056) between SW, salient clicks and the correct answers made on

multiple-choice questions using a SW salient target.

(r = .061, p =.540) between SW, <u>salient</u> clicks and the correct answers made on

multiple choice questions using a SW, <u>non</u>-salient target.

(r = -.082, p=. 407) between FS, <u>non</u>-salient clicks and the correct answers

made on multiple choice questions using a FS, <u>salient</u> target.

(r = .037, p = .709) between FS, non-salient clicks and the correct answers

made on multiple choice questions using a FS, non-salient target.

Table 4.8
Pearson Correlation: Single word (SW) clicks versus multiple-choice questions with single word (SW) targets: salient and nonsalient targets

Single Word		Multiple-choice Questions with a Salient Target	Multiple-choice Questions with a Nonsalient Target
Salient Clicks	Pearson Correlation	.188	.061
	Sig. (2-tailed)	.056	.540
	N	104	104
Nonsalient Clicks	Pearson Correlation	.220*	.210*
	Sig. (2-tailed)	.025	.033
	N	104	104

* Correlation is significant at the 0.05 level (2-tailed).

Table 4.9
Pearson Correlation: Formulaic Sequence clicks versus multiple-choice questions
with formulaic sequence (FS) targets: salient versus nonsalient

Formulaic Sequence		Multiple-choice Questions with a Salient Target	Multiple-choice Questions with a Nonsalient Target
Salient	Pearson Correlation	.256**	.245*
Clicks	Sig. (2-tailed)	.009	.012
	N	104	104
Nonsalient	Pearson Correlation	-.082	.037
Clicks	Sig. (2-tailed)	.407	.709
Salient	N	104	104

** Correlation is significant at the 0.01 level (2-tailed).
 * Correlation is significant at the 0.05 level (2-tailed).

Research Question #3

3. Who is clicking? Are there individual characteristics that can be associated
with reading, the use of glosses, or another trait that determines which L2 readers will
decide to click on a lexical unit to view a gloss?

**3a. Does the reader's attitude, experience, or prior training towards
<u>reading</u> have impact on the reader's clicking behavior to request a gloss while
reading on the computer?** An Independent sample t-test or a Pearson correlation
statistical analysis was done based on individual responses to a survey question and
clicking behavior as seen in the following four target variables: SW, FS, salient, and
nonsalient.

Survey question #1: Do you like reading? Independent sample t-tests
showed no statistically significance between answers made to survey question #1 and
the following target variables:

SW, salient clicks (t [102] = -.521, p < .604).

FS, salient clicks (t [102] =.505, p <.615).

SW, non-salient clicks (t [102] = 1.610, p < .110).

FS, non-salient clicks (t [102] = -.749, p < .456).

Survey question #2: Do you like reading on electronic devices?

Independent sample t-tests showed no statistically significance between answers

made to survey question #2 and the following target variables:

SW, salient clicks (t [102] = -1.176, p = .242).

FS, salient clicks (t [102] = .232, p = .817).

SW, non-salient clicks (t [102] = .729, p = .468).

FS, non-salient clicks showed (t [102] = .250, p = .803).

Survey question #3: What do you like to use for reading: a paper book or a

computer/electronic device (Likert Scale 1 = paper book, 3 = both, 5 =

computer)? The test of Pearson correlation showed no statistically significant

relationship between answers made to survey question #3 and the following target

variables:

SW, salient clicks (r = .147, p = .137).

FS, salient clicks (r = .165, p = .097).

SW, non-salient clicks (r = .005, p = .958).

FS, non-salient clicks (r = .035, p = .722).

3b. Does the reader's attitude, experience, or prior training towards <u>using</u>

<u>glosses</u> on a computer impact their clicking behavior within a text? An

Independent sample t-test or a Pearson correlation statistical analysis was done based

on individual responses to a survey question and clicking behavior as seen in the following four target variables: SW, FS, salient, and nonsalient.

Survey question #4: Have you used the definitions provided in a <u>paper</u> <u>book</u>? Independent sample t-tests showed no statistically significance between answers made to survey question #4 and the following target variables:

SW, salient clicks (t [102] = .369, p = .713).

FS, salient clicks (t [102] = 1.747, p = .084).

SW, non-salient clicks (t [102] = 1.00, p = .320).

FS, non-salient clicks (t [102] = -.078, p = .938).

Survey question #5: Have you clicked on a word to find its definition while reading <u>before</u> this study? Independent sample t-tests showed no statistically significance between answers made to survey question #5 and the following target variables:

SW, salient clicks (t [102] = 1.727, p = .087).

FS, salient clicks (t [102] = 1.095, p = .276).

SW, non-salient clicks (t [102] = .119, p = .905).

FS, non-salient clicks (t [102] = -.618, p = .538).

Survey question #6: Has anyone <u>showed</u> you how to click on a word to see a definition? Independent sample t-tests showed no statistically significance between answers made to survey question #6 and the following target variables:

SW, salient clicks (t [102] = .295, p = .769).

FS, salient clicks (t [102] = .621, p = .536).

SW, non-salient clicks (t [102] = .237, p = .813).

FS, non-salient clicks (t [102] = .669, p = .505).

3c. Is there a <u>demographic trait </u>such as age, gender, class assignments, time studying English as a second language, or time residing in a country where English is a dominant language that will determine if a L2 reader will request a gloss, as seen in clicking behavior while reading on the computer? Statistical analysis with a Pearson correlation or an independent sample t-test was done based on individual traits and clicking behavior considering four target variables: SW, FS, salient, and nonsalient.

Age. The test of Pearson correlation showed no statistically significant relationship between age and clicking behavior as seen in the following target variables:

SW, salient clicks (r = -.031, p = .757).

FS, salient clicks (r = -.024, p = .812).

SW, non-salient clicks (r = -.133, p = .177).

FS, non-salient clicks (r = -.072, p = .469).

Gender. The Independent sample t-test showed no statistically significant relationship between gender and clicking behavior as seen in the following target variables:

SW, salient clicks (t [102] = 1.251, p = .214).

FS, salient clicks (t [102] = -.155, p = .877).

SW, non-salient clicks (t [102] = -.053, p = .958).

FS, non-salient clicks (t [102] = .598, p = .551).

Class Assignment. Participants were divided into three distinct groups based on academic class assignments that correlate to language proficiency and academic achievement as a L2 English learner. In creating these three groups, the following labels have been assigned which corresponds to the participant's enrollment in a L2 English language reading course based on language proficiency accordingly:

Level 1 = participants currently enrolled in an English learning program

Level 2 = participants currently enrolled in a 100 level Reading & Writing course

Level 3 = participants currently enrolled in a 200 level Reading & Writing course.

One-way ANOVA statistical analyses with a post hoc test of Bonferroni was done based on the three levels found in participants' class assignment and clicking behavior as seen in the following four target variables: SW, FS, salient, and nonsalient.

Single words (SW) targets. The results from a One-way ANOVA showed a statistically significant difference in the clicking behaviors on SW targets between groups (F [2] = 4.223, p < .05). A Bonferroni post hoc test shows a statistically significant difference between Level 2 and Level 3 class assignment (p = .038), as seen in Table 4.10. It is also noted that there is no statistically significant difference in the SW clicking behaviors observed between Level 1, and Level 3 (p = .144); nor between Level 1 and Level 2 (p = 1.00).

Formulaic sequence (FS) targets. The results from a One-way ANOVA showed no statistically significant difference in the clicking behaviors on FS targets between groups (F [2] = 1.277, p = .284) as seen in Table 4.10.

Table 4.10
One-way ANOVA with post hoc Bonferroni. Class assignment and clicking behavior

Descriptives

Target	Level	N	Mean	Std. Deviation	Std. Error Mean
Salient	1	23	34.35	29.206	6.090
	2	17	32.35	32.888	7.977
	3	60	50.17	33.572	4.334
	Total	100	43.50	33.223	3.322
Nonsalient	1	23	3.04	10.632	2.217
	2	17	0.59	2.425	0.588
	3	60	1.83	5.039	0.651
	Total	100	1.90	6.466	0.647
Single Word	1	23	16.09	20.167	4.205
	2	17	12.35	16.019	3.885
	3	60	25.00	17.898	2.311
	Total	100	20.80	18.731	1.873
Formulaic Sequence	1	23	21.30	16.870	3.518
	2	17	20.59	20.147	4.886
	3	60	27.00	18.531	2.392
	Total	100	24.60	18.500	1.850

ANOVA

Target	Between Groups	df	F	Sig.
Salient		2	3.171	0.046*
Nonsalient		2	0.708	0.495
Single Word		2	4.223	0.017*
Formulaic Sequence		2	1.277	0.284

Bonferronni - Multiple Comparisons

Target	Levels		Sig.	Target	Levels		Sig.
Salient	1	2	1.000	Single Word	1	2	1.000
		3	0.150			3	0.144
	2	1	1.000		2	1	1.000
		3	0.147			3	0.038*
	3	1	0.150		3	1	0.144
		2	0.147			2	0.038*
Nonsalient	1	2	0.718	Formulaic Sequence	1	2	1.000
		3	1.000			3	0.633
	2	1	0.718		2	1	1.000
		3	1.000			3	0.627
	3	1	1.000		3	1	0.633
		2	1.000			2	0.627

* The mean difference is significant at the 0.05 level.

Salient targets. The results from a One-way ANOVA showed a statistically significant difference in the clicking behaviors on salient targets between groups (F [2] = 3.171, p < .05). A Bonferroni post hoc test shows no statistically significant difference between the three levels of class assignment, as seen in Table 4.10.

Nonsalient targets. The results from a One-way ANOVA showed no statistically significant difference in the clicking behaviors on nonsalient targets between groups (F [2] = .708, p = .495) as seen in Table 4.10.

Time Studying English as a second language. The test of Pearson correlation showed no statistically significant relationship between the amount of time spent studying English as a second language, and clicking behavior as seen in the following target variables:

SW, salient clicks (r = -.013, p = .898).

FS, salient clicks (r = -.009, p = .925).

SW, non-salient clicks (r = -.054, p = .589).

FS, non-salient clicks (r = -.049, p = .623).

Time Residing in a country where English is a dominant language. The test of Pearson correlation showed no statistically significant relationship between the amount of time spent residing in a country where English is a dominant language, and clicking behavior as seen in the following target variables:

SW, salient clicks (r = -.023, p = .816).

FS, salient clicks (r = -.175, p = .075).

SW, non-salient clicks (r = -.033, p = .742).

FS, non-salient clicks (r = -.038, p = .699).

Chapter 5: Discussion

The following discussions are presented based on the issues of clicking behavior associated to each of the three main research questions. Statistical analysis found in this study has been compared to the research done by Bishop (2004b) and De Ridder (2002) as they too considered the issues of clicking behavior, reading comprehension, and saliency based on a single lexical unit form: FS or SW, respectively. In an attempt to understand the clicking behavior and problem solving strategies of L2 readers, an overview of participant responses has also been made based on three tasks, centered on a set of SW and FS targets. These observations could be made and compared, as the participants engaged in an EFL vocabulary pre-test, a reading of a passage with glosses available with the click of a mouse, and the task to answer a set of multiple-choice reading comprehension questions.

Research Question #1

1. When will a L2 reader use an electronic gloss to increase reading comprehension as observed in the <u>clicking behavior</u> on SW and FS, and does typographical saliency play a role?

    1a. Is there a difference in the readers' behavior of clicking between <u>salient and nonsalient unknown SW</u>?

    1b. Is there a difference in the readers' behavior of clicking between <u>salient and nonsalient unknown FS</u>?

    1c. Does providing a gloss with saliency increase learners' awareness of targeted unknown <u>SW</u> compared to unknown <u>FS</u> while reading text, which can be observed in the L2 reader's clicking behavior?

Saliency and clicking behavior. Results from paired sample t-tests (Table 4.3) revealed saliency to be statistically significant for both SW (mean = 43.27) and FS (mean = 48.46) with a higher number of clicks performed on salient targets over nonsalient targets.   The issue of saliency pertaining to FS is also supported by Bishop (2004a, p.238) whose study found typographical saliency (presented as red text or red, underlined text), to have a positive impact on FS clicking behavior. Similarly, De Ridder (2002) research that considered the issue of saliency (presented as blue, underlined text), and clicking behavior among single words; again aligns with these findings concluding that the highlighting of SW targets promotes clicking behavior (F (1.58) = 24.292, p < .05) (p. 132).

Lexical units and clicking behavior. Looking beyond the frequency in the number of clicks made among SW and FS, additional analysis was made based on correlation of Pearson tests that substantiates the issues of saliency between the different lexical units. A positive statistical significance has been discovered between clicking behavior on SW salient versus SW nonsalient targets. This reveals that the participants who clicked on salient SW targets will also tend to click on nonsalient SW targets. It is of interest to find no statistical significance in a correlation relationship between the clicking behavior on FS salient versus nonsalient; in contrast to SW.

These statistical differences between the lexical units (SW versus FS) may in fact be eluding to differences in the lexical properties or possibly other research topics such as noticing (Schmidt, 1990; Laufer 2003; Bishop, 2004b), lexeme visibility (Bishop, 2004a), transparency (Juhasz, Lai, & Woodcock, 2015; Columbus, 2013; Shu, Anderson, & Zhang, 1995), deceptive transparency (Martinez & Murphy, 2011; Kim,

2016; Laufer 1989), and that of vocabulary thresholds (Nation, 2013). Bishop

summarizes "…unknown formulaic sequences are less easily recognizable as holistic

entitles than words, because unlike words, it is not clear, a priori, where the boundaries

of unknown formulaic sequences lie" (Bishop, 2004a, p. 239).

Research Question #2

2. What impact does a L2 reader's clicking behavior to request a gloss have on

reading comprehension?

2a. Does providing a gloss with saliency on targeted SW or FS increase reading

comprehension as seen in higher test scores on a multiple-choice test for L2

readers?

2b. Does clicking behavior on salient or nonsalient unknown SW or unknown FS

increase reading comprehension with L2 readers as seen in a relationship

between clicking behavior and in the number of correct answers to multiple-

choice questions?

The multiple-choice test, for this study, was a compilation of 20 questions where

10 questions were focused on SW targets and 10 on FS targets, with an equal 50%

distribution of saliency applied within each group of targets. In an attempt to look at the

issue of reading comprehension, statistical analysis was done first on test scores

overall and then secondly a correlation of Pearson test to determine if an relationship

exist between clicking behavior and answering multiple choice questions correctly.

Test scores based on correct answers made on multiple-choice questions.

Statistical analysis was applied to two separate sets of variables: correct answers

made on multiple-choice questions centered on a SW salient or nonsalient target, and

then a second set of variables that considered the correct answers made on multiple-choice questions centered on a FS: salient or nonsalient target. To be able to compare and contrast the two sets of variables a Pearson correlation test was executed followed by paired samples t-tests. The Pearson correlation tests, in both cases, demonstrated a positive statistical significance in both SW and FS with a significant level of 0.004 and 0.002 respectively, as seen in Table 4.5. Two possible conclusions can be taken away from these results. First, the similarities in the statistical analysis based on test scores can be a reflection of the participants test taking skills and secondly they may be a reflection of the test format, which in this case is the reliability of multiple-choice questions.

To evaluate reading comprehension and test scores further paired samples t-tests were done considering the answers to multiple-choice questions keeping the questions separate based on target: SW and FS. A paired sample t-test between the correct answers made on multiple-choice questions using a FS target: salient versus non-salient showed a statistically significance difference (t [106] = -4.42, p < .000) in the direction of more multiple-choice questions were answered correctly on non-salient targets (m = 46.0%) over salient targets (m = 33.3%). Similarly, no statistical significant difference was noted among SW multiple choice questions between salient and nonsalient targets (m = 35.51 versus m = 32.15), as seen in Tables 4.6 and 4.7.

In contrast, Bishop's (2004b) findings on FS found participants who read with salient FS earned higher scores on the test. However, the differences in test scores was not statistically significant (8.71 vs. 8.00) (2004a, p. 238). With that said, it is of interest to reexamine the two studies for they had both used the same 10 FS targets.

Beyond the similarities found in the focus of FS, saliency, clicking behavior, and reading comprehension differences do surface. These two studies indeed used the same 10 FS targets, however they appear in different reading passages, in different test formats (multiple-choice questions versus True/False sentences) and they were executed under different designs (within subject versus between subjects). In fact, the differences in design dictated the number of highlighted FS targets that were seen in the reading text by each participant. For example this study highlighted only 50%, or 5 out of 10 FS targets, whereas Bishop (2004b) used 100% saliency, highlighting all 10 FS targets for a treatment group and 0% for a control group who did not see any targets highlighted. With this aside, the findings between these two studies and the statistical differences found in the paired sample t-tests relating to FS targets does merit further consideration. The main focus of this study was to contribute to research and to provide statistical evidence on the acquisition and processing of FS alongside of SW as these lexical units appear in a L2 reading task. Thus far, statistically significant differences and similarities are starting to appear that opens a window into the complexities that are hidden among FS.

Separate from the issues of FS targets, De Ridder (2002) looked at SW saliency and reading comprehension measured by a test composed of multiple-choice and open ended questions. The conclusion of this research supports the findings that there was no statistical significance between SW saliency and reading comprehension scores ($F_{(1.58)} = .003$, $p > .05$) (De Ridder, 2002, pp. 133-134).

So far both similarities and differences have been found in the statistical analysis of test scores based on the participants' ability to correctly answer multiple-

choice questions with targets based on the variables of saliency and lexical units: SW and FS. In attempt, to understand these statistical results further, a look at clicking behavior and answering correctly on multiple-choice questions is warranted.

     Clicking behavior and answers to multiple-choice questions. A test of Pearson correlation was used on the variables of clicking behavior and correct answers to multiple choice questions, reviewing SW and FS separately. As seen in Tables 4.8 and 4.9, a statistically significant positive relationship was only found, under two separate sets of variables:

    1. SW: <u>nonsalient clicks</u> in relation to number of correct answers of both types of questions: SW, salient multiple-choice and SW, nonsalient multiple-choice questions.

    2. FS: <u>salient clicks</u> in relation to the number of correct answers of both types of questions: FS, salient multiple-choice and FS, nonsalient multiple-choice questions.

In addition, no statistical relationship was found with the counterpart variables of FS, nonsalient clicks and SW, salient clicks. These differences may in fact represent a difference in comparing the relationship in the processing of vocabulary when considering FS and SW with reading comprehension. Considering the relationship among SW, FS, and saliency found above, one could speculate into the partnership between the level of vocabulary and reading comprehension of the L2 reader. For example, you could say that in both cases of SW and FS, a positive relationship exist in clicking behavior, saliency and one's success in answering a reading comprehension. However this relationship is not the same when you compare SW and FS.

When you look at SW, statistical analysis shows the L2 reader who clicks nonsalient SW tend to also be successful in answering multiple choice questions. This is of interest since a higher number of clicks had occurred on salient SW, as seen in question 1. In the case of FS, a positive relationship also exists, however it is the L2 readers who clicks the salient FS who are more successful in answering both types of multiple-choice questions. Which corresponds to a higher number of clicks that occur on salient FS, as noted in question 1.

The idea of clicking behavior and reading comprehension does not appear to be a simple issue but it is indeed an interesting one. De Ridder (2002) found that clicking behavior on SW targets did not affect reading comprehension (p. 136). Bishop (2004) also reported that despite an increase in clicking behavior on salient FS, no statistical significance translates in to higher reading comprehension scores among FS True/False sentences (Bishop, 2004a, pp. 240). In addition, a Pearson correlation test actually unveiled an inverse relationship between FS clicking behavior, and reading comprehension (Bishop, 2004b, p. 145). Thus, Bishop (2004a) concluded "the problem of the relationship between clicking on glosses and the understanding of formulaic sequences is currently *terra nova et incognita*" (p. 241).

Comparison of test scores and participant responses. Further consideration was made to look at any possible correlation between the three different responses made by the L2 readers who participated in this study. Table 5.1 presents detailed information on participant's performances on the EFL vocabulary test, clicking behavior on targets while reading the passage, and the performance on the reading comprehension test involving 20 multiple-choice questions.

Table 5.1.
Comparison of test scores and clicking behavior

	Reading Comprehension Test	EFL Vocabulary Pre-test	Clicking Behavior	Unknown Origin for Correct Answer*
Total Average	36.7%	37.7%	29.3%	35.9%
Nonsalient Targets	39.1	41.7	17.9	47.3
Salient Targets	34.4	33.7	40.7	23.7
Nonsalient SW	32.1	30.5	5.7	43.3
Salient SW	35.5	33.2	44.3	22.0
Nonsalient FS	46.0	52.9	30.0	51.3
Salient FS	33.3	34.2	37.1	27.2

*Participants correctly answered the reading question however, did not mark the target on the EFL Vocabulary pre-test as known, nor did they click on the target while reading.

This table allows for a review of the data considering the total number of students and percentages at two different levels. At the top level looking at the total responses made for each of the three components and then at the bottom or target level. At the top level, the following five statements can be made:

1. The total average score on the reading comprehension test is 36.7%.

2. Participants who identified the target on the EFL vocabulary test as known; had 37.7% accuracy on the multiple-choice reading comprehension question.

3. Participants who clicked on the target; had 29.3% accuracy on the multiple-choice reading comprehension question.

4. Participants who did not mark the target as known in the EFL vocabulary test and they did not click on the target; had 35.9% accuracy on the multiple-choice reading comprehension question.

In collecting this data, it was also noted that from the 107 participants, 40 participants had marked the target as known on the EFL vocabulary test, and clicked

the target before answering the multiple-choice reading comprehension question correctly. This was seen with all 10 salient targets (SW and FS) plus one non-salient FS which was the response made by one participant. It is of interest that this response did not occur with nonsalient targets (SW and FS) with the exception of the one target previously noted. Thus saliency has proven to have an impact on participants' responses in the tasks performed in this study.

A comparison of participant's responses at the target level reveals the participants' problem solving strategy for a L2 reading task. Table 5.2 provides both the number of participants who responded along with the level of accuracy in answering the multiple-choice question. The bottom or target level allows for a comparison of participant responses to each specific target. For example, the following statements can be made in regards to the SW target of "consequence":

1. This SW target was marked as known on the EFL vocabulary pre-test by 99 participants with accuracy of 29.3%.

2. This SW target was clicked on by 27 participants with 28.6% accuracy.

3. Two participants were able to answer the multiple-choice question correctly without identifying the target on the EFL vocabulary test as known or by clicking on the target during the reading of the passage.

4. Twelve participants marked this target as known on the EFL vocabulary pre-test and still clicked on the target in the text before answering the multiple-choice question correctly, as seen under the column heading of #**.

5. Overall 30.8% participants were successful in answering the multiple-choice question that was based on this SW target.

In reviewing the data at the target levels, it is evident that the participants are engaging problem solving strategies differently. This is illustrated among 40 participants who were able to get the correct answer to multiple choice questions, only after they had previously claimed to have known the target on the EFL vocabulary test, and clicked on the target in the text as seen with all salient targets and one nonsalient FS. Secondly, 18 participants chose not to click on any of the targets (salient, nonsalient, SW, or FS) to earn a mean score of 33% on the reading comprehension test. Up to this point the statistical analysis and discussions has been based on the first two questions presented in this study. Evidence has provided similarities and differences among L2 readers and strategies, which leads us to the third research question.

Table 5.2
Comparison of test scores and clicking behavior at the target level

Targets	Reading Comprehension Test			EFL Vocabulary Pre-test		Clicking Behavior		Unknown Origin for Correct Answer*	
Nonsalient									
Salient	#	%	#**	#	%	#	%	#	%
expatiate	15	14.0%		10	0%	7	28.6%	13	86.7%
determine	56	52.3		98	53.1	1	0	4	7.1
outweigh	55	51.4		61	54.1	1	0	22	40.0
ongoing	33	30.8		70	37.1	1	0	7	21.2
disrupt	13	12.1		60	8.3	2	0	8	61.5
moderate**	26	24.3	8	87	27.6	40	22.5	1	3.8
consequence**	33	30.8	12	99	29.3	27	51.9	2	6.1
perspicacity**	55	51.4	3	14	28.6	62	61.3	16	29.1
concede**	40	37.4	13	53	39.6	36	47.2	15	37.5
obviated**	36	33.6	2	22	40.9	44	38.6	12	33.3
silver tongued	64	59.8		6	100	6	50.0	55	85.9
carry out	62	57.9		94	55.3	1	0	10	16.1
put off**	40	37.4	1	77	35.1	1	100	13	32.5
cut out	45	42.1		60	35.0	0	0	24	53.3
catch on to	35	32.7		28	39.3	0	0	24	68.6
pile up**	28	26.2	4	39	43.6	46	17.4	7	25.0
do away with**	16	15.0	2	13	30.8	69	17.4	2	12.5
over the top**	66	61.7	23	60	61.7	46	87.0	12	18.2
put up with**	26	24.3	3	63	20.6	39	12.8	11	42.3
have an inkling**	42	39.3	1	7	14.3	51	51.0	16	38.1

*Participants correctly answered the reading question however, did not mark the target on the EFL Vocabulary pre-test as known, nor did they click on the target while reading.
** Participants marked the target as known on the EFL vocabulary test and clicked on the target to achieve the correct answer on the multiple-choice question.

Research Question #3

3. Who is clicking? Are there individual characteristics that can be associated with reading, the use of glosses, or another trait that determines which L2 readers will decide to click on a lexical unit to view a gloss?

3a. Does the reader's attitude, experience, or prior training towards <u>reading</u>

have impact the reader's clicking behavior to request a gloss while reading

on the computer?

3b. Does the reader's attitude, experience, or prior training towards <u>using</u>

<u>glosses</u> on a computer impact their clicking behavior within a text?

3c. Is there a <u>demographic trait</u> such as age, gender, class assignments, time

studying English as a second language, or time residing in a country where

English is a dominant language that will determine if a L2 reader will request

a gloss, as seen through clicking behavior while reading on the computer?

These questions are presented in an attempt to identify individual defining

characteristics as they may relate to a possible link in vocabulary and strategies

associated with a reading task. Gu (2003), explains that "The learner brings to the

language learning situation a wide spectrum of individual differences that will influence

the learning rate and the ultimate learning results" (p. 2). Question 3 therefore, makes

an attempt to identify the individual L2 reader in association to clicking behavior when

reading on the computer. Consideration was made on eleven variables in which the

data was derived from actual clicking behavior performed in this study, along with L2

responses to questions presented on the consent form and on a survey. Three different

types of statistical analyses were executed with independent sample t-tests, Pearson

correlations, and a one-way ANOVA with Bonferroni post hoc tests.

The results for each of these variables are listed in the results section of this

paper along with the statistical analysis. From the analysis of all eleven variables, no

statistical significant difference was noted in the clicking behavior among the

participants, with the exception of one variable and that is in class assignment.

Class Assignment. Class assignment is a variable that divided the participants

into three groups based on their enrollment in a L2 English language reading course.

This is a course that was provided either by a 4-year university or an English learning

program. This English learning program is designed for international students, in

preparation to attend a 4-year university program. Therefore, class assignment is a

variable that divides the participants into the following three levels:

Level 1 = participants currently enrolled in an English learning program

Level 2 = participants currently enrolled in a 100 level Reading & Writing course

Level 3 = participants currently enrolled in a 200 level Reading & Writing course.

A one-way ANOVA statistical analysis with Bonferroni post hoc tests was done

to consider the three levels of participants and their clicking behavior as seen in four

target variables: SW, FS, salient, and nonsalient. A one-way ANOVA test showed a

statistically significant difference in two target variables: SW and salient targets. It is

also of interest that no statistically significant difference was found in the clicking

behavior of participants among FS and nonsalient targets.

SW targets. The results from a one-way ANOVA showed a statistically

significant difference in the clicking behaviors on SW targets between groups

($F [2] = 4.223$, $p < .05$). A Bonferroni post hoc test shows a statistically significant

difference between Level 2 and Level 3 class assignment ($p = .038$), as seen in Table

4.10. It should also noted that there is no statistically significant difference in the SW

clicking behaviors observed between Level 1, and Level 3 (p = .144), nor between Level 1 and Level 2 (p = 1.00).

Salient targets. The results from a one-Way ANOVA showed a statistically significant difference in the clicking behaviors on salient targets between groups (F [2] = 3.171, p < .05). A Bonferroni post hoc test shows no statistically significant difference between the three levels of class assignment, as seen in Table 4.10.

The defining L2 learner characteristic of class assignment has been quite intriguing. For the statistical analysis that is based on a participant's enrollment in a reading class has removed some variation among L2 readers as dictated by the two programs. In both of these programs participants are assigned to classes based on their performance on an entrance exam. Statistical analysis has found no differences in clicking behavior among participants in Level 1 and Level 2. In addition, a statistical difference was only found between Level 3 and Level 2 participants on SW targets, with the highest number of clicks made by Level 3. In fact having Level 3 participants showing a difference in the processing of SW and not FS, may be a reflection into the stages of language acquisition for FS as they are acquired later, as noted by Conklin and Schmitt (2008, p. 84).

These issues presented in question 3 were not part of the research done by Bishop (2004b) and De Ridder (2002) and therefore no comparison can be made. In fact research done by Gu (2003) found that the number of studies to address individual characteristics relating to L2 vocabulary learning strategies are few in number. Here are three research studies that have considered L2 learner variables with look-up behavior:

1. Shang (2016) found motivation and computer self-efficacy had an effect on L2 reader comprehension (p. 332).

2. Dörnyei, Durow, and Zahran (2004) research was unable to find a relationship among individual variables associated with the acquisition of FS (p. 95). It should be noted that the "success in acquiring formulaic sequences is strongly related to the learner's active involvement in some English-speaking social community". (p.104)

3. Hulstijn (1993) identified two learner variables that influenced lookup behavior among L2 readers: size of vocabulary knowledge and inferring ability (pp. 145 – 156).

Limitations

The aim of this study was to look at the clicking behaviors and reading comprehension of L2 readers as they read with SW and FS on the computer. Within this study the following limitations were noted:

1. All participants had volunteered to participant in this study with the hope that each participant would perform to their best abilities on each of the tasks presented. There was no control to motivate participants' best performance or a means to prevent participants to simply walk into the computer lab, sit down, and click until the computer screen froze. On a positive note however, 76.6% of the participants did make a request for test scores and further information at the conclusion of this study.

2. Clicking on a target alone does not imply understanding of a target. Clicking on a target signals that the L2 reader had noticed the target and additional

meaning of that target was needed. In turn, the format of the gloss was not considered in this study, and a decision was made to follow Bishop (2004b). Therefore, the source of each target's hyperlink was based on the default definitions as presented by the web based Cambridge Dictionary that is available online (http://dictionary.cambridge.org/dictionary/english/).

3. Consideration is needed on both the level of difficulty found in the reading task and assessment. The assessment in this study was limited to 20 multiple choice questions to address the issues of reading comprehension based on the following criteria:

   • 10 SW multiple choice questions: 5 salient + 5 nonsalient targets

   • 10 FS multiple choice questions: 5 salient + 5 nonsalient targets.

4. References have been made in this study to look at unknown SW and FS. However, based on the participant responses on the tasks in this study, no distinction could be made on which targets were known versus unknown. For example, Table 5.1 shows that the participants were 37.7% accurate in identifying a target as known on the EFL vocabulary test, with the ability to correctly answer the multiple choice question. In addition, 40 participants marked a target as known, as well as clicked on the target, while reading with limited success on the multiple-choice questions. Therefore for the purposes of this study, no differentiation was made between unknown and known targets. All responses to both SW and FS targets were considered in the statistical analysis of this study. The EFL vocabulary pre-test and TOEFL reading test served only to identify targets and participants.

5. An attempt was made to record the amount of time needed for each task throughout the study. It was noted that the participants were not reliable in recording time and no automated recording of time was available. Therefore, participant's specific time requirements in completing any one task was not available and only general comments could be made from observations.

6. After the completion this study, a review of the text, targets, and manual coding of the hyperlinks revealed a few issues to consider.

   • Ideally, all targets should have been used only once. It should be noted that one SW target was inadvertently used as a nontarget SW.

   • Use only one target in a sentence. On four occasions a single sentence had contained two targets in the reading passage.

   • Manual code hyperlinks for all targets as well as for any nontarget FS. In a closer review of the hyperlinks, nontarget SW were manually coded to generate a hyperlink as necessary however an oversight was made on nontarget FS. These lexical units require additional attention for they will, by default, implement a SW gloss in error. This was seen in the nontarget FS of "from the cradle to the grave".

Recommendations

This study looked at L2 readers as they performed reading tasks, to allow a comparison between two lexical units: SW and FS. Observations were made on clicking behavior to request a gloss, along with a review of reading comprehension test scores as a means to understand the cognitive processes of the L2 reader. The

results derived from this study, have served as a signal for the need of continual research in three ways:

1. A need for more corpus based studies to evaluate FS similar to SW in aspects of frequency analysis, vocabulary size (breadth/depth), lexical visibility, semantic transparency, opaque transparency, and deceptive transparency.

2. A need to consider defining characteristics of the L2 reader, that may or may not be associated with L2 reading skills in a world of evolving technology.

3. To consider the pedagogical implications that will allow teachers to help students' increase their level of awareness and noticing skills associated with reading involving both SW and FS.

Chapter 6: Conclusion

In this study three main questions were asked centered around the response of L2 readers towards SW and FS while reading on the computer. Participants were observed as they read a passage on the computer, requested glosses with a click of the mouse, and answer multiple-choice questions. This study's statistical data analysis has revealed both similarities and differences exist among L2 readers based on the variables of saliency, and two lexical units SW versus FS.

The first question, which looked at the issues of saliency and the lexical units of SW and FS, appears to be comparatively an easy one to conclude. Results found in this study support other research (Bishop, 2004b; De Ridder, 2002) which found saliency does indeed promote clicking behavior among L2 readers. The question now is does this clicking behavior also translate into reading comprehension, the second question of this study?

Reading comprehension analysis was based on two factors: test scores and clicking behavior. Looking first at the test scores and the ability to answer multiple-choice questions, the following conclusions can now be made:

1. A Pearson Correlation found a statistical relationship in L2 reader's ability to correctly answer multiple choice questions that were targeted on SW both salient and nonsalient in the text. This same relationship was also found to be true among FS targeted questions

2. A statistically significance difference however, appeared in the number of correct answers made on multiple-choice questions targeted with a FS comparing salient versus nonsalient targets. It fact participants were able to

correctly answer more multiple-choice questions that were based on FS

nonsalient targets over salient. No such difference was seen in the statistical

analysis of SW, salient versus nonsalient.

In an attempt to understanding the issues of reading comprehension further, a second

factor was considered and that is observed in clicking behavior. More specifically is

there a statistical relationship between L2 clicking behavior on a target, associated with

the ability to answer that target's multiple-choice questions correctly? Statistical

analysis has revealed two points of interest:

1. A Pearson correlation showed a statistically significant positive relationship

   between SW, nonsalient clicks and the success in correctly answering the

   multiple-choice questions focused on both salient and nonsalient SW targets.

   This does not exist among FS nonsalient clicks.

2. A Pearson correlation also revealed a statistically significance positive

   relationship between FS, salient clicks and the success in correctly

   answering the multiple-choice questions focused on both salient and

   nonsalient FS targets. Again this correlation does not exist among SW,

   salient clicks.

The third and final question in this study took into consideration the L2 reader

themselves. Are there any individual defining characteristics that show a relationship

between L2 clicking behavior, and reading in a second language? Eleven different

variables were considered and only one stood out among L2 readers and that was

class assignment. The class assignment variable divided the participants into three

groups based on their enrollment in a L2 reading class. Statistical analysis using a one-way ANOVA, with Bonferroni post hoc tests found the following similarities and differences in the clicking behavior among three levels of L2 readers:

1. The clicking behavior of Level 1 participants, who were considered to be the lowest reading level, were similar to both Level 2 and Level 3 participants among all four variables: SW, FS, salient, and nonsalient targets.

2. The clicking behaviors between all three levels of participants performed similarly on three of the four variables: FS, salient, and nonsalient. A statistical difference was found in the clicking behavior on SW targets. Level 3 participants, who were considered to be of the highest reading level of the participants in this study, clicked SW targets statistically more often than Level 2.

In the end, these similarities and differences between the lexical units of SW and FS illustrate the complexities and the roles they play in a reading task. I agree with Bishop (2004a) in that the issues seen in clicking behavior and reading with FS, as a lexical unit, are as of yet unknown. I propose, therefore, that the mysteries found in L2 reading comprehension involve both SW and FS, and it is one that can only be solved once the lexical units have been **noticed.**

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Appendix A

Figure A1. Consent Form

SW and FS Language Study

INFORMED CONSENT

In this project, we need your help to develop English teaching materials. You will be reading a passage with glosses and you will be given an opportunity to answer some comprehension questions. You will also help in identifying single words and multiple word vocabulary learning strategies.

☐ This is NOT a test.
☐ Your name will NOT be used after the data have been recorded for analysis.
☐ Your participation is **voluntary**. You may withdraw any time if you want.
☐ Even if you decide not to do this, it will NOT affect your relations with your instructor, the researcher, or the university.
☐ Your participation will NOT affect your grades.
☐ The result from the research may be presented or published. (Your name will NEVER be used.)
☐ The data will be used ONLY for academic research. If you are interested to know about the results, we can share that information with you when it becomes available.
☐ Upon completing your participation in this study you will be given an opportunity to submit your Student Study ID number for a drawing to win a $25.00 gift card that will be held at the conclusion of this study.

If you give your permission to use the data for research, please sign below.

Are you at least <u>18</u> years of age? **Yes** ___ **No** ___
If you answered NO, please stop. Thank you.

Print your name _____
Signature ..... _____
Date .... _____

For questions, please contact: **Deborah Dieterich**
Department of English, SCSU at kode1303@stcloudstate.edu
or my Faculty Advisor Dr. Kim at ckim@stcloudstate.edu

SW and FS Language Study

Your Name: _____

Student Study ID: _____

Your Gender: Female ( ) Male ( )
Your Age: _____

Check ALL the classes you are taking now:
☐ ENGL 190 (Intro Rhetorical & Analytical Writing Supplemental)
☐ ENGL 191 (Intro to Rhetorical & Analytical Writing)
☐ EAP 101 (Listening & Speaking)
☐ EAP 102 (Reading & Writing)
☐ EAP 201 (Listening & Speaking)
☐ EAP 202 (Reading & Writing)
☐ IEC courses

If you are a student in the IEC, check your level:
☐ Level 3
☐ Level 4
☐ Level 5

What languages do you speak?
Your first language: _____

Other languages: _____

How long have you been studying the English language?

_____ years _____ months

How long have you lived in the U.S.? (or any other English-speaking countries)

_____ years _____ months

Figure A2. Student Reminder

SW and FS Language Study

Student Reminder

Pick the gift card you would be most interested in winning:

_____ Target Store gift card

_____ Coburn's Food Store

_____ SCSU Husky Cash

_____ VISA Card

-   - Tear Here -   -

SW and FS Language Study

Student Study ID Number:_____

DATE: _____

TIME: _____

LOCATION: _____

TASKS:

Day 1   ✓ Consent Form with Student Reminder
          __ Yes/No Vocabulary Pre-test
          __ TOEFL Reading Pre-test

Day 2   __ Training Session
          __ Reading Passage & Multiple-choice reading comprehension questions
          __ Survey
          __ Gift Card Drawing slip (Optional)

Thank you for your time and a chance to get to know you.

I look forward to seeing you in one week

when you get an opportunity to enter a drawing for a chance to win a $25.00 gift card.

Appendix B

Figure B1. EFL Vocabulary list of components

A complete list of targets (SWs and FSs) along with two types of distractors: non-target and pseudoword. These vocabulary items were randomized into 4 different versions of the EFL Vocabulary Pre-Test.

		Distractors	
Single Words			
	Target	**NonTarget**	**Pseudoword**
	expatiate	eliminate	nonagrate
	moderate	endure	balfour
	determine	excessive	galpin
	perspicacity	discern	benevolate
	outweigh	distinguish	adair
	ongoing	accumulate	gumm
	disrupt	implement	suddery
	consequences	postpone	acklon
	obviate	abolish	litholect
	concede	persuasive	quorant

		Distractors	
Formulaic Sequences			
	Target	**NonTarget**	**Pseudoword**
	silver tongued	fall out	as mean as
	pile up	hold forth	in your case
	carry out	loom larger than	to tell the price
	do away with	under way	on the other bed
	put off	cut down on	to climb up
	over the top	cut off	in other fields
	put up with	come to terms with	at the church
	cut out	clearness of mind	on the man
	catch on to	come up with	as a women
	have an inkling of	throw into disorder	in the first year

Three different sources were needed to consolidate this list of targets and nontargets.
Single words (SW) target and non-target (Bishop, 2004, p. 134)
Single words (SW) pseudowords (Meara, 2010, pp. 18, 40, 62, 84, 106)
Formulaic sequences (FS) targets and non-target (Bishop, 2004, p. 135).
Formulaic sequences (FS) pseudowords Jiang and Nekrasova (2007, pp. 445-446)

Figure B2. EFL Vocabulary Pre-test (version 1)

SW & FS Language Study

Student Study ID _____

Date _____

Read the list of words. If you KNOW it is a word in English, check the circle next to it.
Remember: Some words in the list are NOT real words in English.

Example:		
● poor	○ glandle	● song
○ ralling	○ lannery	● obey

Answer: There are only 3 words that are correct: poor, song, obey.

1 ○ distinguish	2 ○ concede	3 ○ determine
4 ○ eliminate	5 ○ disrupt	6 ○ gumm
7 ○ excessive	8 ○ acklon	9 ○ implement
10 ○ nonagrate	11 ○ ongoing	12 ○ discern
13 ○ expatiate	14 ○ accumulate	15 ○ endure
16 ○ benevolate	17 ○ suddery	18 ○ perspicacity
19 ○ quorant	20 ○ galpin	21 ○ abolish
22 ○ moderate	23 ○ balfour	24 ○ litholect
25 ○ adair	26 ○ consequences	27 ○ persuasive
28 ○ postpone	29 ○ outweigh	30 ○ obviate

Vocabulary Test 2016v1:   H: _____   FA: _____   DM: _____

Figure B2. EFL Vocabulary Pre-Test (version 1)

SW & FS Language Study

The expression "to begin with" is commonly used in English. When these three words are used together ("to begin..."_) most English speakers can complete the expression naturally (to begin with) because these three words together form ONE commonly used expression in English.

Now, compare this to the expression "to dance with." Although we know what this means, these three words do NOT form one commonly used expression. So when the two words "to dance" are heard together, most English speakers would NOT always say "to dance with" naturally.

Read the list of expressions below. Check the circle next to the expressions that are commonly used in English, like "to begin with."
Remember: Some expressions listed will not be commonly used together in English.

Example:		
○ to dance with	● at any rate	● to begin with
○ on the chair	● on the contrary	○ at any period

Answer: There are only 3 groups of words that are correct: at any rate, to begin with, on the contrary.

31 ○ as a women	32 ○ catch on to	33 ○ silver tongued
34 ○ pile up	35 ○ as mean as	36 ○ cut off
37 ○ on the man	38 ○ fall out	39 ○ come up with
40 ○ come to terms with	41 ○ over the top	42 ○ at the church
43 ○ in your case	44 ○ in the first year	45 ○ on the other bed
46 ○ throw into disorder	47 ○ to tell the price	48 ○ loom larger than
49 ○ hold forth	50 ○ to climb up	51 ○ under way
52 ○ do away with	53 ○ have an inkling of	54 ○ cut out
55 ○ cut down on	56 ○ in other fields	57 ○ clearness of mind
58 ○ put up with	59 ○ carry out	60 ○ put off

Vocabulary Test 2016v1:   H: _____   FA: _____   DM: _____

Appendix C

Figure C1. TOEFL Reading passage

SW and FS Language Study

"Surprise! Empire State Building Switches to LED"
While New York slept, the Empire State Building switched on a new light show with the capability to produce millions of color combinations and effects.   By Verena Dobnik

In the middle of the night, as most of New York slept, something big and bright lit up the Manhattan skyline for just seconds-a tightly kept secret to all but a handful of people. It was a tiny test for the huge public surprise four days later: the flipping of a switch at the Empire State Building to turn on its dancing new LED lights. They burst from the skyscraper while synchronized with R&B star Alicia Keys singing "Empire State of Mind" on nationwide radio.

The LED system has "16.7 million color possibilities, in digital combinations of ripples, sparkles, sweeps and strobes," says Phil O'Donnell, of Burlington, Mass.-based Philips Color Kinetics that's responsible for the system and worked with a resident lighting designer. "It's the sum of all possibilities - a huge palette." The old lights came in only 10 colors. From Manhattan and the Bronx to Staten Island and even New Jersey, "there were hundreds of thousands of people on the streets looking up, filming and videoing, clustered on street corners," when the new lights came on, said Anthony Malkin, whose family controls the iconic Art Deco building.

In an interview with The Associated Press at his office, he glowed with pleasure describing Monday night's inaugural light show. Keys also sang "Girl On Fire" from her new CD. After all, the 102-story skyscraper "has always been a symbol of what's possible in New York, and all the dreams that can come true in this city that never sleeps," Keys, a New York native, said before her performance, which was ready on tracks while she watched from a Manhattan studio. Malkin and his technical team wanted to test the new lighting system with as few people noticing as possible and chose early Thanksgiving morning. Good luck, in the middle of Manhattan, with people walking around even at 2:30 a.m. That seemed the best moment, after most bars close and before dawn. "We decided to do it facing west, in very short bursts between 2:30 a.m. and 3 a.m., because we knew we didn't have a camera trained on us from there," Malkin said. Apparently, the secret test worked. No images of the Empire State Building alight that night appeared anywhere, as far as Malkin knows. To stage the show, he worked with Clear Channel radio, which has 239 million monthly listeners in the United States.

The lights are part of a larger effort to modernize the 81-year-old edifice that is undergoing a more than half a billion-dollar renovation that includes making it "green." The computerized LED system will cut energy consumption by more than half, while delivering light and vibrancy superior to the old floodlights, which have huge timpani drum-size lenses that had to be changed every so often, O'Donnell said. They may still have nostalgic value to some who watched them light up New York City for every special occasion from Christmas to the Fourth of July.
They were part of "the grande dame of the New York skyline, now state-of-the-art, but still stately," says Malkin, adding that the light show was "a gift we gave to the world, these lights. We don't get paid for this." On a sunny Wednesday afternoon, with a spectacular view of the new World Trade Center and New York Harbor, a vacant space under reconstruction on the building's 72nd floor was filled with the retired floodlights, sitting side by side in long lines, veterans of years of New York weather. What will be done with them is also a secret - for now. One old light will not be discarded in favor of a 21st century novelty: a red beacon - "half the size of a Volkswagen Beetle," as Malkin puts it - that serves as a warning signal for aircraft constantly flying over New York City.

Figure C2. TOEFL Reading pre-test

SW and FS Language Study: TOEFL Reading Pre-Test Questions

Student Study ID _____

Date: _____   START Time: _____

Surprise! Empire State Building Switches to LED
by Verena Dobnik

Reading questions
Remember you can select your answer by filling in the circle next to your answer.

1. What is the primary purpose of the first sentence of the article?
   - ○ A. To explain that New Yorkers are commonly asleep in the middle of the night.
   - ○ B. To mislead readers into thinking the light flash was some sort of attack.
   - ○ C. To build suspense and curiosity so that the reader wants to know more".
   - ○ D. To suggest that there is a secret organization working late at night at the Empire State Building.

2. The phrase "huge palette" in Paragraph 3 is most likely
   - ○ A. A metaphor for the scope and range of combinations the new LED lights have.
   - ○ B. A literal explanation of the shape of the new lights, which form an artist's palette.
   - ○ C. An extreme over exaggeration meant to draw more onlookers to the new display.
   - ○ D. A way to emphasize the amount of lights, since 16.7 could never fit onto a palette.

3. What does Alicia Keys suggest the Empire State building is a symbol of?
   - ○ A. A way for Americans to have a landmark similar to other major global cities.
   - ○ B. The iconic American capacity to push boundaries and break new ground in art and architecture.
   - ○ C. Lights that are always on due to the number of New Yorkers who work night shifts.
   - ○ D. That any person can use the new lights as a way to make a wish, as people do with other world landmarks.

4. To help keep the new lights secret during their initial test, all precautions were taken EXCEPT:
   - ○ A. Conducting the test in the middle of the night.
   - ○ B. Conducting the test facing west, away from cameras.
   - ○ C. Conducting the test in short bursts, so that there was no sustained lighting.
   - ○ D. Conducting the test with additional sound effects to distract anyone who might be on the street.

5. What was the primary reason Malkin and his team chooses to test the new LED lights in the middle of the night?
   - ○ A. Because the lights are impossible to see in the daylight.
   - ○ B. So that no spies would be awake to steal the new lighting design.
   - ○ C. Because his team only works at night, to enhance their creativity.
   - ○ D. So that when they made the formal reveal to the city and world, it would be a true surprise.

Figure C2. TOEFL Reading pre-test

6. How does the new LED display contribute to the Empire State Building's efforts to become more "green"?
   - ○ A. The lights will be bright enough to reflect into the building, allowing less lighting to be used indoors.
   - ○ B. The new lighting will consume almost half the amount of energy the old lights did.
   - ○ C. The lights can become green in color, to cover the entire building.
   - ○ D. The lights will be solar-powered, generating their own electricity.

7. The article suggests that some older people might miss the old lights. Why is this?
   - ○ A. The elderly who have poorer eyesight have an easier time seeing the old lights.
   - ○ B. The older generation might not understand the technology behind the new LED lighting.
   - ○ C. Those who used to work in the Empire State Building will no longer be able to recognize it without the old, larger lights.
   - ○ D. The old lights represented momentous occasions in American history, and may still have nostalgic alue.

8. In the second-to-last paragraph, the old floodlights are described as "veterans." What is the most suitable explanation for this word in context?
   - ○ A. The old lights have worked through the years, despite harsh weather conditions and continual use for special occasions.
   - ○ B. The old lights have been up through many previous wars, making them literal veterans.
   - ○ C. The old lights were dedicated to the Empire State Building to memorialize war heroes.
   - ○ D. The old lights were only used before to celebrate Veteran's Day.

9. Currently, how many of the former lights are set to be preserved for a specific purpose?
   - ○ A. All, to replace other major lights around the city.
   - ○ B. None, they are all set to be discarded entirely.
   - ○ C. Five, spaced across Central Park for more light and better security.
   - ○ D. One, to serve as a warning beacon for aircraft.

10. Why might it be important for the Empire State's global image to replace its lighting?
   - ○ A. To represent that it is both environmentally conscious as well as technologically advanced.
   - ○ B. To prove that other world landmarks are not as spectacular.
   - ○ C. To suggest that despite its being decades-old, the Empire State Building is still relevant.
   - ○ D. To provide New Yorkers and visitors with better entertainment.

END Time _____

TOEFL Reading Pre-Test 2016v1

Appendix D

Figure D1. Computer screen – Welcome

Welcome to the SW and FS Language study!

There are four main sections to this study:
- I.   Training example
- II. Reading Summary
- III. Survey
- IV. Gift Card drawing

You have also been presented with a study packet to use as you go through these sections.
Thank you for participating in this exciting study.

So let's begin!

Move your cursor [I] over the NEXT PAGE button and press to click the mouse to begin.

NEXT PAGE

Figure D2. Computer screen – Introduction

Introduction

In your study packet will have 4 paper items:

    1. Example questions
    2. Study questions
    3. Survey
    4. Gift Card drawing

Before you begin, you will need to know how to move between the screens and how to use the tools that are available to you. On the bottom of each page you will find buttons. Clicking on these buttons will allow you to move between screens.

While reading on the computer, you will have a tool that will look up a definition for a word or phrase. This is done with a single click or double click of the mouse. You will also see in the reading text that some words and phrases are blue and underlined; this is to remind you of the tools that are available.

Are you ready? Let's PRACTICE in 4 easy steps:

    1. Open a link to a short summary.
    2. Practice the single click and double click tools.
    3. Read a short summary.
    4. Answer 4 multiple choice questions (on paper).

To begin click the NEXT PAGE button.

PREVIOUS PAGE   NEXT PAGE

Figure D3. Computer screen – Section I: Example

I. Example: Short Summary

Step 1. Click on this link to open a short summary.
Type in your **Study ID** for your name in the box located in the top left corner of the screen.
This is a summary that was written by D. Dieterich on a Ted Talk presentation that aired on September 2014 by Topher White.

What can save the rainforest? Your cell phone.

Step 2. Practice the SINGLE click and DOUBLE click tools.
While reading you can click on a word or phrase to see it's definition.
In this short summary, 2 items have been highlighted for you: **cacophony**   **in dire straits**

Click on these items or any word to see a definition. All words in this summary will allow you to use a single click or a double click. If you click on a word and only a blue box appear on the right; try to double click the word to see its definition.

Step 3. Read the short summary.
While reading, you are free to use the single click and double click tools to get a definition of a word or phrase.
When you want to sign on as a member of this study and CLOSE the reading screen you must - CLICK the **FINISHED READING** button located in the top, left hand corner of the screen. Please note: you can close the reading screen after step 3 or wait until you have finished step 4 below.

Step 4. Answer four questions.
Find your paper with the training questions. This paper will have 4 questions to answer based on your reading of the Ted Talk done by T. White: *What can save the rainforest? Your used cell phone.*

- Use a pencil to write your study name and the time on the top of your paper.
- Read each question and select your answer by filling in the circle next to your answer.
- When you are finished with the 4 questions return to this screen to click the NEXT PAGE button below.

PREVIOUS PAGE   NEXT PAGE

Figure D4. Computer screen – Congratulations: End of training

Congratulations you have now completed the training practice.

You are ready to begin your session. Move your mouse to the "START Session" button and click to begin.

PREVIOUS PAGE   START Session
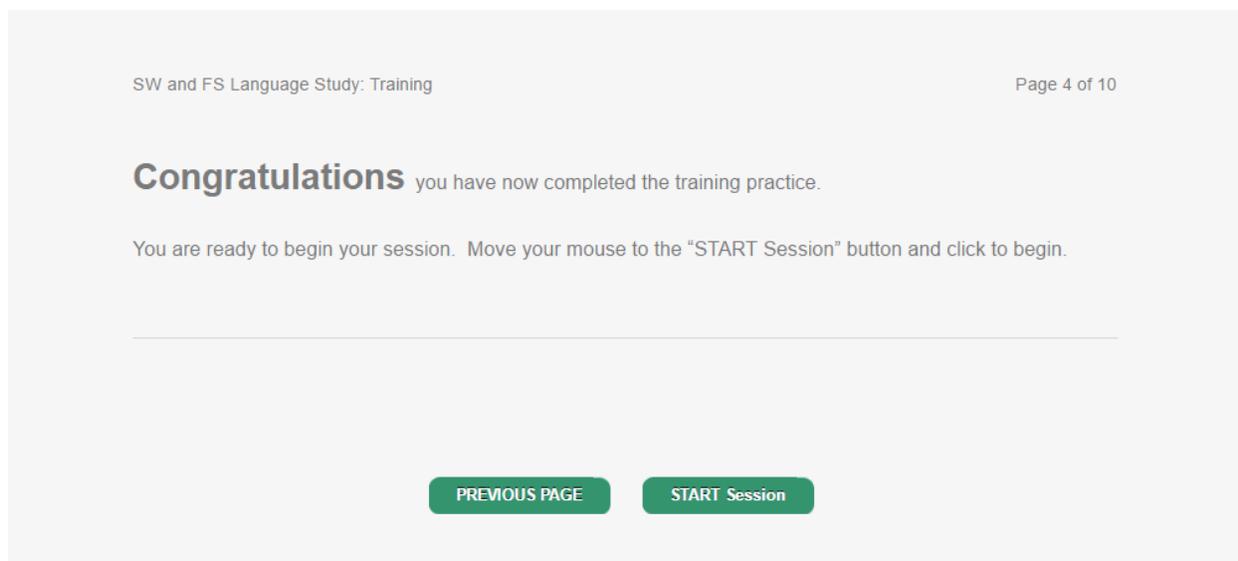
Figure D5. Computer screen – Section II: Instructions

II. Read a short summary and complete the reading questions.

This is just like the practice session you have just completed. You will:
1. Click on a link to open a screen with a short reading summary.
2. Read a short summary and use the look-up tools.
3. Answer 20 multiple choice questions (on paper).

Step 1. Click on the link to open the study summary.
This is a summary that was written by D. Dieterich on a PBS film T*he Brain with David Eagleman: What makes Me?* Once you have opened the reading screen, type in your **Study ID** for your name in the box located in the top left corner of the screen.

Step 2. Read the summary
Remember while reading, you can use the single click and double click tools to get a definition of any word or phrase.
To sign on as a member of this study and to CLOSE the reading screen you must CLICK the **FINISHED READING** button located in the top, left hand corner of the screen.   You are welcomed to close the reading screen before or after you do the questions.

To begin click the "Let's BEGIN" button.

Let's BEGIN

Figure D6. Computer screen – Reminder SPLASH screen

SW and FS Language Study

Remember you have the **SINGLE click** and the **DOUBLE click** tools to use while you read the text.

Click the button to open the summary now.

[The Brain with David Eagleman: What Makes Me?]

.

When you are done reading the text, return to this screen to click the Next Page button below. This button will take you to **Step 3. Answer 20 questions**.

[NEXT PAGE]
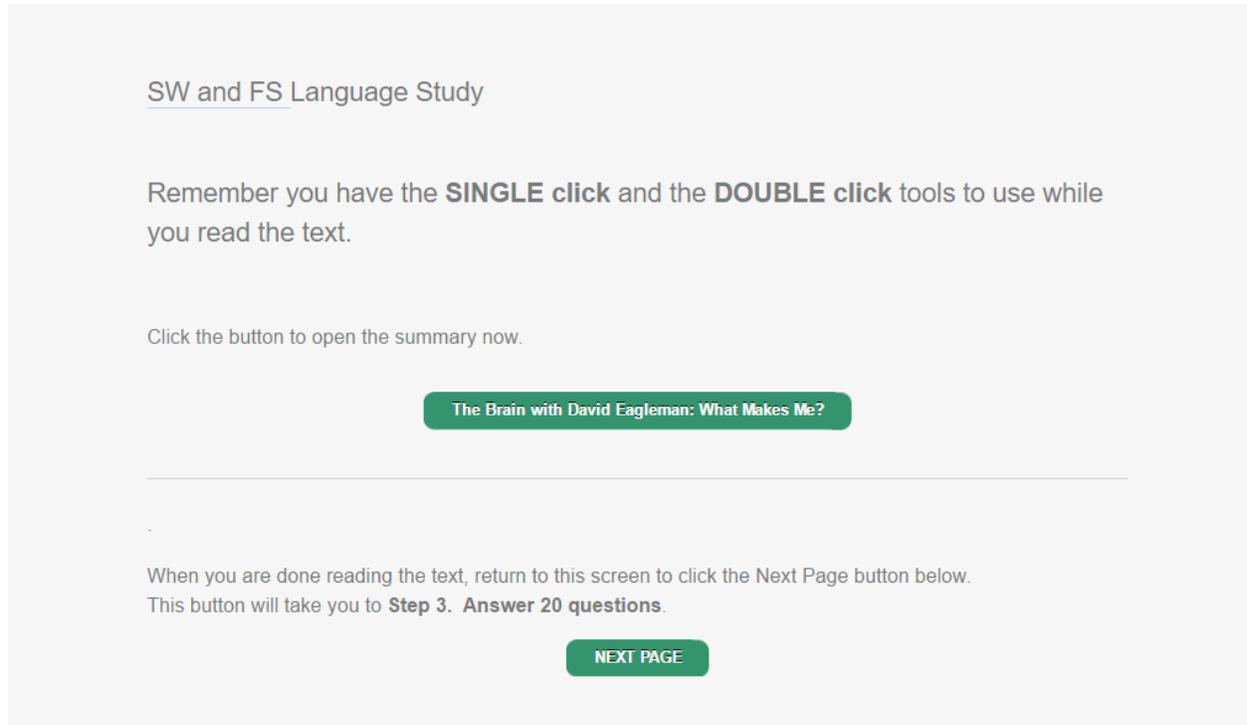
Figure D7. Computer screen – Answer questions

II. Read a short summary and complete the reading questions.

Step 3. Answer 20 questions

In your study packet, you will find 20 questions to answer based on your reading of the PBS film.
When you complete these questions please remember to:

   - Use a pencil to write your study name and the time on the top of your paper.
   - Read each question and select your answer by filling in the circle next to your answer

When you are finished with the questions return to this screen to click the NEXT PAGE button below.

NEXT PAGE

Figure D8. Computer screen – Section III: Survey

III. Survey.

Find and complete the paper labelled: SW and FS Language Study - 2016 Survey.

When you are finished with the survey return to this screen to click the NEXT PAGE button below.

NEXT PAGE

Figure D9. Computer screen – Section IV: Gift card drawing

IV. Gift Card Drawing.

The Gift Card Drawing form is located in your study packet. Complete this form to enter into the drawing. Please note that this is an optional step and winners will be notified by email.

I wish you good luck!

When you are finished with this form, return to this screen to click the NEXT PAGE button below.

NEXT PAGE

Figure D10. Computer screen – Thank You/Task completed

Thank you!

It is time to submit your study packet and sign out.
You have completed this study.

To end this computer session click the COMPLETED button below.

COMPLETED
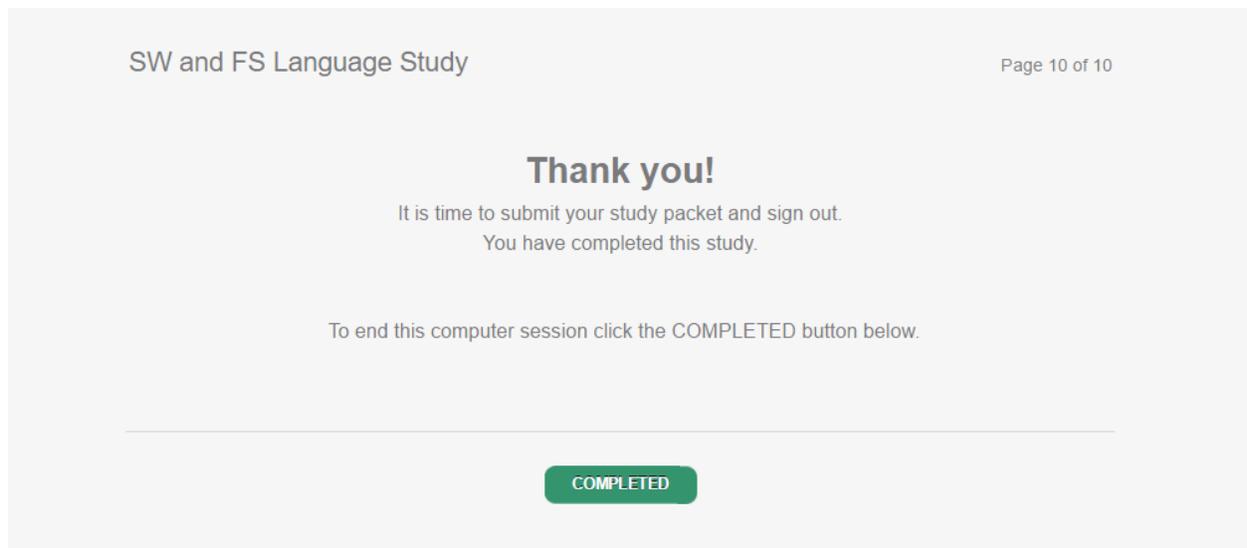
Appendix E

Figure E1. Example text

SW and FS Language Study: Example Short Summary

What can save the rainforest? Your used cell phone.

In September 2014, Topher White was filmed on Ted Talk (*What can save the rainforest? Your used cell phone).* On this occasion, Topher White introduces himself as an engineer who had an opportunity to visit a rainforest in Borneo. It is here that he discovered a forest filled with a "constant cacophony of noise". The noises of the rainforest came from the insects and the animals as you may expect. However, there were also sounds you may not expect, and that is the sound of chainsaws. In fact, it is this noise from the chainsaws that are the most difficult to hear.   These chainsaws cause the most suffering to the rainforest. T. White continued to say that he was able to learn that 90% of the logging in the rainforest is actually illegal. In addition, these criminal acts of cutting down large number of trees accounts for the second highest cause of greenhouse gases.

So what can be done? The problems facing the rainforests have put us all in dire straits and they are not simply going to disappear. With this realization, T. White explains that he knew the solution for this problem had to be "simple and scalable"**.** After seeing what was already in the rainforest, he soon discovered that it had cell phone reception. Yes, your cell phone … that small hand held device you use every day can work well in the rainforest. With a little engineering, T. White was able to combine old unwanted cell phones into a new tool that could be hung in the trees of the rainforest. These renewed cell phones would then listen for the sounds of a chainsaw. When the chainsaw sound is heard, a warning would go out to the people who are already working in the rainforest. In fact, T. White was able to put his invention to the test, which was found to be successful. With the help of T. White, we now have one tool that can provide a means to find and stop illegal logging in real time. So, you can be like others and stop throwing your old cell phone in the trash. Instead, give it a new purpose; to help save the rainforest against illegal logging. For as the old saying goes, one man's trash is another man's treasure.

Figure E2. Example coded text

SW and FS Language Study: Example Short Summary
<p>
*
*
<h3 align=center>What can save the rainforest? Your used <A
HREF=http://dictionary.cambridge.org/us/dictionary/learner-english/cell-phone
onclick=recordit('cell_phone') target=concFrame style=text-
decoration:none;color:inherit >cell phone</A>.
</h3 align=center>
<p>
In September 2014, Topher White was filmed on Ted Talk (*What can save the
rainforest? Your used* <A HREF=http://dictionary.cambridge.org/us/dictionary/learner-
english/cell-phone onclick=recordit('cell_phone') target=concFrame style=text-
decoration:none;color:inherit >cell phone</A>*).* On this occasion, Topher White
introduces himself as an engineer who had an opportunity to visit a rainforest in
Borneo. It is here that he discovered a forest filled with a "constant <A
HREF=http://dictionary.cambridge.org/us/dictionary/learner-english/cacophony
onclick=recordit('cacophony') target=concFrame>cacophony</A> of noise". The
noises of the rainforest came from the insects and the animals as you may expect.
However, there were also sounds you may not expect, and that is the sound of <A
HREF=http://dictionary.cambridge.org/us/dictionary/english/chainsaw?fallbackFrom=le
arner-english onclick=recordit('chainsaws') target=concFrame style=text-
decoration:none;color:inherit >chainsaws</A>. In fact, it is this noise from the <A
HREF=http://dictionary.cambridge.org/us/dictionary/english/chainsaw?fallbackFrom=le
arner-english onclick=recordit('chainsaws') target=concFrame style=text-
decoration:none;color:inherit >chainsaws</A> that are the most difficult to hear.
These <A
HREF=http://dictionary.cambridge.org/us/dictionary/english/chainsaw?fallbackFrom=le
arner-english onclick=recordit('chainsaws') target=concFrame style=text-
decoration:none;color:inherit >chainsaws</A> cause the most suffering to the
rainforest. T. White continued to say that he was able to learn that <A
HREF=http://www.wordreference.com/definition/ninety
onclick=recordit('90') target=concFrame style=text-decoration:none;color:inherit
>90</A><A HREF=http://www.wordreference.com/definition/percent
onclick=recordit('%') target=concFrame style=text-decoration:none;color:inherit
>%</A> of the logging in the rainforest is actually illegal. In addition, these criminal
acts of cutting down large number of trees accounts for the second highest cause of <A
HREF=http://www.wordreference.com/definition/greenhouse%20gas
onclick=recordit('greenhouse_gases') target=concFrame style=text-
decoration:none;color:inherit >greenhouse gases</A>.

<p>
<p>
So what can be done? The problems facing the rainforests have put us all <A
HREF=http://dictionary.cambridge.org/us/dictionary/english/in-dire-straits
onclick=recordit('in_dire_straits') target=concFrame>in dire straits</A> and they are not
simply going to disappear. With this realization, T. White explains that he knew the
solution for this problem had to be "simple and scalable".   After seeing what was
already in the rainforest, he soon discovered that it had <A
HREF=http://dictionary.cambridge.org/us/dictionary/learner-english/cell-phone
onclick=recordit('cell_phone') target=concFrame style=text-
decoration:none;color:inherit >cell phone</A> reception. Yes, your <A
HREF=http://dictionary.cambridge.org/us/dictionary/learner-english/cell-phone
onclick=recordit('cell_phone') target=concFrame style=text-
decoration:none;color:inherit >cell phone</A>… that small hand held device you use
every day can work well in the rainforest. With a little engineering, T. White was able
to combine old <A HREF=http://dictionary.cambridge.org/us/dictionary/learner-
english/unwanted onclick=recordit('unwanted') target=concFrame style=text-
decoration:none;color:inherit >unwanted</A> <A
HREF=http://dictionary.cambridge.org/us/dictionary/learner-english/cell-phone
onclick=recordit('cell_phones') target=concFrame style=text-
decoration:none;color:inherit >cell phones</A> into a new tool that could be hung in the
trees of the rainforest. These renewed <A
HREF=http://dictionary.cambridge.org/us/dictionary/learner-english/cell-phone
onclick=recordit('cell_phones') target=concFrame style=text-
decoration:none;color:inherit >cell phones</A> would then listen for the sounds of a <A
HREF=http://dictionary.cambridge.org/us/dictionary/english/chainsaw?fallbackFrom=le
arner-english onclick=recordit('chainsaw') target=concFrame style=text-
decoration:none;color:inherit >chainsaw</A>. When the <A
HREF=http://dictionary.cambridge.org/us/dictionary/english/chainsaw?fallbackFrom=le
arner-english onclick=recordit('chainsaw') target=concFrame style=text-
decoration:none;color:inherit >chainsaw</A> sound is heard, a warning would go out to
the people who are already working in the rainforest. In fact, T. White was able to put
his invention to the test, which was found to be successful. With the help of T. White,
we now have one tool that can provide a means to find and stop illegal logging in real
time. So, you can be like others and stop throwing your old <A
HREF=http://dictionary.cambridge.org/us/dictionary/learner-english/cell-phone
onclick=recordit('cell_phone') target=concFrame style=text-
decoration:none;color:inherit >cell phone</A> in the trash. Instead, give it a new
purpose; to help save the rainforest against illegal logging. For as the old saying goes,
<A

HREF=http://idioms.thefreedictionary.com/One+man's+trash+is+another+man's+treasure onclick=recordit('one_man's_trash_is_another_man's_treasure') target=concFrame style=text-decoration:none;color:inherit > one man's trash is another man's treasure</A>.
<p>

Figure E3. Lextutor.ca screen shot of example text

Figure E4: Lextutor.ca screen shot of example text after clicking on a target

Figure E5. Example test (version 1) with answer key

SW and FS Language Study: Example Questions

Student Study ID _____

Date: _____   START Time: _____

What can save the rainforest? Your used cell phone.

Step 3. Example questions
Remember you can select your answer by filling in the circle next to your answer.

1. Topher White describes the noises of the rainforest as _____
   ○ A. loud and filled with many sounds
   ○ B. simple and just loud
   ○ C. noises in a zoo with a cell phone
   ○ D. a symphony of noises.

2. The act of cutting down of a large number of trees in the rainforests can add _____
   ○ A. to the poor quality of our atmosphere.
   ○ B. to poor oxygen levels and cleans the air.
   ○ C. to life on earth and makes our world more green.
   ○ D. a gas to enrich the air we breathe.

3. The problems facing the rainforest today are _____
   ○ A. not a problem if we can all work together.
   ○ B. based on the shape of the land itself.
   ○ C. both very bad and difficult to solve.
   ○ D. costly and they cannot be solved with current technology.

4. The solution to unlawful logging in the rainforest must be simple and be _____
   ○ A. measured in kilometers.
   ○ B. weighed against the harmful effects of doing nothing.
   ○ C. done with great care that works in warm climate.
   ○ D. matched in size.

Once you have completed these questions return to the the training session
and click the NEXT PAGE button.

END Time _____

Training Example Questions 2016v1

Answer Key: 1. A   2. A   3. C   4. D
Targets: cacophony   greenhouse gases   in dire straits   scalable

Figure E6. Assignment of test questions to targets in the example text

Note: all targets (SW and FS) are presented here with a gray highlight along with the salient targets shown in a blue, underlined text.

Written text	Comprehension questions
What can save the rainforest? Your used cell phone. In September 2014, Topher White was filmed on Ted Talk (*What can save the rainforest? Your used cell phone).* On this occasion, Topher White introduces himself as an engineer who had an opportunity to visit a rainforest in Borneo. It is here that he discovered a forest filled with a "constant cacophony of noise". The noises of the rainforest came from the insects and the animals as you may expect.	1. Topher White describes the noises of the rainforest as _____ A. loud and filled with many sounds. B. simple and just loud. C. noises in a zoo with a cell phone. D. a symphony of noises.
However, there were also sounds you may not expect, and that is the sound of chainsaws. In fact, it is this noise from the chainsaws that are the most difficult to hear. These chainsaws cause the most suffering to the rainforest. T. White continued to say that he was able to learn that 90% of the logging in the rainforest is actually illegal. In addition, these criminal acts of cutting down large number of trees accounts for the second highest cause of greenhouse gases.	2. The act of cutting down of a large number of trees in the rainforests can add _____ A. to the poor quality of our atmosphere. B. to poor oxygen levels and cleans the air. C. to life on earth and makes our world more green. D. a gas to enrich the air we breathe.

So what can be done? The problems facing the rainforests have put us all in dire straits and they are not simply going to disappear.

3. The problems facing the rainforest today are _____

A. not a problem if we can all work together.

B. based on the shape of the land itself.

C. both very bad and difficult to solve.

D. costly and they cannot be solved with current technology.

With this realization, T. White explains that he knew the solution for this problem had to be "simple and scalable".   After seeing what was already in the rainforest, he soon discovered that it had cell phone reception. Yes, your cell phone … that small hand held device you use every day can work well in the rainforest. With a little engineering, T. White was able to combine old unwanted cell phones into a new tool that could be hung in the trees of the rainforest. These renewed cell phones would then listen for the sounds of a chainsaw. When the chainsaw sound is heard, a warning would go out to the people who are already working in the rainforest. In fact, T. White was able to put his invention to the test, which was found to be successful. With the help of T. White, we now have one tool that can provide a means to find and stop illegal logging in real time. So, you can be like others and stop throwing your old cell phone in the trash. Instead, give it a new purpose; to help save the rainforest against illegal logging. For as the old saying goes, one man's trash is another man's treasure.

4. The solution to unlawful logging in the rainforest must be simple and be _____

A. measured in kilometers.

B. weighed against the harmful effects of doing nothing.

C. done with great care that works in warm climate.

D. matched in size.

Appendix F

Figure F1. A list of targets that appear in the reading passage text

This is a list of target SW and FS as they are presented in regards to saliency and the order of which they occur in the reading of the passage.

1. silver tongued

2. pile up

3. expatiate

4. moderate

5. carry out

6. do away with

7. determine

8. consequence

9. put off

10. over the top

11. outweigh

12. perspicacity

13. ongoing

14. put up with

15. disrupt

16. have an inkling of

17. concede

18. cutout

19. obviated

20. catch on to

Figure F2. Reading passage text

SW and FS Language Study: Short Summary

The Brain with David Eagleman: What Makes Me?

A PBS film made for public viewing on October 21, 2015

Who are we? What makes you a person? Where do our thoughts, ideals, or even our personality, come from? These are the questions presented by David Eagleman in the PBS film titled: The Brain with David Eagleman: What Makes Me? It is clear that some people are kind, while others are musical, and still others may have the gift of a silver tongue. The facts have begun to pile up and what we have discovered is that who we are, comes from our brains. How we think, is the result of a 3 pound organ, the human brain. The human brain allows us to discover our world and what begins to define who we are. At birth, the brain is made of cells. The cells are the smallest specialized units that make up any organ. Neurons however, are cells in the brain, that make connections between cells sending signals at a rate of a trillion per second. You do not need to expatiate to understand that the brain cells, neurons, and the use of memory, are what allow us to think, give meaning to objects, and to moderate our environment. Unlike other animals, the human brain is different, and it is with both disadvantages and advantages. One disadvantage of the human brain is that, as babies, each of us is completely dependent on our environment. This dependency is not so for other animals as seen in baby dolphins who swim, zebras who run, and giraffes who stand. When it comes to the advantages of the human brain, we have the ability to learn languages, carry out expressions with our face, and most importantly, change to meet the needs of the world around us. In fact by the age of 2, the human brain will simply do away with neurons that are determined to be unnecessary. Then by the age of 5, our brain will have become developed, giving us what is needed to live out the rest of our lives.

In this PBS film, Dr. David Eagleman discusses the human brain, and how our experiences shape our brain. The human brain supports and cultivates our need to know and understand our environment. With touch and love we are driven to search out and learn about our world. However, if at birth a child faces neglect and lacks objects to encourage curiosity, this too will create an environment that will determine one's future; and these early years will come to serve as a consequence. Dr. Eagleman explains further that both environment and genetics (Genetics is the field of science that looks at the characteristics passed down from parents to children) gives the brain the ability to shape each one of us into someone who is like no other. By the time a person becomes a teenager, between the ages of 13-19 years old; our brain is kept very busy continuously working and running connections. At the age of 15, our feelings are also running at full speed and the prefrontal cortex, the part of the brain responsible for feelings and beliefs of "self", cannot be put off. In fact, the behaviors of teenagers are often seen as over the top in social events when risks outweigh reason. It is not until we reach our early 20's that our behavior change again and we are able to reach a level of common sense and understanding.

In the beginning, scientific exploration of the brain believed with perspicacity, that the brain's level of plasticity or ability to change comes to an end as we grow old. Our brains are no longer able to experience ongoing change and our ability to learn would become subject to growing old, disease, and medicine. Older people would have to simply put up with a poor memory that may disrupt their daily lives. Recent brain research however has discovered that the brain of older people, actually do keep its ability to change. These studies have revealed that we did not have an inkling of what was actually taking place in the human brain. It is now believed that the brain's limited number of neurons is guided by the work of the hippocampus. The hippocampus is a small part of the brain that replays a memory until it becomes, fixed and the information can be available as needed. As memories fade over time, it is the result of neurons being wiped clean so they can become new memories. This is observed when we remember events differently over time. For example, the memories a child who is going to school for the first time, is excited and sees their new classroom for the first

time. This classroom would appear to be a room of immense size, with endless possibilities, filled with desks, books, and posters. However, when this same person returns, many years later as a grown-up, they may now see their first classroom very differently. In fact, they may need to concede and truly see the classroom for what it really is compared to their own childhood memories. Even with limitations to our memory, it is an important part of our personality and it simply cannot be cut out. It is memory and our connected meanings that make up who we are.

Each person is a one of a kind. Each of us has our own wiring of connections that are the result of our personal experiences as we live within our world. The human brain, with its neurons, has not obviated humans' ability to change, give meaning, and with memory explore the world; to discover who we are. As a human you need to experience and catch on to the events that are taking place all around us. We may be dependent on others at birth, however it is with love, family, friends, and our many experiences that frames and shapes us into a person. Dr. Eagleman concludes that the brain is indeed a mysterious organ and "from the cradle to the grave, we are works in progress".

Figure F3. Reading passage text & test statistics – Vocabulary profile

Reading Passage ONLY

Frequency Level	FAMILIES (%)	TYPES (%)	TOKENS (%)	Cumulative token (%)
K-1 Words	211 (80.84)	274 (75.69)	854 (84.98)	84.98
K-2 Words	40 (15.33)	45 (12.43)	80 (7.96)	92.94
AWL	10 (3.83)	10 (2.76)	14 (1.39)	94.33
OFF-List	??	32 (8.84)	57 (5.67)	100.00
TOTAL (unrounded)	261+?	362 (100)	1,005 (100)	≈100.00

Offlist: [?:types 32: tokens57]
cells, classroom, concede, cortex, cradle, david, dependency, disrupt, dolphins, Eagleman, expatiate, fs, genetics, giraffes, hippocampus, inkling, neurons, obviated, outweigh, pbs, personality, perspicacity, plasticity, prefrontal, sw, teenager, teenagers, trillion, zebras

Note: lexical units highlighted in blue, underlined text are targets used in this study.

Passage Questions ONLY (TEST)

Frequency Level	FAMILIES (%)	TYPES (%)	TOKENS (%)	Cumulative token (%)
K-1 Words	204 (81.93)	250 (79.11)	621 (86.25)	86.25
K-2 Words	28 (11.24)	30 (9.49)	47 (6.53)	92.78
AWL	17 (6.83)	18 (5.70)	23 (3.19)	95.97
OFF-List	??	19 (6.01)	29 (4.03)	100.00
TOTAL (unrounded)	249+?	316 (100)	720 (100)	≈100.00

Offlist: [?:types 19: tokens 29]
cells, click, cute, david, Eagleman, emotions, fs, id, jewelry, modernize, neurons, numbervnumber, obsolete, overly, sw, teenagers

Note: "numbervnumber" is the reference used for the version of the test notation: 2016v1

Note: These text statistics are obtained by using the online tool: VocabProfilers that is found at www.Lextutor.ca

Figure F4. Reading Passage Text & test statistics – Readability Measures

Text Statistics	Reading Passage ONLY	Test ONLY
Character Count	4,496	3,363
Syllable count	1,497	1,159
Word Count	1,018	803
Sentence Count	55	209
Character Per Word	4.4	4.2
Syllables per Word	1.5	1.4
Words per Sentence	18.5	3.8
Average Grade Level	10.2	4.5
Flesch-Kincaid Reading Ease	64.4	88.5

Note: These text statistics using the online tool Readable.io that is found at
https://readable.io/text/

Figure F5. Reading passage coded text

SW and FS Language Study: Short Summary
<p>
*
*
<h3 align=center>
The Brain with David Eagleman: What Makes Me?
</h3 align=center>
<p>
<center>
A PBS film made for public viewing on October 21, 2015
</center><p>
<p>
Who are we? What makes you a person? Where do our thoughts, ideals, or even our personality come from? These are the questions presented by Dr. David Eagleman in the PBS film titled: *The Brain with David Eagleman: What Makes Me?* It is clear that some people are kind, some are musical, and still others may have the gift of a <A HREF= http://dictionary.cambridge.org/dictionary/english/silver-tongued onclick=recordit('silver_tongue') target=concFrame style=text-decoration:none;color:inherit >silver tongue</A>. The facts have begun to <A HREF=http://dictionary.cambridge.org/us/dictionary/learner-english/pile-sth-up onclick=recordit('pile_up') target=concFrame>pile up</A> and what we have discovered is that who we are, comes from our brains. How we think, is the result of a <A HREF=http://www.wordreference.com/definition/three onclick=recordit('3') target=concFrame style=text-decoration:none;color:inherit >3</A> pound organ, the human brain. The human brain allows us to discover our world and what begins to define who we are. At birth, the brain is made of cells. The cells are the smallest specialized units that make up any organ. Neurons however, are cells in the brain, that make connections between cells sending signals at a rate of a trillion per second. You do not need to <A HREF= http://dictionary.cambridge.org/dictionary/english/expatiate onclick=recordit('expatiate') target=concFrame style=text-decoration:none;color:inherit >expatiate</A> to understand that the brain cells, neurons, and the use of memory, are what allow us to think, give meaning to objects, and to <A HREF=http://dictionary.cambridge.org/us/dictionary/learner-english/moderate onclick=recordit('moderate') target=concFrame>moderate</A> our environment. Unlike other animals, the human brain is different, and it is with both disadvantages and advantages. One disadvantage of the human brain is that, as babies, each of us is completely dependent on our environment. This dependency is not so for others animals as seen in baby dolphins who swim, zebras who run, and giraffes who stand. When it comes to the advantages of the human brain, we have the ability to learn languages, <A HREF= http://dictionary.cambridge.org/dictionary/english/carry-sth-out?q=carry+out onclick=recordit('carry_out') target=concFrame style=text-decoration:none;color:inherit >carry out</A> expressions with our face, and most importantly, change to meet the needs of the world around us. In fact by the age of <A

HREF=http://www.wordreference.com/definition/two
onclick=recordit('2') target=concFrame style=text-decoration:none;color:inherit >2</A>,
the human brain will simply <A
HREF=http://dictionary.cambridge.org/us/dictionary/learner-english/do-away-with-
sth?q=do+away+with onclick=recordit('do_away_with') target=concFrame>do away
with</A> neurons that are determined to be unnecessary. Then by the age of <A
HREF=http://www.wordreference.com/definition/five
onclick=recordit('5') target=concFrame style=text-decoration:none;color:inherit >5</A>,
our brain will have become developed, giving us what is needed to live out the rest of
our lives.
<p>
<p>
In this PBS film, Dr. David Eagleman discusses the human brain, and how our
experiences shape our brain.   The human brain supports and cultivates our need to
know and understand our environment. With touch and love we are driven to search
out and learn about our world. However, if at birth a child faces neglect and lacks
objects to encourage curiosity, this too will create an environment that will <A HREF=
http://dictionary.cambridge.org/dictionary/english/determine
onclick=recordit('determine') target=concFrame style=text-decoration:none;color:inherit
>determine</A> <A HREF=http://www.wordreference.com/definition/one
onclick=recordit('one's') target=concFrame style=text-decoration:none;color:inherit
>one's</A> future; and these early years will come to serve as a <A
HREF=http://dictionary.cambridge.org/us/dictionary/learner-english/consequence
onclick=recordit('consequence') target=concFrame>consequence</A>. Dr. Eagleman
explains further that both environment and genetics (Genetics is the field of science
that looks at the characteristics passed down from parents to children) gives the brain
the ability to shape each one of us into someone who is like no other. By the time a
person becomes a teenager, between the ages of <A
HREF=http://www.wordreference.com/definition/thirteen
onclick=recordit('13') target=concFrame style=text-decoration:none;color:inherit
>13</A> - <A HREF=http://www.wordreference.com/definition/nineteen
onclick=recordit('19') target=concFrame style=text-decoration:none;color:inherit
>19</A> years old; our brain is kept very busy continuously working and running
connections. At the age of <A HREF=http://www.wordreference.com/definition/fifteen
onclick=recordit('15') target=concFrame style=text-decoration:none;color:inherit
>15</A>, our feelings are also running at full speed and the prefrontal cortex, the part
of the brain responsible for feelings and beliefs of "self", cannot be <A HREF=
http://dictionary.cambridge.org/dictionary/english/put-sth-off?q=put+off
onclick=recordit('put_off') target=concFrame style=text-decoration:none;color:inherit
>put off</A>. In fact, the behaviors of teenagers are often seen as <A
HREF=http://dictionary.cambridge.org/us/dictionary/learner-english/over-the-top
onclick=recordit('over_the_top') target=concFrame>over the top</A> in social events
when risks <A HREF= http://dictionary.cambridge.org/dictionary/english/outweigh
onclick=recordit('outweigh') target=concFrame style=text-decoration:none;color:inherit
>outweigh</A> reason. It is not until we reach our early <A
HREF=http://www.wordreference.com/definition/twenties

onclick=recordit('20's') target=concFrame style=text-decoration:none;color:inherit
>20's</A> that our behavior change again and we are able to reach a level of common
sense and understanding.
<p>
<p>
In the beginning, scientific exploration of the brain believed with <A
HREF=http://dictionary.cambridge.org/dictionary/english/perspicacity?fallbackFrom=lea
rner-english onclick=recordit('perspicacity') target=concFrame>perspicacity</A>, that
the <A HREF=http://www.wordreference.com/definition/brain
onclick=recordit('brain's') target=concFrame style=text-decoration:none;color:inherit
>brain's</A> level of plasticity or ability to change comes to an end as we grow old.
Our brains are no longer able to experience <A HREF=
http://dictionary.cambridge.org/dictionary/english/ongoing
onclick=recordit('ongoing') target=concFrame style=text-decoration:none;color:inherit
>ongoing</A> change and our ability to learn would become subject to growing old,
disease, and medicine. Older people would have to simply <A
HREF=http://dictionary.cambridge.org/us/dictionary/learner-english/put-up-with-sb-
sth?q=put+up+with onclick=recordit('put_up_with') target=concFrame>put up with</A>
a poor memory that may <A HREF=
http://dictionary.cambridge.org/dictionary/english/disrupt
onclick=recordit('disrupt') target=concFrame style=text-decoration:none;color:inherit
>disrupt</A> their daily lives. Recent brain research however has discovered that the
brain of older people, actually do keep its ability to change. These studies have
revealed that we did not <A
HREF=http://dictionary.cambridge.org/us/dictionary/learner-
english/inkling?q=have+an+inkling
onclick=recordit('have_an_inkling_of') target=concFrame>have an inkling of</A> what
was actually taking place in the human brain. It is now believed that the brain's limited
number of neurons is guided by the work of the hippocampus. The hippocampus is a
small part of the brain that replays a memory until it becomes, fixed and the information
can be available as needed. As memories fade over time, it is the result of neurons
being wiped clean so they can become new memories. This is observed when we
remember events differently over time. For example, the memories a child, who is
going to school for the first time, is excited and sees their new classroom for the first
time. This classroom would appear to be a room of immense size, with endless
possibilities, filled with desks, books, and posters. However, when this same person
returns, many years later as a <A
HREF=http://www.wordreference.com/definition/grown-up onclick=recordit('grown-
up') target=concFrame style=text-decoration:none;color:inherit >grown-up</A>, they
may now see their first classroom very differently. In fact, they may need to <A
HREF=http://dictionary.cambridge.org/us/dictionary/learner-english/concede
onclick=recordit('concede') target=concFrame>concede</A> and truly see their
classroom for what it really is compared to their own childhood memories. Even with
limitations to our memory, it is an important part of our personality and it simply cannot
be <A HREF= http://dictionary.cambridge.org/dictionary/english/cut-out

onclick=recordit('cut_out') target=concFrame style=text-decoration:none;color:inherit
>cut out</A>. It is memory and our connected meanings that make up who we are.
<p>
<p>
Each person is one of a kind. Each of us has our own wiring of connections that are
the result of our personal experiences as we live within our world. The human brain,
with its neurons, has not <A
HREF=http://dictionary.cambridge.org/us/dictionary/english/obviate?fallbackFrom=lear
ner-english&q=obviated onclick=recordit('obviated') target=concFrame>obviated</A>
humans' ability to change, give meaning, and with memory explore the world; to
discover who we are. As a human we need to experience and <A HREF=
http://dictionary.cambridge.org/dictionary/english/catch-on
onclick=recordit('catch_on_to') target=concFrame style=text-
decoration:none;color:inherit >catch on to</A> the events that are taking place all
around us. We may be dependent on others at birth, however it is with love, family,
friends, and our many experiences that frames and shapes us into a person. Dr.
Eagleman concludes that the brain is indeed a mysterious organ and "from the cradle
to the grave, we are works in progress".
<p>

Figure F6. Lextutor.ca partial screen shot with reading passage text

Figure F7. Reading passage test (version 1)

Student Study ID _____

Date: _____   START Time: _____

The Brain with David Eagleman: What Makes Me?

Reading questions
Remember you can select your answer by filling in the circle next to your answer.

1. This summary talks about how every person is special. One example, is that some people are good in giving _____
   - ○ A. a speech.
   - ○ B. silver jewelry.
   - ○ C. small meals.
   - ○ D. gifts.

2. Facts that look at "who we are" as a person has been _____
   - ○ A. proving to be up and down.
   - ○ B. adding up to 3 pounds.
   - ○ C. increasing in quantity.
   - ○ D. creating small hills.

3. To understand the human brain you must be able to _____
   - ○ A. read the words of many experts in the field.
   - ○ B. exercise and review written brain signals.
   - ○ C. listen to the experiences of a few people.
   - ○ D. speak or write general concepts.

4. The connections between cells make it possible to give meaning to objects, and to _____
   - ○ A. modernize our world.
   - ○ B. rate objects by size.
   - ○ C. apply control.
   - ○ D. keep tradition.

5. Even as babies, the human brain gives us an advantage to learn a language and faces to _____
   - ○ A. experience talking outside.
   - ○ B. hold items close to us.
   - ○ C. show emotions.
   - ○ D. swim, run, or stand.

Figure F7. Reading passage test (version 1)

6. By age 2, brain cells called neurons are _____
   - O A. slowing down in the number of new cells.
   - O B. destroying cells.
   - O C. only moving cells around as needed.
   - O D. no longer changing in number.

7. The environment and the human brain _____
   - O A. forces us to see good and bad in the future.
   - O B. are connected; good or bad.
   - O C. are not an influencing factor for the future.
   - O D. prevents future inequality.

8. In regards to our brains, the early years serves as _____
   - O A. having a positive impact for one's future.
   - O B. a set sequence from the age of 2.
   - O C. no influencing factor for the future.
   - O D. the result of what we experience from day 1.

9. As teenagers, the human brain remains mysterious, and our emotions can _____
   - O A. be put aside as we continue to learn.
   - O B. not be seen as being important.
   - O C. be placed under control with our feelings.
   - O D. not be put aside with reason.

10. In social events, the behaviors of teenagers tend to be _____
   - O A. suitable.
   - O B. overly simple.
   - O C. top heavy.
   - O D. extreme.

11. Between the ages of 13-19 years of age our brain can _____
   - O A. reach a level of common sense and understanding.
   - O B. become over powered by feelings.
   - O C. feel the equal weight of reasoning and understanding.
   - O D. consider risks and reason equally.

12. In the beginning, the study of the brain was believed to be _____
   - O A. easily understood.
   - O B. unknown and complicated.
   - O C. personal.
   - O D. simple and dull.

Figure F7. Reading passage test (version 1)

SW and FS Language Study: Reading Questions Continued

Student Study ID _____

13. Originally, research had believed that the brain was _____
   - ○ A. not able to change throughout one's life.
   - ○ B. not connected to change.
   - ○ C. able to be turned on and off.
   - ○ D. able to change throughout one's life.

14. In early brain research, it was believed that as we age the changes in the human brain requires us to _____
   - ○ A. keep our memories based on time.
   - ○ B. accept a loss in memories.
   - ○ C. place memories in order from poor to good.
   - ○ D. put up memories based on needs.

15. In early brain research, our findings showed that poor memories of older people _____
   - ○ A. calms the lives of the young.
   - ○ B. provide a sense of order.
   - ○ C. does not disturb anything at all.
   - ○ D. can stop and change everyday life.

16. Today's brain research has shown that our early research was _____
   - ○ A. known and written in stone.
   - ○ B. required a small amount of ink.
   - ○ C. largely unknown.
   - ○ D. written without ink.

17. When we can compare old childhood memories to today we may _____
   - ○ A. need to admit that our first memories may not be true.
   - ○ B. see that our first memories are truly special.
   - ○ C. see into our consciousness.
   - ○ D. be able to see new and old ideas as one.

18. Memories are a part of who we are as a person and they can _____
   - ○ A. be cut and shaped with scissors.
   - ○ B. not be removed or changed.
   - ○ C. not be changed so they become cute.
   - ○ D. be changed as we see fit.

Figure F7. Reading passage test (version 1)

19. Each person is a one of a kind and our brain has determined our <u>ability to change</u> as _____
     ○ A. necessary.
     ○ B. independent.
     ○ C. variable.
     ○ D. obsolete.

20. Humans are like no other for we have been able to _____
     ○ A. see the cause and effect of our actions.
     ○ B. experience and fish for new ideas.
     ○ C. allows people to talk without understanding.
     ○ D. quickly understand our changing world.

You have completed the questions.

It is now time to return to the computer screen to click the DONE button.

END Time _____

Figure F8. Assignment of test questions to targets in the reading passage text

Note: all targets (SW and FS) are presented here with a gray highlight along with the salient targets shown in a blue, underlined text.

Written text	Comprehension questions
The Brain with David Eagleman: What Makes Me? A PBS film made for public viewing on October 21, 2015 Who are we? What makes you a person? Where do our thoughts, ideals, or even our personality, come from? These are the questions presented by David Eagleman in the PBS film titled: The Brain with David Eagleman: What Makes Me? It is clear that some people are kind, while others are musical, and still others may have the gift of a silver tongue.	1. This summary talks about how every person is special. One example, is that some people are good in giving _____ A. a speech. B. silver jewelry. C. small meals. D. gifts.
The facts have begun to pile up and what we have discovered is that who we are, comes from our brains. How we think, is the result of a 3 pound organ, the human brain. The human brain allows us to discover our world and what begins to define who we are. At birth, the brain is made of cells. The cells are the smallest specialized units that make up any organ. Neurons however, are cells in the brain, that make connections between cells sending signals at a rate of a trillion per second.	2. Facts that look at "who we are" as a person has been _____ A. proving to be up and down. B. adding up to 3 pounds. C. increasing in quantity. D. creating small hills.

You do not need to expatiate to understand that the brain cells, neurons, and the use of memory, are what allow us to think, give meaning to objects, and to moderate our environment.

3. To understand the human brain you must be able to _____

   A. read the words of many experts in the field.

   B. exercise, and review written brain signals.

   C. listen to the experiences of a few people.

   D. speak or write the general concepts.

4. The connections between cells make it possible to give meaning to objects, and to _____

   A. modernize our world.

   B. rate objects by size.

   C. apply control.

   D. keep tradition.

Unlike other animals, the human brain is different, and it is with both disadvantages and advantages. One disadvantage of the human brain is that, as babies, each of us is completely dependent on our environment. This dependency is not so for other animals as seen in baby dolphins who swim, zebras who run, and giraffes who stand. When it comes to the advantages of the human brain, we have the ability to learn languages, carry out expressions with our face, and most importantly, change to meet the needs of the world around us.

5. Even as babies, the human brain gives us an advantage to learn a language and faces to _____

   A. experience talking outside.

   B. hold items close to us.

   C. show emotions.

   D. swim, run, or stand.

In fact by the age of 2, the human brain will simply do away with neurons that are determined to be unnecessary. Then by the age of 5, our brain will have become developed, giving us what is needed to live out the rest of our lives.	6. By age 2, brain cells called neurons are _____
	
	   A. slowing down in the number of new cells.
	   B. destroying cells.
	   C. only moving cells around as needed.
	   D. no longer changing in number.

In this PBS film, Dr. David Eagleman discusses the human brain, and how our experiences shape our brain. The human brain supports and cultivates our need to know and understand our environment. With touch and love we are driven to search out and learn about our world. However, if at birth a child faces neglect and lacks objects to encourage curiosity, this too will create an environment that will determine one's future; and these early years will come to serve as a consequence.	7. The environment and the human brain _____
	
	   A. forces us to see good and bad in the future.
	   B. are connected; good or bad.
	   C. are not an influencing factor for the future.
	   D. prevents future inequality.
	
	8. In regards to our brains, the early years serves as _____
	
	   A. having a positive impact for one's future.
	   B. a set sequence from the age of 2.
	   C. no influencing factor for the future.
	   D. the result of what we experience from day 1.

Dr. Eagleman explains further that both environment and genetics (Genetics is the field of science that looks at the characteristics passed down from parents to children) gives the brain the ability to shape each one of us into someone who is like no other. By the time a person becomes a teenager, between the ages of 13-19 years old; our brain is kept very busy continuously working and running connections. At the age of 15, our feelings are also running at full speed and the prefrontal cortex, the part of the brain responsible for feelings and beliefs of "self", cannot be put off.

9. As teenagers, the human brain remains mysterious, and our emotions can _____

A. be put aside as we continue to learn.

B. not be seen as being important.

C. be placed under control with our feelings.

D. not be put aside with reason.

In fact, the behaviors of teenagers are often seen as over the top in social events when risks outweigh reason.   It is not until we reach our early 20's that our behavior change again and we are able to reach a level of common sense and understanding.

10. In social events, the behaviors of teenagers tend to be _____

A. suitable.

B. overly simple.

C. top heavy.

D. extreme.

11. Between the ages of 13-19 years of age our brain can _____

A. reach a level of common sense and understanding.

B. become over powered by feelings.

C. feel the equal weight of reasoning and understanding.

D. consider risks and reason equally.

In the beginning, scientific exploration of the brain believed with <u>perspicacity</u>, that the brain's level of plasticity or ability to change comes to an end as we grow old.	12. In the beginning, the study of the brain was believed to be _____ A. easily understood. B. unknown and complicated. C. personal. D. simple and dull.
Our brains are no longer able to experience ongoing change and our ability to learn would become subject to growing old, disease, and medicine.	13. <u>Originally</u>, research had believed that the brain was _____ A. not able to change throughout one's life. B. not connected to change. C. able to be turned on and off. D. able to change throughout one's life.
Older people would have to simply <u>put up with</u> a poor memory that may disrupt their daily lives.	14. In early brain research, it was believed that as we age the changes in the human brain requires us to _____ A. keep our memories based on time. B. accept a loss in memories. C. place memories in order from poor to good. D. put up memories based on needs. 15. In early brain research, our findings showed that poor memories of older people _____ A. calms the lives of the young. B. provide a sense of order. C. does not disturb anything at all. D. can stop and change everyday life.

Recent brain research however has discovered that the brain of older people, actually do keep its ability to change. These studies have revealed that we did not have an inkling of what was actually taking place in the human brain. It is now believed that the brain's limited number of neurons is guided by the work of the hippocampus. The hippocampus is a small part of the brain that replays a memory until it becomes, fixed and the information can be available as needed. As memories fade over time, it is the result of neurons being wiped clean so they can become new memories.

16. Today's brain research has shown that our early research was _____

A. known and written in stone.

B. required a small amount of ink.

C. largely unknown.

D. written without ink.

This is observed when we remember events differently over time. For example, the memories a child who is going to school for the first time, is excited and sees their new classroom for the first time. This classroom would appear to be a room of immense size, with endless possibilities, filled with desks, books, and posters. However, when this same person returns, many years later as a grown-up, they may now see their first classroom very differently. In fact, they may need to concede and truly see the classroom for what it really is compared to their own childhood memories.

17. When we can compare old childhood memories to today we may _____

A. need to admit that our first memories may not be true.

B. see that our first memories are truly special.

C. see into our consciousness.

D. be able to see new and old ideas as one.

Even with limitations to our memory, it is an important part of our personality and it simply cannot be cut out. It is memory and our connected meanings that make up who we are.

18. Memories are a part of who we are as a person and they can _____

A. be cut and shaped with scissors.

B. not be removed or changed.

C. not be changed so they become cute.

D. be changed as we see fit.

Each person is a one of a kind. Each of us has our own wiring of connections that are the result of our personal experiences as we live within our world. The human brain, with its neurons, has not obviated humans' ability to change, give meaning, and with memory explore the world; to discover who we are.

19. Each person is a one of a kind and our brain has determined our ability to change as _____

A. necessary.

B. independent.

C. variable.

D. obsolete.

As a human you need to experience and catch on to the events that are taking place all around us. We may be dependent on others at birth, however it is with love, family, friends, and our many experiences that frames and shapes us into a person. Dr. Eagleman concludes that the brain is indeed a mysterious organ and "from the cradle to the grave, we are works in progress".

20. Humans are like no other for we have been able to _____

A. see the cause and effect of our actions.

B. experience and fish for new ideas.

C. allows people to talk without understanding.

D. quickly understand our changing world.

Appendix G

Figure G1. Survey

SW and FS Language Study
2016 Survey

Student Study ID: _____

Date _____

1. Do you like reading?   Yes _____ No _____

2. Do you like reading on electronic devices   Yes _____ No _____
   (such as a computer)?

3. What do you like to use for reading:
   a paper book or a computer/electronic device?   Paper book   Both   Computer
   Write an "X" on the line based on your opinion.

4. Have you used the definitions provided in a **paper book**?   Yes _____ No _____

While reading on a **computer or electronic device**, you can see a definition to a word
by simply clicking on it.

5. Have you clicked on a word to find its definition while   Yes _____ No _____
   reading **before** this study?

6. Has anyone **showed** you how to click on a word to see a   Yes _____ No _____
   definition?

7. Do you want to know more about this study?   Yes _____ No _____
   You can receive your score and the results of this study.

   Do you have any comments to share?

Once you have completed this survey return to the computer screen to click the
NEXT PAGE button.

Appendix H

Figure H1. Gift Card Drawing Slip

SW and FS Language Study

Gift Card Drawing

Student Study ID: _____

Email Address: _____

Good Luck!

It is now time to submit your Study Packet.
You have successfully completed this Study.

Appendix I

Figure I1. IRB Approved Application

Institutional Review Board (IRB)

OFFICE OF RESEARCH AND
SPONSORED PROGRAMS
ST. CLOUD STATE UNIVERSITY.

Administrative Services 210
Website: stcloudstate.edu/osp   *Email: osp@stcloudstate.edu*
Phone: 320-308-4932

Name: Deborah Dieterich

Address 749 Marie Ct.
Delano, MN 55328   USA

Email: kode1303@stcloudstate.edu

IRB PROTOCOL DETERMINATION: Exempt Review

Project Title: Reading and the Response Towards Unknown Single Words and Formulaic Sequences by English Second Langauage Learners

Advisor Choonkyong Kim

The Institutional Review Board has reviewed your protocol to conduct research involving human subjects. Your project has been: **APPROVED**

Please note the following important information concerning IRB projects:

- The principal investigator assumes the responsibilities for the protection of participants in this project. Any adverse events must be reported to the IRB as soon as possible (ex. research related injuries, harmful outcomes, significant withdrawal of subject population, etc.).

- For expedited or full board review, the principal investigator must submit a Continuing Review/Final Report form in advance of the expiration date indicated on this letter to report conclusion of the research or request an extension.

-Exempt review only requires the submission of a Continuring Review/Final Report form in advance of the expiration date indicated in this letter if an extension of time is needed.

- Approved consent forms display the official IRB stamp which documents approval and expiration dates. If a renewal is requested and approved, new consent forms will be officially stamped and reflect the new approval and expiration dates.

- The principal investigator must seek approval for any changes to the study (ex. research design, consent process, survey/interview instruments, funding source, etc.). The IRB reserves the right to review the research at any time.

Good luck on your research. If we can be of further assistance, please contact the Office of Research and Sponsored Programs at 320-308-4932 or email lidonnay@stcloudstate.edu. Use the SCSU IRB number listed on any forms submitted which relate to this project, or on any correspondence with the IRB.

Institutional Review Board:

Linda Donnay
IRB Administrator
Office of Research and Sponsored Programs

St. Cloud State University:

Marilyn Hart
Interim Associate Provost for Research
Dean of Graduate Studies

OFFICE USE ONLY		
SCSU IRB# 1528 - 1902	Type: Exempt Review	Today's Date: 1/14/2016
1st Year Approval Date: 12/21/2015	2nd Year Approval Date:	3rd Year Approval Date:
1st Year Expiration Date: 12/20/2018	2nd Year Expiration Date:	3rd Year Expiration Date:

St. Cloud State University IRB
Continuing Review / Final Report

OFFICE OF RESEARCH AND
SPONSORED PROGRAMS
St. Cloud State University.

Principal Investigator: **Deborah Dieterich**

Co-Investigator:

Project Title: **Reading and the Response Towards Unknown Single Words and Formulaic Sequences by English Second Langauage Learners**

1. Please indicate the status of your project:

This form serves as a Final Report
_____ Project has been completed.
_____ Data collection has been completed but data analysis continues.
_____ Project has not and will not be conducted. Explain:_____

This form serves as a Continuing Review
_____ Participant recruitment/enrollment continues; current consent/assent required. Please attach.
_____ Data collection continues with enrolled participants; no additional participants will be recruited.

2. How many participants have participated in your study? _____

3. Have any unexpected reactions, complications or problems occurred during this research?
_____ No _____ Yes, explain:_____

4. Have any participants withdrawn from the research, either voluntarily or at the researcher's request?
_____ No _____ Yes, explain:_____

5. Have any participants complained about the research?
_____ No _____ Yes, explain:_____

6. Has any new information been identified which may affect the willingness of current or future participants to participate in this research?
_____ No _____ Yes, explain:_____

7. Have any changes been made to your research (including changes to informed consent documents, debriefing statements, recruitment materials, etc.) since it was approved by the IRB?
_____ No _____ Yes, explain and indicate whether changes were approved by the IRB:
_____

_____   _____
Principal Investigator's Signature   Date

SCSUIRB# **1528 - 1902**

Administrative Services 210
Website: stcloudstate.edu/osp   Email: osp@stcloudstate.edu   Phone: 320-308-4932